3-001

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of an Automatic Therapeutic Substitution Program Using CPOE

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Purpose: As a result of federal and state healthcare budget reductions, hospital leadership requested interdepartmental contributions toward cost minimization, with a particular emphasis on reducing pharmaceutical expenditures for the fiscal year of 2010. As a cost reduction initiative identified to have a significant opportunity for expense reduction, therapeutic substitution was implemented at this institution. In an effort to minimize disruption in workflow and maximize successful conversion, computerized prescriber order entry (CPOE) with decision support capabilities was utilized to implement therapeutic substitution.

Methods: Medical logic module (MLM) within the computerized prescriber order entry system was utilized to implement the rules regarding the therapeutic interchange of non formulary agents to the preferred formulary agents in selected patient populations. This decision support provides prescribers with defaulted equivalent doses while taking into account parameters such as concomitant treatments and accepted indications for use. Exclusions for specific indications, drug interactions, and patient intolerance of formulary agents are allowed. The computerized prescriber order entry also provides real-time screening of concomitant active medications identify and prevent any potential drug interactions.

Results: Analysis of internal data has demonstrated a precipitous drop in the use and purchasing of non-formulary agents. Successful adoption of conversion resulted in greater than 50% reduction in doses dispensed for non-preferred agents. Post-implementation comparative benchmarking data reveals a reduction in case utilization rate for non-formulary agents, placing the target hospital in the lower third of institution resource consumption within a peer group of similar hospitals.

Conclusion: Utilization of computerized prescriber order entry to initiate therapeutic substitution has enabled a successful reduction in the use of non-formulary agents in appropriate patient populations, while minimizing disruptions in workflow and enhancing patient safety.

3-002

Category: Administrative practice / Financial Management / Human Resources

Title: Professional Recruiter for Health System Pharmacy Recruitment

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Purpose: In 2000 there were 196,000 Pharmacists in the United States. ASHP estimated that 8.9% of Hospital Pharmacist positions were unfilled at that time. The Department of Health & Human Services Health Resources and Services Administration Bureau of Health Professions labeled the problem as a dynamic shortage. This shortage created staffing problems, higher turnover rates and the inability to expand new programs. We describe the development of an internal recruitment program managed by the Department of Pharmacy in a large health system.

Methods: In 2003 a dedicated professional healthcare Recruitment Manager was hired into the Department of Pharmacy within a 1000 + bed academic medical center. This position was created to develop overall strategic initiatives for the recruitment processes in response to organizational needs. This required developing and executing effective recruitment and hiring procedures; both standard and advanced strategies were utilized: Standard methods included internet advertising, print advertising, networking, college recruitment national / state conferences, direct mail solicitation, recruitment agencies, and redesigned on boarding process. Advanced methods included social media, open houses featuring CE credit, meet and greet dinners, tele-recruiting, sign on bonus and tuition reimbursement, referral fees to any member of the health system, sourcing unmatched residency candidates, e-mail database built from college fairs, e-mail blasts, work at home program, pharmacist practice models and Career Ladders. This started as an initiative at the academic medical center, recruiting pharmacists exclusively, and branched out as the entire health system was integrated to include 10 community based hospitals. The goal was to establish programs and activities to effectively coordinate and manage the overall staffing function system wide. The Pharmacy Department works closely with an Human Resources Recruitment professional to effectively choose and onboard candidates.

Results: Over 9600 resumes were reviewed and over 3000 candidates contacted between 2003 and 2011. This resulted in interviewing approximately 750 applicants and bringing over 300 candidates for on campus interviews. There have been 146 pharmacists and 110 technicians hired.

Conclusion: Developing an in house recruitment program using professional healthcare recruiters has been an effective and successful hiring method for a large health system. Internal pharmacy recruiters working with established practices and procedures meet staffing requirements and organizational needs. Implementing the vision of the practice model and instituting a career ladder improved

retention. Pharmacist recruitment coupled with retention initiatives results in both stabilization and growth.

3-003

Category: Administrative practice / Financial Management / Human Resources

Title: Financial Impact of Utilization of Dipyridamole IV Infusion as the Sole Agent for Pharmacologic Stress Testing in an Academic Health System

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Purpose: Pharmacologic stress testing is used to evaluate the cause of symptoms, signs, or perceived risk from coronary artery disease. Coronary vasodilators such as dipyridamole, adenosine and regadenoson are used for the testing. The objective of the presentation is to describe the economic impact of using dipyridamole as the sole agent in a 925-bed academic health system.

Methods: An interdisciplinary team consisted of radiologists and pharmacists evaluated the literature and cost associated with the three agents. After thorough analysis of effectiveness, cost and adverse event profiles, the team decided to replace regadenoson, formulary agent with dipyridamole as the sole agent for stress testing. The primary differences between the agents were the required insusion times; 4-6 minutes for adenosine, 10-15 minutes for dipyridamole and rapid injection for regadenoson. There were striking cost differences among the agents.For example, the acquisition cost of regadenoson was sixty times more expensive than dipyridamole. Pharmacy staff worked closely with the radiology staff to streamline the compounding process. The new process was implemented at the begining of our fiscal year. Numerous inservice education programs were provided to the care providers prior to implementation.

Results: We were able to achieve 100% formulary compliance. We spent $300,000 for the procurement of the regadenoson in the previous year. The formulary change resulted in an average savings of $23,000 per month during the first seven months of the current fiscal year. We are expecting an annual savings of $275,000.

Conclusion: Limited financial resources are major challenges faced by majority of the institutions around the country. We believe that similar formulary change can be achieved by any organization.

3-004

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of multiple daily batches for IV waste reduction in a large community hospital

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Purpose: Significant focus is placed upon using medications in the safest and most cost effective manner as supported through evidence-based medicine. IV medications comprise a significant percent of drug spend on an annual basis. This project focuses on the process of preparing and delivering medications for use within the hospital. The initial goal was to reduce IV waste from the baseline average amount by 50 percent.

Methods: The pharmacy department of a 443 bed, tertiary referral, community hospital completed a three month baseline audit to measure the amount (in dollars) captured on the waste log. During the baseline period, the IV medication fill was generated daily at 0700 and was delivered at 1500. This batch contained medication doses due from 1600 on the current date through 1559 the following day. Analysis was completed on the waste log data. It was determined to divide the single daily fill into five multiple batches to be prepared and delivered throughout the day. The pharmacy information system programming was changed to accommodate the multiple daily batch fills. The pharmacy staff was educated on the process. Instead of dedicating a single pharmacy technician to the daily IV batch preparation, the technicians were trained to work as a team and work collaboratively at batch times instead of segregating work among the pharmacy technicians assigned to IV preparation.

Results: After implementation of the multiple daily batch fills, the amount of medications captured on the IV waste log decreased. The baseline waste amount was $10,652. The baseline amount was calculated over a three month period (January - March 2010). By implementing the multiple daily batch fills, the hospital met the target of greater than 50 percent waste reduction from baseline during the first month. The project has continued for one year and has only experienced one month where the savings did not achieve the target. As a result of implementing multiple daily batches, the pharmacy department has achieved waste reduction far greater than anticipated. The department has saved $88,937 from the baseline average. The amount of waste recorded during the 12 month project was $49,539; based upon the baseline average, the department would have expected to see $127,824 in waste. The $49,539 in waste represents approximately 0.23% of the annual pharmaceutical budget for the hospital.

Conclusion: Implementation of multiple daily batch fills allowed the pharmacy department to achieve waste reduction while improving efficiency. The pharmacy technician staff was encouraged to work together in a collaborative effort instead of dividing work among the technicians. Because the multiple daily batches provide smaller quantities of products to be prepared, the new process facilitated

teamwork approach that was encouraged. As such, the process was implemented without the addition of any FTEs.

3-005

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of six-sigma based asset management program in Jesse Brown VAMC outpatient pharmacy

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Purpose: To improve procurement process efficiency, increase inventory turns and contract compliance as well as decrease emergency deliveries and waste.

Methods: Observation study of the pharmacy's established practices and work flow following by evaluation of observed data, development of the Opportunity Matrix and determination of the key areas for potential improvement.

Results: The key areas for improvement were identified as 1. Inventory management 2. Accuracy and quality of ordering 3. Productivity 4. Expense and waste reduction Followed application of the Opportunity Matrix has resulted in significant improvement in the target areas.

Conclusion: Implementation of Six-Sigma based Asset Management Program produced the following measurable outcomes: 1. Inventory turns increase by 25% 2. Contract compliance increase to 98% 3. Emergency deliveries reduced by 60% 4. Patient waiting time decreased by 50%

3-006

Category: Administrative practice / Financial Management / Human Resources

Title: Doctor of Pharmacy students save clinician time and money performing prior authorizations for specialty medications

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Purpose: Prior authorizations (PA) for medications serve as a utilization management measure for insurance companies. The PA process includes contacting insurance companies, completing forms, and contacting patients to obtain insurance information. For clinicians completing these PAs can be time consuming, time sensitive, and labor intensive. Specialty medications include therapies for complex conditions e.g., multiple sclerosis, cancer, rheumatoid arthritis. Usually, these medications require PAs due to their high cost and complex therapeutic regimens. Pharmacists may complete PAs upon request from health care providers and insurance companies. Thus, the purpose of this study was to evaluate the use of Doctor of Pharmacy students to complete specialty medication PAs.

Methods: Doctor of Pharmacy students were recruited from a college of pharmacy located within an academic teaching hospital. They received skill development from a clinical pharmacist who provided an overview of disease states, medications, and how to access electronic medical records and complete the PAs. After this skill development period, students completed PAs independently, and contacted the pharmacist when questions arose. Students received requests from pharmacists, physicians, nurses, or pharmacies through email or fax. Students recorded the time spent on each stage of the PA process; time from the receipt of the PA request to receiving approval from the insurance company and average time from the PA approval to the start of treatment. Cost was calculated by multiplying the hourly wage for the students (i.e., $18) or the pharmacist (i.e., $50.48) by the average time needed to complete a PA. Descriptive analysis was used to document the results.

Results: During the 7 month period from 10/2010 to 5/2011, 112 PA requests were received from the rheumatology clinic. All PAs were started within one business day of receiving the request. Three pharmacy students (1st, 2nd, 3rd year) completed 16 (14.3%), 73 (65.2%), and 23 (20.5%) PAs, respectively. Among the PA requests, 39.3% had Medicaid, 31.3% had Medicare Part D, and 29.4% had private insurance. Seventy-three percent of the PAs were approved, and 16% were denied. Eleven percent did not require a PA but were received to identify if a PA was required. PA forms were required in 30.4% of the requests. Students contacted insurance companies, pharmacies, and patients in 93.8%, 43.8% and 54.5% of the time, respectively during the PA process. A total of 60.03 hours with an average

of 32.4 minutes (range: 5-105 minutes) per PA was spent. Approximately 30.3 hours was spent in contacting insurance companies. The average time from the receipt of the PA request to receiving approval from the insurance company was 5 days (range 1-24 days), and the average time from the PA approval to the start of treatment was 5 days (range 1-42). The labor cost for a student for each PA request was $9.72 compared to $27.25 for a pharmacist which is not accounting for paperwork, fax, and telephone expenses. The labor student cost over the 7 month period was $1,075.14 compared to $3,015.17 for pharmacists completing the PAs; demonstrating an annualized savings of $3,325.76.

Conclusion: Doctor of Pharmacy students provided a feasible, cost effective approach to complete PAs and relieve the burden for health care providers. This approach may be replicated at other teaching hospitals where clinicians are responsible for PAs.

3-007

Category: Administrative practice / Financial Management / Human Resources

Title: Consolidation of intravenous medication compounding services in a tertiary care health system leads to operational efficiencies and inpatient cost avoidance

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Purpose: To comply with United States Pharmacopeia (USP) 797, improve patient safety, and reduce pharmaceutical expenditures.

Methods: In November 2007, the health system acquired an offsite, USP 797 compliant intravenous (IV) compounding facility centrally located to the three hospital health system. Prior to the acquisition, pharmaceutical purchasing and dispensing information was compiled for various compounded sterile preparations (CSPs) that were purchased through outside pharmacies and vendors. Various literature sources were evaluated to determine stability data for these products. A relative timeline for consolidation of products was developed. Additional evaluation included operational cost estimates to run the facility, delivery fees, and needed equipment. Also, contracted services were contacted to establish billing and assure continuation of these services. The state board of pharmacy was contacted to set up the required facility inspections and obtain the required licensure. Recruitment of pharmacy personnel was conducted to fill the needed 6 pharmacy technicians and 2.4 full time pharmacist positions.

Results: The offsite compounding pharmacy opened on November 15, 2007. Billing, service, and maintenance agreements were transitioned on this date. All licensing and regulatory requirements were met prior to the compounding of sterile preparations. On the date of opening, the facility began to compound TPN and continuous renal replacement therapy (CRRT) for the health system. During the first full month of operation, 1,758 CSPs were produced. After installation of additional compounding equipment, additional compounded sterile preparations (CSPs) were transitioned for batch production in a stepwise process. These items included cardioplegia, electrolyte minibags, antibiotics, various prefilled syringes, and various critical infusions (amiodarone, epinephrine, norepinephrine, and phenylephrine). Currently, the department is averaging over 22,000 CSPs each month. By having batch prepared drips and intravenous medications, pharmacy turnaround time for these pharmaceuticals has decreased. In addition, most of these medications are loaded in automated dispensing cabinets in the intensive care units to increase efficiency. Financially, the health system has experienced a yearly decrease in pharmaceutical expenditures of $ 1,968,662. After taking into account the labor costs

associated with 8.4 FTEs, fixed operating costs, and variable operating costs, the health system has realized a decrease in total annual expenditures of $ 1,176,445.

Conclusion: Consolidation of clean room services to an off-site, dedicated compounding facility at our health system has removed workload from our inpatient pharmacies, thus allowing the pharmacy team to focus on direct patient care. In addition, patient care and compliance with The Joint Commission (TJC) and USP 797 has improved secondary to decreased medication turnaround time, consistency of CPSs compounded in various settings, reduced fluid volume from IV medications, and improved labeling of medications on and off the sterile field in the operating rooms. Finally, the health system has experienced an estimated $ 1,968,662 a year savings in pharmaceutical expenditures and $ 1,176,445 in total expenditures while adding an additional 8.4 pharmacy FTEs to the health system.

3-008

Category: Administrative practice / Financial Management / Human Resources

Title: Applying health promotion programs during experiential rotations

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Purpose: To empower pharmacy students to design, implement, and evaluate health promotion programs during their pharmacy practice experiences.

Methods: Pharmacy students implemented smoking cessation programs during their Advanced Pharmacy Practice Experiences (APPE). Prior to implementing a health promotion program, the students followed four key steps: (1) The initial phase of designing and planning the program; (2) Selection of a health behavior theory or model, (3) Implementation of the program, and (4) Assessment and evaluation of outcomes. The students selected the Transtheoretical (Stages of Change) Model and Motivational Interviewing Technique to implement their health promotion programs. The Transtheoretical Model was developed out of work conducted with smokers in their attempt to quit smoking. This model emphasizes that an individuals experience to change behavior is a process. The patient moves from one stage to the next as their confidence in their ability to make the necessary behavior changes increases. Five stages of change in this model are precontemplation, contemplation, preparation, action, and maintenance.

Results: Pharmacy students assessed and evaluated the success of the smoking cessation program. Based on the total number of patients who received interventions at their pharmacies, the program was successful. Specifically, the majority of the patients who were screened agreed to complete the smoking cessation program.

Conclusion: Based on the successful implementation of the health promotion program, additional health initiatives need to be included during students experiential experiences. Future research may include having the pharmacy students evaluate patients clinical outcomes (i.e., blood pressure, number of asthma attacks, emergency room visits). Finally, the pharmacy students may also conduct cost-utility analyses to evaluate the costs of the smoking cessation program and its impact on their patients quality of life.

3-009

Category: Administrative practice / Financial Management / Human Resources

Title: Missing medications: the estimated financial impact to an organization

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Purpose: Baystate Medical Center (BMC) is a 653-bed tertiary care, Level 1 trauma center and academic teaching institution. It is the flagship hospital of a 3-hospital integrated system. The inpatient pharmacy department provides pharmacy services 24 hours a day and 7 days a week, in order to meet the demands of all adult and pediatric medication orders. Missing medication requests continue to interrupt daily processes and impact both pharmacy and nursing workflow. As a result, nurses are taken away from direct patient care duties while searching for medications, pharmacists are interrupted during order review, and pharmacy technician time is required to retrieve and process missing medication requests. Ultimately this non-value added time can impede future projects and negatively impacts the drug budget. The goal of this analysis was to estimate the financial impact on the organization attributed to missing medications.

Methods: Missing medication request data was tracked and logged over a 7 day period across all shifts (24 hours). The labor impact for nurses, pharmacy technicians and pharmacists was calculated using conservative estimates of time expended by each group to search for the medication and process the medication request. For nurses, we estimated 5 minutes expended on all medication requests, regardless of type. For pharmacy technicians, we estimated 3 minutes to process (preparation/labeling) an intravenous (IV) medication and 90 seconds to process a non-IV medication. For pharmacists, we estimated 1 minute to process an IV medication and 30 seconds to process a non-IV medication. We then used average base salaries at our institution to calculate the amount of wasted labor per year, based on extrapolated data. Materials waste (drug expense) was estimated to be 11 dollars per medication based on the average costs for the top 10 oral and IV medications documented as missing at our institution. This data was extrapolated to calculate an annual cost impact.

Results: 1132 medications were documented as missing during the 7 day observation period. 13 percent (151) were IV medications, 87 percent (981) were unit-dosed or bulk product medications. It was estimated that 94 hours, 32 hours, and 11 hours per week were devoted to missing medication requests for Nurses, Pharmacy Technicians and Pharmacists respectively. Based on this information, the financial impact of the labor estimates was 250,705 dollars for a 7 day period. The estimate for annual materials wasted (drug expense) per year was 647,504 dollars. The combined financial impact (labor and materials) of missing medications was calculated to be 898,209 dollars annually.

Conclusion: The financial impact of missing medications for our organization annually is significant. Based on these findings, we have determined this to be a major focus for our organization and justified the creation of a task force. This team will be charged with investigating other contributing factors for missing medications (reducing costs and maximizing workflow).

3-010

Category: Administrative practice / Financial Management / Human Resources

Title: Impact of hospital introductory pharmacy practice experiences on students, preceptors and sites

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Purpose: To date, the effects of a hospital pharmacy-based introductory pharmacy practice experience on students and hospitals have not been reported. The purpose of this study was to evaluate the impact of hospital introductory pharmacy practice experiences (IPPEs) on student understanding and perception of hospital pharmacy and preceptor perception of value and impact on workload.

Methods: All students and preceptors involved in the hospital IPPEs program during the fall 2010 and winter 2011 semesters were surveyed to determine their perceptions of the impact of the IPPEs using on-line survey methods. Data were aggregated and descriptive statistics were used to illustrate the trends in the data.

Results: A total of 135 students were assigned to 12 sites and 21 to 24 preceptors during the fall 2010 and winter 2011 semesters. Surveys were completed by 92% of students and 55% of preceptors. Student surveys revealed that the hospital IPPE experience improved student understanding of the roles and responsibilities of hospital pharmacists (93%), the medication use process in hospitals (90.3%) and their role as a member of the health care team (86%). When asked about their plans for practice after graduation, 49% of students were considering hospital practice prior to the hospital IPPE. After the hospital IPPE, 72% were considering hospital practice. Preceptor surveys revealed that 88% spent an expected amount or less than expected amount of time in preparation for students arrival and 60% oriented students in groups. During the first 20 hours of the students experience, 76% preceptors noted an increased staff workload and 8% noted a decreased workload. However, after the first 20 hours of experience, 32% of preceptors indicated an increased staff workload and 60% indicated a decreased workload. Students on hospital IPPEs were thought to be valuable as resources for projects (68%), to lighten staff workload (44%) and to perform routine operations (36%). Preceptors felt the hospital IPPE provided value in increasing student interest in hospital pharmacy (84%) and in their having access to future employees (64%). Overall, 91% of preceptors felt there was value in having hospital IPPE students and 100% would recommend other preceptors and sites to participate in the hospital IPPE program.

Conclusion: During the first year of a hospital IPPE program, both preceptors and students found value in the hospital IPPE program. The hospital IPPE program positively influenced students consideration of

hospital practice after graduation. These data will be used to design methods to enhance the impact of the hospital IPPEs on student development and interest, preceptor and staff workload, and pharmacy projects and routine activities.

3-011

Category: Administrative practice / Financial Management / Human Resources

Title: IV waste reduction strategy in a women and childrens hospital

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Purpose: With the increasing cost of medications, pharmacy and hospital leadership continue to explore various cost containment strategies. Innovation, prioritization, and appropriate planning are essential when evaluating options within a pharmacy operation. Hospital pharmacies waste a significant quantity of intravenous medications through the daily IV batching process, particularly by preparing doses that are subsequently discontinued and not administered. This project was undertaken to redesign the process surrounding IV batch preparation and delivery times to reduce an area of significant waste.

Methods: A complete redesign of the IV batch cart fill process was undertaken. Prior to the initiation of this project, the IV cart fill was processed once daily at 0700 and encompassed all IV doses to be administered between 1500 same day to 1459 the following day. After reviewing data and determining the most common times medications were administered, the IV cart fill was broken down into five smaller batches daily. IV waste data was collected both pre- and post- implementation of changes. In addition to assessing the batch changes on IV waste, workflow/staffing was assessed.

Results: Baseline IV waste data showed an average loss of $5,909 monthly, annualized to $70,908. Following implementation of five smaller IV batches daily, the average monthly waste has decreased to approximately $2,300. This equates to approximately $43, 308 annual savings. With the changing of the IV batch times, the largest IV batch was generated for midnight shift to complete. As a result, the oral medication cart fill processing time was changed from 9 pm daily to 10 am daily to facilitate workflow processes.

Conclusion: By increasing the number of IV batches daily and decreasing the amount of time between preparation and administration, less medication is wasted due to discontinuation of therapy and missing doses. In addition, this process change required no additional labor resources.

3-012

Category: Administrative practice / Financial Management / Human Resources

Title: Impact of risk evaluation and mitigation strategies (REMS) on erythropoietic stimulating agents utilization at a community hospital

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Purpose: The FDA required manufacturers of Erythropoietic Stimulating Agents (ESAs) to implement actions to improve safe use. Collectively called REMS (Risk Evaluation and Mitigation Strategies) the actions differed based upon indication. All patients are required to receive education on risks and benefits in the form of a FDA approved Medication Guide. Patients prescribed ESAs for the indication of treating chemotherapy induced anemia are required to receive several other safety interventions by the prescriber. This study evaluated the impact of the REMS requirements on ESA utilization at a community hospital.

Methods: Manufacturers communication plan for providers described the ESA REMS requirements for the drugs. Patient education about medications commonly occurs in the hospital setting and commonly involves printed monographs for patients. Additional elements to assure safe use required for ESAs prescribed for chemotherapy induced anemia include physician certification, documentation of a risk:benefit discussion between the provider and patient, and a method to confirm these elements were implemented. Following up on inhouse reports of ESA prescribers it was confirmed that facility employed Hospitalists and consulting nephrologists do not prescribe ESAs for the latter indication. It was confirmed that hematology/oncology (heme-onc) prescribers do. Based upon this prescriber information the hospitals Vice President of Medical Affairs and Director of Pharmacy sent a letter to heme-onc providers affiliated with the hospital detailing how the REMS program was to be implemented. ESA purchases for a three month period post REMS implementation was compared to the same prior year period. Since ESA stock par levels remained the same throughout the control and intervention periods it was determined that purchase data was a reasonable index of utilization.

Results: The number of ESA units purchased decreased 38% and the number of patients treated with ESAs decreased 26 percent after REMs implementation. There was a 3.1 percent increase in admissions, 1.4 percent increase in patient days for the intervention period compared to the prior year control period. The number of heme-onc prescribed ESA orders decreased 29 percent after REMs implementation. Heme-onc prescribers attribute reduced utilization to more appropriate prescribing based upon risk benefit data communicated to them.

Conclusion: Since REMs implementation there has been an overall reduction in ESA utilization, number of patients receiving ESAs, number of units prescribed per treatment course and number of prescriptions ordered by heme-onc providers at this community hospital.

3-013

Category: Ambulatory Care

Title: Case report of thrombocytopenia secondary to angiotensin II receptor blocker therapy

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Purpose: This case report will 1) describe a case of thrombocytopenia secondary to angiotensin II receptor blocker (ARB) therapy 2) discuss the prevalence of this rare adverse effect and 3) make recommendations for the management of ARB induced thrombocytopenia. The patient is a 64 year old male who experienced an acute episode of thrombocytopenia while taking losartan followed by an exacerbation of symptoms when switched to valsartan. The patients past medical history includes: hypertension, diabetes mellitus type 2, post traumatic stress disorder, depression, bipolar disorder, dyslipidemia, and gastroesophageal reflux disease. His medications at the time of his first episode of thrombocytopenia included metformin 1000mg twice daily, Novolin 70/30 insulin 70 units in the morning and 85 units in the evening, ranitidine 150mg twice a day, atenolol 75mg, losartan 50mg, simvastatin 20mg, aspirin 325mg and temazepam 15-30mg once daily. Patient was initiated and maintained for five years on a dosage of losartan 50mg once daily with a baseline platelet count of 248,000 platelets per microliter of blood. Due to multiple consecutively elevated blood pressure readings at clinic visits, his losartan dose was increased to 100mg once daily and four weeks later he experienced an isolated episode of thrombocytopenia. The patients platelet count dropped to 14,000 platelets per microliter of blood. Due to this acute incident of thrombocytopenia that occurred subsequent to an increase in the dosage of losartan, the patient was treated for presumed idiopathic thrombocytopenic purpura secondary to losartan and was switched to valsartan 160mg once daily. The patient received a prednisone taper and platelet counts increased to the patients baseline; a level greater than 200,000 platelets per microliter of blood. After three months, the patients platelet counts plummeted again to 37,000 platelets per microliter of blood. At this time, another prednisone taper was initiated. His platelet count continued to fluctuate over the next four months and returned to his baseline. Then three months after undergoing a splenectomy, his platelets dropped once again to 48,000 platelets per microliter of blood. It was suspected that the patients isolated incidences of thrombocytopenia were drug related rather than immune related. As a result, his valsartan was held and the patients platelet counts began to steadily increase in a linear-fashion back to 314,000 platelets per microliter of blood in a period of four weeks. There is less than a one percent chance reported in the current literature of developing thrombocytopenia secondary to ARB therapy. The exact mechanism of this adverse event is unknown; however, post-marketing surveillance data reported a single case of losartan induced immune thrombocytopenia. Patients should be encouraged to report any signs of excessive bruising or spontaneous bleeding, as these can be early indications of thrombocytopenia.

However, monitoring for thrombocytopenia is not necessary due to its low rate of occurrence. Nevertheless, this is a serious adverse event that warrants immediate discontinuation of the offending agent and the initiation of an agent from an alternative antihypertensive class. Institutional review board approval and informed consent were obtained for this case.

Methods: N/A

Results: N/A

Conclusion: N/A

3-014

Category: Ambulatory Care

Title: Effects of Dual Blockade of the Renin Angiotensin System in Diabetic Kidney Disease: A Systematic Review and Meta-Analysis

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Purpose: There is much evidence to support a renoprotective effect of inhibitors of the renin-angiotensin system in diabetic kidney disease. However, it remains unclear whether dual renin-angiotensin system blockade has additional benefits in this population and whether any benefits outweigh the risks.

Methods: Study Design: Systematic review and meta-analysis Setting and Population: Diabetic patients with overt proteinuria Selection Criteria for Studies: Randomized, controlled, parallel or crossover design studies Intervention: Combination renin-angiotensin system blockade vs. monotherapy Outcomes: The primary outcome measure was the post-treatment difference in proteinuria with combination therapy versus monotherapy. Secondary outcomes included percent change in proteinuria, changes in systolic blood pressure, glomerular filtration rate, and serum potassium, and incidence of hyperkalemia. Sensitivity analyses that evaluated differences in outcome based on study quality (assessed by Jadad scores), baseline systolic blood pressure, and drug types and doses were conducted.

Results: There was significantly less proteinuria (by 334 mg/24 hr) after treatment with combination therapy vs. monotherapy. Systolic blood pressure (BP) after treatment with combination therapy vs. monotherapy was significantly lower (by 4.1 mmHg). However, clinically significant hyperkalemia was 3.5-fold more common with dual blockade. Sensitivity analyses did not identify subgroup differences that altered these findings.

Conclusion: Dual renin-angiotensin system blockade in patients with diabetic kidney disease reduces proteinuria and BP but is associated with a higher incidence of clinically significant hyperkalemia. Further studies assessing long-term outcomes are needed to weigh the benefits versus risks of combination renin-angiotensin system inhibitor therapy.

3-015

Category: Ambulatory Care

Title: Patient Counseling Exercise for an Ambulatory Care Advanced Pharmacy Practice Experience (APPE)

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Purpose: Classroom assignments during the first three years at the Purdue College of Pharmacy do not adequately instill students with sufficient skills for commonly encountered tasks in an ambulatory care pharmacy practice. Students are often asked to perform these tasks while in practice where a patient may be waiting in front of them for an explanation. The goal of this activity is to improve student comfort level with communication and explanation of difficult tasks commonly encountered in an ambulatory care pharmacy practice while comparing written instruction to verbal instruction to determine the impact of this activity on student patient counseling.

Methods: Ambulatory care rotation students from three rotation sites were randomly divided into two groups. All students received written explanations of the tasks to be performed. Half of the students received verbal explanations of each task from an ambulatory care faculty member with the use of a standardized instructional script. At the time of counseling, each student was assigned 2-3 tasks to explain to a mock patient. Following the activity, a survey was administered to students to assess the level of comfort with performing each task and their perceived usefulness of their method of instruction.

Results: Twenty-three students have completed the activity. Ten students have received only written instructions. Thirteen students have received verbal instructions. Survey response was 100%. Ninety-two percent of students receiving verbal instructions felt more comfortable in counseling on the assigned tasks as compared to 60% of students receiving only written instruction. Seventy-eight percent of students felt that this activity, regardless of instruction type, improved their knowledge and ability to counsel patients on reviewed tasks.

Conclusion: This activity enhanced student comfort with interpersonal communication strategies by allowing them to counsel mock patients on complicated tasks encountered within ambulatory care pharmacy. More students receiving verbal instructions in addition to written instructions felt that their method of instruction allowed for more effective counseling.

3-016

Category: Ambulatory Care

Title: Incidence of new onset heart failure, stroke and myocardial infarction in veteran's affairs patients with type II diabetes receiving pioglitazone or rosiglitazone; a pilot study

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Purpose: The purpose of this pilot study was to compare the incidence of new onset congestive heart failure (CHF), stroke and myocardial infarction (MI) among diabetic patients who received rosiglitazone or pioglitazone.

Methods: Subjects with type 2 diabetes mellitus (T2DM) who have received rosiglitazone from May 2006 May 2008 or Pioglitazone from May 2007 May 2009 were included in the study analysis. Subjects were further divided into two treatment arms, those prescribed rosiglitazone and those prescribed pioglitazone. The medical records were reviewed for ICD-9 codes indicating a diagnosis of CHF, stroke and MI. Also, all charts were reviewed for documented signs and symptoms of CHF, including development of shortness of breath, dyspnea, fatigue, fluid retention and discharge summaries documenting CHF exacerbations. Subjects were followed for all outcomes over a two year time frame. Differences in overall incidences of cardiovascular adverse events between the two treatment arms were tested by multiple logistic regressions. Differences in the rates of progression to occurrences of these adverse events were tested by the Cox proportional hazards model. Power analysis indicated that a total sample size of 200 participants was sufficient to detect an effect size as small as 20% (power = 0.8: =0.05, two-tailed).

Results: A total of 110 patients meeting the inclusion criteria were randomly selected to be enrolled in this study. There were 52 subjects in the rosiglitazone group and 58 subjects in the pioglitazone group. A total of 11 primary endpoints were observed during the study period. All study subjects were also evaluated for individual endpoints of new onset heart failure, stroke and myocardial infarction. New-onset heart failure occurred in 4/52 (7.7%) patients in the rosiglitazone group and 4/58 (6.9%) patients in the pioglitazone group; stroke occurred in 1/52 (1.9%) patients in the rosiglitazone group and 1/58 (1.7%) of patients in the pioglitazone group; myocardial infarction occurred in 1/52 (1.9%) of patients in the rosiglitazone group and 0/58 (0%) of patients in the pioglitazone group.

Conclusion: Current literature comparing the safety profiles of both rosiglitazone and pioglitazone show conflicting data in regards to their efficacy and safety. Although this study was insufficiently powered to assess for statistical significance between the primary outcomes the results showed a trend towards no difference between the two study groups. Our evidence is insufficient; however the clinical implications

of this pilot study may be that both rosiglitazone and pioglitazone are similar when compared for the incidence of cardiovascular outcomes.

3-017

Category: Ambulatory Care

Title: Creation and evaluation of a chronic opioid registry in a family medicine residency program

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Purpose: Patients suffering from chronic nonmalignant pain (CNMP) are increasingly treated with opioids in the primary care setting, resulting in additional challenges for providers who offer pain management. Patient registries can be generated from the electronic medical record (EMR) and are commonly used to identify and track patients with chronic illnesses including pain by searching for specific International Classification of Diseases (ICD) codes. Electronic prescription (e-prescribing) review identifies opioid medications and frequency of prescription. We aimed to create a registry of CNMP patients in a primary care practice receiving opiates to allow for 1) identification, tracking and distribution of patients across a practice and 2) evaluation of patient characteristics and prescribing trends.

Methods: The EMR (Allscripts) of a rural family medicine practice was searched to identify patients receiving e-prescriptions for an opioid analgesic (morphine, codeine, hydrocodone, oxycodone, oxymorphone, hydromorphone, fentanyl, or methadone) by a health center physician or resident between January 1, 2011 and May 31, 2011. Chronic opioid use was defined as receiving 1 or more opioid prescriptions per month for greater than or equal to 3 months. Data was analyzed to determine distribution of CNMP and chronic opioid use across the practice. Proportions were evaluated with Pearson's Chi-Squared test. Normally distributed means and standard deviation were calculated and evaluated with the Student t-test. ANOVA was used to compare normally distributed linear variables and non-normally distributed variables were evaluated with Wilcoxon Ranks. P-values of less than 0.05 were considered significant.

Results: 499 patients received at least 1 opioid prescription between January 1, 2011-May 31, 2011. 371 patients (74.3%) met criteria for chronic use ($p<0.001$). The mean age of patients with chronic use was 50.5 +/- 14.5 years compared to 46.4 +/- 16 years for patients who were not classified as chronic users during this time period ($p=0.02$). 76.3% of chronic opioid use patients were cared for by attending physicians while residents cared for the remaining 23.72%. The distribution of CNMP patients between second and third year residents was similar (41% vs. 55%, $p=0.22$), however greater than first year residents ($p<0.001$). There was no difference between the number of opioid prescriptions provided between attending and resident physicians ($p=0.77$).

Conclusion: A registry generated from EMR e-prescribing records systematically identifies CNMP patients receiving opioid prescriptions. This method allows for evaluating the distribution of CNMP patients within the practice and for comparison of patient characteristics. Future study will define prescribing patterns and evaluate adherence with prescribing and monitoring guidelines.

3-018

Category: Ambulatory Care

Title: Evaluation of a clinical pharmacist in managing hyperlipidemia through telephone appointments

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Purpose: Cardiovascular disease is one of the most common and costly diseases in America. Elevated low density lipoprotein (LDL) level is a risk factor in the development of coronary heart disease, yet studies show it remains poorly controlled. In 2005, a protocol for Collaborative Drug Therapy Management by Clinical Pharmacists was implemented in the Primary Care clinics in our institution. Under this protocol, a clinical pharmacist is utilized as an alternative to a physician in providing care for patients with hypertension, diabetes, and/or hyperlipidemia. During patient visits, pharmacists provide education regarding non pharmacologic and medication therapies, monitor for adverse events, order pertinent labs, and titrate or renew medications to help patients achieve their specific target goals. Subsequently, pharmacist run telephone visits for lipid management were introduced to help increase access to patients, eliminate travel time, decrease no shows, and provide more convenient care to patients. The purpose of this study is to examine the efficacy of a pharmacist-run telephone clinic in the management of hyperlipidemia in achieving patient-specific target goals.

Methods: The institutional review board approved this retrospective study. A retrospective chart review was conducted utilizing the Veterans Affairs Computerized Patient Record System (CPRS) and Veterans Integrated Systems Technology Architecture (VISTA) databases. Patients included in the study were those referred to the clinical pharmacist-run lipid telephone clinic by their primary care provider during the period of March 1, 2009 and March 1, 2011. Providers electronically place referrals in CPRS indicating a specific LDL goal. Clinical pharmacists would assess appropriateness of LDL goal based on patient-specific risk factors. Patients who were lost to follow-up or with planned follow-up after the data collection period were excluded. The following data were collected: age, gender, LDL at time of referral, LDL at time of discharge, number of telephone visits required before LDL goal was reached, length of follow-up time before LDL goal was achieved, number of medication initiations, titrations, or discontinuations ,compliance, adverse events, and amount of time spent per telephone visit. The primary outcome measures were a change in LDL from time of referral to discharge, number of telephone visits and length of follow-up time until LDL goal is reached. Secondary outcome measures include number of medication initiations, titrations, and/or discontinuations, compliance reinforcement, and detection of adverse events.

Results: A total of 67 patients were referred to the clinical pharmacist-run lipid telephone clinic. Of those 67 eligible patients, 29 were excluded, and 38 were included in the data analysis. All 38 patients reached their LDL goal with an average LDL reduction between 46mg/dL. Most patients attained LDL goal with an average of 2.2 telephone visits and an average of 6.7 minutes per telephone visit. Twenty-three patients did not require any medication adjustments to reach LDL goal as their primary care provider had already made changes at time of referral, therefore only 15 patients required medication adjustments. Only two patients required medication discontinuation due to adverse effects.

Conclusion: Clinical pharmacist-run telephone clinics are effective and efficient in managing hyperlipidemia as all patients attained LDL goal. Most patients required few visits and minimal time at each telephone visit. Telephone visits provide a good alternative for the treatment of hyperlipidemia.

3-019

Category: Ambulatory Care

Title: Impact of statin-associated muscle intolerance on achievement of goal LDL

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Purpose: Statins are one of the most commonly prescribed medications in the United States and responsible for 20-30% reductions in CHD mortality, which is the leading cause of death in the United States. Patient-tailored statin therapy can result in achievement of ATP-III LDL-C targets in 80-85% of patients after 4-8 weeks of treatment. However, only a third of statin treated persons are achieving targeted LDL goals and less than 20% of CHD patients are at their LDL goal. This low success rate has largely been attributed to poor adherence, which is linked to medication tolerability. Statin-induced rhabdomyolysis occurs rarely, but lower-grade muscle pain or weakness occurs much more frequently and is often under appreciated or under reported by healthcare professionals. These statin-associated muscle intolerances often lead to discontinuation, dose reductions or use of less effective lipid lowering medication. In turn, statin-intolerances can result in failure to achieve targeted lipid goals and full realization of proven cardiovascular mortality benefits. The purpose of this study is to describe the impact low grade statin-associated muscle intolerances may have on individual LDL-goal achievement.

Methods: The institutional review board approved this retrospective chart review of the electronic medical record (Centricity 9.5) at the Terry Reilly Health Clinic in Nampa Idaho. The clinical pharmacist queried the database for patients who had a documented statin intolerance recorded in their medication allergy list. Each event was categorized as muscle-related, non-muscle related, or unknown. Further review of the record determined each subjects current ATP-III LDL goal. ATP-III LDL goal achievement was the primary outcome and determined by reviewing most recent recorded laboratory lipid studies. Secondary outcome was the therapy intervention as result of the intolerability (permanent discontinuation of statin, dose reduction, change to different statin, or use of alternative lipid lowering agent). Patients were excluded from analysis if ATP-III LDL target could not be determined, lipid laboratory data was missing, or the muscle related event was described as rhabdomyolysis or of a serious nature. A one sample chi square compared the LDL-goal achievement rate in patients experiencing a statin-associated muscle intolerance to typical LDL-goal achievement rates reported in treat-to-target randomized control trials (about 80 percent). The primary outcome result is expressed as a percentage with the associated chi-square and p value, while secondary outcomes (therapy intervention as a result of the intolerability) are presented as descriptive percentages only.

Results: 158 statin adverse events were identified, 56 percent being muscle-related. Among those experiencing muscle-related events, 28.4 percent achieved ATP-III LDL targets, compared to 80 percent

achievement rates reported in generally accepted literature (chi square equals 202.3, p less than 0.0001). Of those patients not achieving their LDL goal, 39 percent permanently discontinued statin therapy, 30 percent changed to an alternative statin, 28 percent changed to an alternative lipid-lowering agent, and 1 percent made no change.

Conclusion: Patients experiencing low grade statin-associated muscle intolerance demonstrated a significantly reduced likelihood of achieving LDL goal, despite two-thirds of these patients continuing to take an alternative statin or other lipid-lowering medication. The LDL achievement rate was similar to the low achievement rates reported in the ATP III guidelines. Failure to achieve ATP-III LDL goal implies increased cardiovascular risk and possible failure to fully realize proven statin cardioprotective effects. Although suggestive, our study did not directly measure the effect these intolerances may have on CHD outcomes. Whether low grade statin-associated myopathies translate to increased cardiovascular morbidity/mortality remains uncertain and requires validation by well designed prospective or retrospective studies.

3-020

Category: Ambulatory Care

Title: Evaluation of diabetes awareness among patients with diabetes mellitus within Lebanese community pharmacy practice settings

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Purpose: Diabetes mellitus (DM) is a major contributor to mortality and morbidity and affects around 8% of the Lebanese population. The primary objective of this survey is to evaluate the awareness of Lebanese patients with DM on the diagnosis and monitoring of the disease. The secondary objective is to evaluate their awareness on the management of their disease.

Methods: This is a statistical non-paid survey. A graduating PharmD student supervised by pharmacy practice faculty, developed the survey questionnaire based on available validated literature. The survey included patient general information (demographics, co-morbidities, complications, concurrent use of aspirin and lipid lowering drugs), and four major categories with questions relating to patient awareness on: diagnosis and monitoring, non-pharmacologic management, and pharmacologic management of DM, and management of hypoglycemia complication. The survey required an average of 10 minutes to be filled. It was distributed to and conducted in community pharmacies across Lebanon, piloted over a period of one month. Either registered pharmacists (employee or employer) or third professional year students on community pharmacy clerkship as part of their counseling duties and under preceptor supervision interviewed patients with diabetes known to their respective pharmacy site and filled the survey forms. The PharmD student highlighted key questions to survey takers, did the necessary follow-up and then collected the completed surveys.

Results: Between May and June 2011, a total of 207 patients with DM (type I = 4.3 percent, type II = 95.6 percent) were surveyed. Of the 207 patients, 120 (58 percent) were males (mean age = 60.3 years, mean weight = 77 Kg); 63 (30.4 percent) received university education, 50 (24 percent) received high school education, and 94 (45.6 percent) either did not complete high school education or did not receive any education. Of the 207 patients, 118 patients were smokers (cigarette smoking = 43.5 percent, hubble-bubble smoking = 13.5 percent), 159 (77 percent) had a family history of diabetes, 92 (44.4 percent) had hypertension, 71 (34.4 percent) had dyslipidemia, 98 (48 percent) were on aspirin, and 87 (42 percent) were on lipid-lowering medications. When questioned about their awareness on DM diagnosis and monitoring, of the 207 patients, 124 (60 percent) were diagnosed by a physician, 83 (40 percent) were diagnosed by coincidence. Of the 207 patients, 148 (71.5 percent) used a machine to measure their blood glucose level at home, 57 (27.5 percent) never checked their fasting blood glucose (FBG) level and

169 (81.6 percent) reported being aware of FBG normal levels; of those, only 46 (22.2 percent) patients gave a correct answer. Of the 207 patients, 125 (60.3 percent) were aware of their HbA1c level, and 126 (60.8 percent) reported being aware of HbA1c normal levels; of those, only 39 (30.9 percent) gave a correct answer. Of the 207 patients, 138 (66.6 percent) routinely checked their blood creatinine levels, 131 (63.2 percent) never had a foot exam, and 52 (25 percent) never had an eye exam. When questioned about non-pharmacologic management of their diabetes, of the 207 patients, 124 (60 percent) had already implemented a special diet, with sugars and carbohydrates as the most common foods to avoid, followed by lipids, and 72 (34.8 percent) reported engaging in physical activity. When questioned about pharmacologic management, of the 207 patients, 33 (15.9 percent) were on insulin therapy, 172 (83 percent) on oral hypoglycemic agents, and 13 (6.3 percent) on a combination of both. Of the 207 patients, 195 (94.2 percent) were aware of the name of the drug they were taking however 171 (82.6 percent) were not aware of their drugs adverse effects. Of the 33 patients on insulin therapy, 20 (60.6 percent) were aware of insulin injections self-administration technique. When questioned about their awareness on the management of a hypoglycemic episode, 62 (29.9 percent) patients reported having experienced one. Of the 207 patients, 192 (92.7 percent) were aware of its management by taking a sugary food or drink immediately, while 15 (7.2 percent) patients followed other methods such as lying down or taking their diabetes medications.

Conclusion: Based on survey results, participants with DM were well-aware of the necessary monitoring parameters of their disease but more education on normal FBG and HbA1c is warranted for better monitoring of drug therapy efficacy and safety. Raised awareness is also anticipated for regular foot exam, exercise and smoking cessation. Use of aspirin and lipid-lowering agents was not optimal. Participants were not fully aware of their diabetes medications adverse event profile. The existing student-driven counseling service in community pharmacies can fill the gap however a multi-disciplinary approach to diabetes management in Lebanon remains crucial for a more solid control of the disease.

3-021

Category: Ambulatory Care

Title: Retrospective evaluation of glycemic control with once or twice daily dosing of insulin glargine

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Purpose: Insulin glargine is approved by the U.S. Food and Drug Administration (FDA) for once daily subcutaneous administration to improve glycemic control in adults with type 1 or type 2 diabetes and in children with type 1 diabetes. However, there have been recent reports of insulin glargine being used in a split-dose or twice daily regimen. The purpose of this study was to determine whether the twice daily dosing of insulin glargine would provide better glycemic control in patients with diabetes.

Methods: The Institutional Review Board along with the Research and Development Committee approved this retrospective electronic chart review of data collected from July 2007 to January 2011. The study included men and women who were greater than or equal to 18 years of age, had a diagnosis of either type 1 or type 2 diabetes, had adequate baseline and follow up hemoglobin A1c (HbA1c) levels, were initiated on either once or twice daily insulin glargine therapy between July 2007 to December 2009 and remained on the therapy during the 1 year follow up period. Patients on insulin glargine therapy with greater than twice daily dosing or patients with continuous oral steroid use for longer than 90 days within 3 months prior to the initiation or during the study period were excluded. The study evaluated 2 groups: all patients who were initiated on a once daily (n equals 39) or a twice daily (n equals 26) dosing of insulin glargine therapy between the predetermined time frame. The primary outcome was to compare the change in HbA1c from baseline to month 3, 6, and 12 within each group and between the 2 groups. The secondary outcomes were to identify if there was any correlation of patient demographics with twice daily insulin glargine therapy. The patient factors that were evaluated included gender (male versus female), age (less than 65 versus greater than or equal to 65), body mass index (less than 30 versus greater than or equal to 30), co-morbidities (chronic kidney disease and anemia), concurrent use with other anti-hyperglycemic agents, and the total daily dose (TDD) of insulin glargine. The primary outcome was measured by either a paired t-test or t-test as appropriate. The secondary outcomes were measured by either a Fishers exact or Chi square test as appropriate. Statistical significance was set at a P value of less than 0.05.

Results: Within the once daily insulin glargine group, there was a trend for HbA1c reduction from baseline to month 3 (from mean HbA1c of 8.3 percent with a standard deviation (SD) of 1.6, to mean HbA1c of 7.9 percent with a SD of 1.3; P equals 0.0503). This reached statistical significance at month 6 (mean HbA1c of 7.9 percent with a SD of 1.5; P equals 0.0454), but was not appreciated at month 12

(mean HbA1c of 8.0 percent with a SD of 1.9; P equals 0.3301). Within the twice daily insulin glargine group, there was a trend for HbA1c reduction from baseline to month 3 (from mean HbA1c of 8.6 percent with a SD of 1.4, to mean HbA1c of 8.4 percent with a SD of 1.7; P equals 0.3778). This reached statistical significance at month 6 (mean HbA1c of 7.9 percent with a SD of 1.3; P equals 0.0255), and lasted through month 12 (mean HbA1c of 7.6 percent with a SD of 1.2; P equals 0.0030). Between the 2 groups, the change in HbA1c from baseline through month 12 was comparable with no statistical difference. The TDD of insulin glargine was the only identified patient factor that correlated with twice daily insulin glargine therapy (mean TDD for the once daily group at baseline equaled 32.7 units with a SD of 22.6, mean TDD at month 12 equaled 37.9 units with a SD of 25.0; mean TDD for the twice daily group at baseline equaled 75.3 units with a SD of 36.0, mean TDD at month 12 equaled 86.9 units with a SD of 49.8; P less than 0.001).

Conclusion: The twice daily dosing of insulin glargine may provide better glycemic control with greater HbA1c reduction in patients with diabetes who require a higher total daily dose of insulin glargine. The role for twice daily dosing of insulin glargine must be determined in prospective, randomize, control clinical trials.

3-022

Category: Ambulatory Care

Title: Creation of a pharmacist-driven risk reduction program for University employees with diabetes

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Purpose: Diabetes and frequently associated characteristics, (e.g. unhealthy BMI, lack of exercise and feelings of diminished well being), have been associated with both increased absenteeism and decreased presenteeism in the workplace. In an effort to increase University employee health, decrease the risk of diabetic complications and offset employer costs associated with the disease, a pharmacy-driven initiative was designed and implemented through collaboration with the University's Human Resources department.

Methods: Faculty in the School of Pharmacy, along with pharmacists employed within the University system, designed the program in conjunction with Human Resources representatives. Identification of key players with expertise appropriate to the goals of the program were identified. Aside from pharmacy personnel, representatives from Exercise Science and a dietician with board certification as a diabetes educator (a CDE) were approached to participate. In addition, a licensed mental health professional employed by the School of Pharmacy would be made available on an as needed basis. Eligible participants must receive their healthcare benefits through the University, and are required to fill their prescriptions at the University-affiliated pharmacy. Continued participation will be contingent on adherence to the program determined by bi-annual evaluation.

Results: The program was designed to be cost-free for participants. The finalized design includes the assignment of each participant to a pharmacist who serves as an ambulatist responsible for coordinating the recommendations of all other professionals involved in the program. The Human Resources department has mandated that supervisors allow for time off during the participants' workday in order to allow for monthly appointments with their assigned ambulatist. An initial meeting with an exercise physiologist is set so that a participant-specific exercise prescription can be created. A one-time orientation to the campus exercise facility chosen by each participant is included. Participant-specific plans for dietary changes are designed by the dietician CDE . Additional components include support group meetings (optional), periodic laboratory assessments of cholesterol and glycemic control, pre-paid dues to a University-affiliated exercise facility, an eight-hour longitudinal diabetes education program, a blood pressure monitor, a pedometer, and written education and self-monitoring materials. A pilot

group of fifteen participants has been enrolled in the initial offering of the program. The estimated per-participant value of the program is $2,263.

Conclusion: Through collaboration among multiple University departments and with the support of Human Resources, a novel, pharmacist-run program for employees with diabetes designed to prevent complications and decrease the negative impact of diabetes on employee productivity has been successfully implemented.

3-023

Category: Ambulatory Care

Title: Virtual Samples - Bridging Patients From the Hospital to Home in the Ambulatory Pharmacy

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Purpose: Cleveland Clinic discharges thousands of patients each year most of which require medication therapy. The pharmacy department created a novel solution for all caregivers to facilitate a patient's discharge on a high cost medication.

Methods: Pharmacy developed an internally controlled website titled, Virtual Samples. Any caregiver can access it directly from a closed intranet site or linked within the electronic health record. Patients can obtain free or low cost medications in the Cleveland Clinic pharmacy or any willing provider where the patient is located.

Results: Thousands of patients have expressed their satisfaction with this solution. Physician and administrative leadership have recognized this novel solution as a means to expedite patient discharge. Various manufacturers are now wanting to participate as they understand the value of this creative system.

Conclusion: All stakeholders win when the patient can access free or low cost pharmaceuticals. Discharges are expedited, patients have choice, and pharmacy continues to generate innovative ideas that are patient and organization centric.

3-024

Category: Ambulatory Care

Title: Implementation of a discharge prescription service utilizing a dedicated pharmacy technician

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Purpose: The current economic conditions make it imperative for organizations to look for growth and revenue enhancement opportunities. In 2008, The University of Illinois Medical Center (UIMC) did not have a formal hospital discharge prescription service. However, University of Illinois Ambulatory Care Pharmacy was informally providing this service to the solid organ transplant and neonatal patients. Providing discharge prescriptions to a wider range of patients was identified as a way to promote outpatient prescription services offered by University of Illinois Ambulatory Care Pharmacy and assure safe and efficient discharge prescription processing for those patients discharged from UIMC.

Methods: A Discharge Prescription Technician (DPT) position was created to coordinate services between the outpatient pharmacy and the inpatient setting. The DPT worked out of one of the inpatient pharmacy satellites Monday through Friday 8am 4:30pm. The DPT verified prescription insurance and entered prescriptions into the outpatient pharmacy system from the inpatient pharmacy satellite. Prescriptions were processed in the outpatient pharmacy and tubed to the inpatient pharmacy satellite or picked up by the DPT if necessary. The DPT collected payments or co-payments from the patient or family member and delivered the prescriptions to the patients clinical pharmacist or nurse to provide the necessary medication counseling. The DPT obtained patient signatures and required documentations to fulfill insurance billing compliance. The services were advertised in the patient rooms with bedside placards and the DPT made an effort to meet patients when first admitted and provided the patients with her contact information. The DPT also met monthly with the new resident physicians on the targeted general medicine and cardiology services.

Results: In the first fiscal year, discharge prescription volume increased from an average of 134 per month to 533; a 298 percent increase. The average volume increased to 796 Rx per month in the second fiscal year; an additional 49 percent increase. The discharge prescription revenue was approximately 1.1 million dollar during the first fiscal year and 1.2 million dollars during the second fiscal year. Prior to the DPT service, approximately 2 percent of patients discharged from the hospital had prescriptions filled at a UIC pharmacy. This increased to 6.75 percent in the first fiscal year and 11.7 percent in the second fiscal year. Patient retention rates after the initial prescription fill are being analyzed.

Conclusion: A discharge prescription service utilizing a dedicated technician has increased prescription volume and revenue. Convenience of service, ease of payment arrangements, and knowledgeable pharmacy staff to address formulary coverage and insurance issues have brought satisfaction to patients, families, and clinicians. Access to prescribers and the electronic medical record information has led to timely clarification of prescription issues and avoidance of potential adverse drug events.

3-025

Category: Ambulatory Care

Title: Pilot of a telepharmacy intervention to improve inhaler use in veterans with COPD

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Purpose: Patients with chronic obstructive pulmonary disease (COPD) often misuse inhaled medications; misuse includes poor regimen adherence and inaccurate inhaler technique. Pharmacists' patient education and counseling may help veteran patients with COPD use inhaled medication accurately, but many patients live several hours away from a Veterans Heath Administration Clinic and may not be willing to travel for an appointment to review their inhalers. The purpose of this study was to pilot a telepharmacy intervention to improve inhaler use in veterans with COPD.

Methods: The local Institutional Review Board and Research and Development Committee approved the project. Participants were identified by pharmacy record screens for use of tiotropium and or a long-acting beta-agonist (LABA) with or without an inhaled corticosteroid (ICS). Veterans were invited to participate if they demonstrated probable low adherence by refilling at least one of their daily inhalers less than 80 percent of the time over the previous six months. Exclusion criteria included hearing impairment, cognitive disorders, transfers of primary care, and age younger than 60 years. Signed informed consent and HIPAA waivers were obtained from all participants via mail. The counseling intervention consisted of a telephone call to review the patients medication use and identification of barriers to adherence with tailored counseling to improve inhaled medication use. A follow up phone call took place approximately four weeks after the initial counseling session and reviewed issues of inhaler misuse previously identified during the baseline intervention. Outcomes of interest include barriers to inhaler use, knowledge of inhaler directions, and inhaler technique (23 survey items were used to measure outcomes). Data are expressed as means with standard deviations and proportions.

Results: Forty-nine veterans were enrolled and participated in the counseling intervention. The majority of participants were male (48 participants, 98 percent) and the mean age was 76.1 years (SD 7.8 years). At baseline, 51 percent (25 participants) reported incorrect directions for at least one inhaler. During the counseling intervention 7 out of 49 participants (14.3 percent) could not report correct LABA directions and 13 out of 44 participants (29.5 percent) could not report correct ICS directions. The metered dose inhaler (MDI) had the highest proportion of missed steps. Out of 42 participants who used an MDI, 21 participants (50 percent) did not use the correct inhalation, 30 participants (71.4 percent) did not wait one minute between puffs, and only two participants (4.8 percent) could identify when an MDI was empty. At follow up, three of the seven participants (42.9 percent) who had incorrect LABA directions

reported correct LABA directions and seven of the 13 participants (53.8 percent) who had incorrect ICS directions reported correct ICS directions. Additionally, 11 participants corrected their MDI inhalation technique (52.4 percent), 14 participants reported waiting a minute between MDI breaths (46.7 percent), and ten participants had started to appropriately determine when their MDI was empty (29.4 percent).

Conclusion: Incorrect interpretation of directions and inaccurate inhaler techniques were primary reasons for the misuse of inhalers. Veterans are able to learn inhaler information over the phone. This telepharmacy intervention may help to fill the education gap without creating a travel burden for patients. Future research is needed to determine the clinical impact of this telepharmacy intervention on inhaler use and management of COPD.

3-026

Category: Ambulatory Care

Title: Development and implementation of an insulin treat to target clinic by a pharmacist

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Purpose: Utilization of a team based approach to diabetes in primary care is at the forefront of chronic disease state management. This study evaluates the development and implementation of a pharmacist run insulin treat to target clinic.

Methods: The Northampton Veterans Affairs identified the need for a pharmacists involvement in the multidisciplinary Patient Aligned Care Team (PACT) model. A protocol for insulin therapy management was developed and approved to facilitate insulin initiation and titration (basal and/or bolus) in patients with type 2 diabetes. Patients are identified for enrollment in the insulin treat to target clinic by their primary care provider or endocrinologist. The clinic work flow provides intensive pharmacotherapeutic follow up in between primary care visits and increases health care provider access. Once patients are enrolled in the clinic protocol, they are initially followed on weekly or bi-weekly basis until their next primary care visit to prevent disruption in insulin therapy. The clinic receives all consults electronically. A clinic clerk schedules the initial face to face consult with the pharmacist. Subsequent encounters are done via telephone calls. The pharmacist utilizes a home tele-health system to evaluate home glucometer readings in order to make appropriate therapeutic recommendations. In addition to telephone communication, patients have access to the clinic pharmacist via a secure messaging system. The primary clinical outcomes (hemoglobin A1C, lipids, and weight loss) will be evaluated at three, six, and nine month intervals from the time of enrollment.

Results: In the first three months, this twice-weekly clinic received a total of 80 consults, of which 78 met the inclusion criteria. To date, 46 patients are enrolled, 7 have been lost to follow-up and 25 are scheduled.

Conclusion: The primary care PACT redesign placed an emphasis on the pharmacists role in multidisciplinary diabetes team. The pharmacist driven insulin treat to target clinic augments diabetes specialty PACT by increasing access to health care for high risk patients. The development and implementation of the clinics protocol and its workflow facilitates insulin therapy management and continuous follow up care.

3-027

Category: Ambulatory Care

Title: Can patients maintain their a1c goal one year post discharge from a pharmacist managed clinic?

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Purpose: Diabetes affects approximately 23.6 million Americans and in 2007 a total of 1.6 million new cases of diabetes were diagnosed in people ages 20 years or older. Studies have looked at the impact of pharmacists on helping patients achieve and maintain their A1c goal while under the care of these pharmacist managed services. However, it is unknown whether A1c goal can be sustained once a patient is discharged from clinic. The primary objective of this study is to determine the percentage of patients that maintain their A1c goal 1 year post discharge from the pharmacist managed clinic.

Methods: The institutional review board approved this retrospective chart review which reviewed patient information on the computerized patient record system (CPRS) at Jerry L. Pettis Memorial Veterans Medical Center in Loma Linda, California. The A1c values prior to enrollment into the pharmacist managed diabetes clinic and at time of discharge as well as 12 months post discharge were collected. The location of the pharmacist managed clinic was documented. Age, sex, weight, body mass index, and medications were collected for these patients as well. Other information such as number of hospital visits, ER visits, PCP visits, and endocrinologist visits were recorded. Medication compliance was calculated via the medication possession ratio equation.

Results: Sixty-nine patients who were discharged from a pharmacist managed clinic were enrolled into this study. 72.4% of 69 patients enrolled into a pharmacist managed clinic were able to maintain their A1c <8% one year post discharge. Patients were more likely to maintain their A1c goal when they had a lower A1c at enrollment, higher rate of compliance, and were not on insulin therapy.

Conclusion: A majority of patients were able to maintain their A1c at goal <8% at one year post discharge from a pharmacist managed clinic. Further studies may be considered to determine the ideal follow up time for the patients who were unable to maintain their A1c at goal one year post discharge.

3-028

Category: Ambulatory Care

Title: Pharmacist-managed diabetes care in a medically underserved population

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Purpose: The purpose of this study was to evaluate the impact on clinical outcomes of patients receiving pharmacist-managed diabetes care in a Federally Qualified Health Center (FQHC).

Methods: This retrospective case series was approved by the institutional review board. The study included all patients over the age of 18 years with uncontrolled Type 2 diabetes mellitus referred to the pharmacy clinic within a FQHC. Uncontrolled diabetes was defined as meeting one of the following criteria during the year prior to referral: A1C greater than 9 percent, systolic blood pressure (SBP) greater than 140 mmHg, diastolic blood pressure (DBP) greater than 90 mmHg, hospital admission or emergency department visit for a diabetes-related complication. Patients participating in the pharmacy outreach program received disease state management, patient education, and medication management. The pharmacist provided clinical services under a standing order set agreement with collaborating physicians. Primary outcomes analyzed were A1C, blood pressure, and low-density lipoprotein cholesterol (LDL). Baseline and study end data were analyzed for those patients who attended at least one session with a clinical pharmacist during an 18 month period. Outcomes were assessed using general descriptive statistics, analysis of variance, and independent samples T-test (PASW 18.0, Chicago, IL).

Results: Sixty-one patients with a mean age of 49.8 years (standard deviation 11.3) met inclusion criteria and were included in the analysis (61.3 percent female). Of the primary outcomes targeted by the pharmacy outreach program, statistically significant reductions were realized for A1C, SBP, DBP, and LDL (0.87 percent, 12.1 mmHg, 5.1 mmHg, 22.8 mg/dL, respectively; $p < 0.05$).

Conclusion: Patients with poorly controlled diabetes benefited from receiving pharmacist-delivered diabetes care. The significant improvements in A1C, blood pressure, and LDL support the role of a clinical pharmacist in this medically underserved population.

3-029

Category: Ambulatory Care

Title: Experiences in a Student-Run Patient Assistance Program

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Purpose: Patient assistance programs (PAP) can be pivotal tools in the management of underserved patients who have no prescription insurance coverage. These programs are sponsored by individual drug companies and offer free medications for patients who qualify. Unfortunately, the process of attaining medications via PAP can be burdensome and overwhelming. Patient barriers to submitting PAP applications on their own include illiteracy, lack of internet access due to financial difficulties, knowledge of PAP, access to prescribers, and a difficult process for obtaining PAP medications. Since revenue is not directly generated by PAP, many prescribers cannot or do not dedicate time for staff to help patients complete forms. Pharmacy students make ideal candidates to manage PAPs. Advantages for the students include one-on-one patient consultation and increased knowledge of medications. Since many patients require completion of multiple PAP applications, students are also able to conduct medication reviews. This project was designed to assess the implementation of a student-run PAP in an internal medicine outpatient setting.

Methods: Pharmacy students completing their Advanced Pharmacy Practice Experience (APPE) in ambulatory care were responsible for managing PAP in a geriatric ambulatory clinic with the guidance of clinical pharmacist preceptors. Students were to track interventions made on a daily basis including: patient assistance application information, drug order dates, arrival of medication, delivery of medication to patients, medication counseling, medication chart reviews, new prescriptions or refill request authorizations, prescription clarifications, lab orders, patient counseling, drug information requests, and Medicare part D assistance. Description of daily activities and logs were kept by the students. To maintain continuity of care, services were overseen by clinical pharmacists at the clinic.

Results: Two clinical pharmacists were responsible for the supervision of a total of 24 fourth-year pharmacy students completing an ambulatory care APPE at two separate clinic sites. Data was collected and compiled along with estimated medication costs if patients were to pay out-of-pocket for the drugs. The number of patients served monthly ranged from 12 to 48 with the number of medications processed via PAP ranging from 9 to 68 per month. The monthly estimated out-of-pocket medication costs ranged from nearly $4000 to just over $34000.

Conclusion: The initiation of student-run PAP in an ambulatory clinic setting resulted in significant medication cost savings for patients who were lacking prescription medication insurance coverage.

Further studies are recommended to address any changes in outcomes that might occur as patients have improved access to medication via PAP.

3-030

Category: Ambulatory Care

Title: Implementing a pharmacist clinician directed refill clinic in an academic medical center

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Purpose: Develop a process for pharmacist clinicians to facilitate prescription refills of chronic medications. This process was intended to increase the efficiency of the refill process and decrease medical provider workload in processing refill requests. The refill clinic was also designed to decrease the turnaround time from the initial request from the patient or pharmacy to patient being able to obtain their medication refill at the pharmacy. Pharmacist clinicians in New Mexico are in a unique position to assist with refilling chronic medications given their ability to prescribe under protocol.

Methods: Three pharmacist clinicians in concert with Internal Medicine and Family Practice physicians developed protocols for refilling specific therapeutic classes of chronic medications. Protocols included specific therapeutic classes covered and appropriate monitoring parameters for each medication. Patients were also required to have a medical visit with the provider within the past year to qualify for the protocol. Pharmacist clinicians were able to titrate doses of medication or change medications to a formulary medication within the same therapeutic class. Patients meeting the above criteria had their prescriptions refilled by the pharmacist clinician for up to one year. Patients whose laboratory values were outside specified limits or without a recent physician visit were referred back to their primary care provider.

Results: Prescription refill protocols were developed for sixteen therapeutic classes of chronic medications. Forty-eight providers at four ambulatory care clinics entered in collaborative practice agreements with our pharmacist clinicians. Our pharmacist clinicians began providing refill services in September 2010. Currently our pharmacist clinicians review requests for approximately 83 prescriptions for 75 patients per day. The most common therapeutic classes requested through the pharmacist refill service are antihypertensives, antihyperlipidemics and antidiabetic medications and supplies. Our pharmacists are able to independently complete the refill requests for approximately 75% of the prescriptions and 25% are referred back to their medical provider. The most common reasons that our pharmacist clinicians are unable to complete the refill request are required laboratory monitoring parameters are either not completed or outside a specified range, the medication requested is no longer listed as current in the patients medical record or the patient did not have a visit within the past year with their medical provider.

Conclusion: Pharmacist clinicians participating in a refill clinic are able to offset a large amount of medical providers time by allowing them to complete refill requests independently based on protocol. Pharmacist clinicians are able to complete approximately 75% of the refill requests sent to them by patients or pharmacies based on current refill protocols. We are currently evaluating changes to increase the percentage of refills that our pharmacist clinicians can independently complete. These changes include revising protocols to allow pharmacist clinicians more leeway in interpreting laboratory values, pharmacist clinicians ordering more required laboratory monitoring parameters and increasing referrals to pharmacist clinician disease state management clinics for patients not achieving their therapeutic goals.

3-031

Category: Ambulatory Care

Title: Outcomes of a pharmacist-run smoking cessation program in an underserved population

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Purpose: Patients of low socioeconomic status smoke at rates higher than the general population. More striking is the rate of smoking in the homeless population, almost three times that of the general population, yet few study the success of smoking cessation in this population. To address this health disparity, pharmacists at the Birmingham Free Clinic have offered a free smoking cessation program for a predominantly homeless, underserved population for ten years. The primary objective of this study was to assess the quit rate of patients participating in the program. In addition, we looked at patient characteristics, daily nicotine use and dependence, motivations and barriers to quitting. We also determined if any differences existed between homeless and housed participants.

Methods: This was a retrospective chart review of patients participating in the smoking cessation program from 2001-2009. The 9-weeek smoking cessation program included weekly counseling sessions and free nicotine replacement therapy in the form of a patch. Data retrieved included patient demographics (age, race, gender, education, housing status), reasons for quitting, barriers to quitting, daily nicotine use, Fagerstrom test for nicotine dependence score (FTND), previous quit attempts, number of weeks in the program and final cigarettes per day. This study was approved by the Institutional Review Board.

Results: A total of 368 patients participated in the program during the timeframe evaluated. They were 43.6 years old, male (79%), African American (54%) and white (37%). Sixty percent were classified as homeless. Nineteen percent had less than a high school education, and only 7% had a college degree. They smoked an average of 20.7 cigarettes per day; the homeless population smoked fewer cigarettes per day (19 vs 24 p=0.0001). Most (75%) had a previous quit attempt and had smoked for 20 years or more (70%). The majority of patients had high (59%) or moderate (39%) nicotine dependence. There was no difference in nicotine dependence (FTND average =6.8) in housed vs homeless. The main reasons for quitting were health (94%) and cost (49%). The major barriers to quitting were habit (34%) and dealing with stress (26%). Housed patients were significantly more likely to consider weight gain a barrier to quitting (p=0.0003). There was a trend for the homeless to report habit as a barrier (p=0.08). Patients stayed in the program an average of 4 weeks. At the last session attended, 30% of homeless and 40% of housed reported no cigarettes (p=0.057). Attrition from the program was high. Only 54 (15%) patients completed the 9-week program and self-reported zero cigarettes per day.

Conclusion: Housed and homeless quit rates were similar but success rates in smoking cessation were low overall. There were some differences in barriers to quitting. Further research is needed to develop culturally adaptive programs for this special population. Such targeted programming may enhance the success of such programs in underserved populations in the future.

3-032

Category: Ambulatory Care

Title: The pharmacist role in providing expanded access to medicines and care at a free urban primary care clinic

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Purpose: The Birmingham Free Clinic (BFC) in Pittsburgh, PA serves a growing population of patients with chronic diseases. This busy clinics walk-in model requires patients to return monthly in order to receive all medicines for free on-site. This model works well to provide access for new patients, but is less-than-ideal for patients needing continuing care. Because of the time required by patients to navigate the first-come-first-serve model, patients often delay returning to the clinic until they are out of medicines complicating management of their chronic diseases. With limited volunteer physician staffing and thus, physician continuity, BFC developed a pharmacist-run appointment-based collaborative care program to provide on-going care and medication refills to patients with chronic diseases. The goal of this program was to improve access to care and reduce the number of patients returning to the clinic after they were out of medicines. In this assessment we investigate the impact of the pharmacist-run program on overall patient follow-up and on timeliness of medication refills for patients participating in the program.

Methods: In this retrospective chart review, we reviewed all patients who had a pharmacist visit since the initiation of the collaborative care program (June 2009-May 2011). For patients with two or more pharmacist visits during the time frame, we tracked the number of clinic (physician) visits in the year prior to their first pharmacist visit, and the number of clinic (physician or pharmacist) visits in the year after their first pharmacist visit. In addition, we tracked the number of visits where the patient would have been overdue for medicines (calculated based on the number of days of medicine dispensed and the date they returned for refills) in the year before and after their first pharmacist visit. The University of Pittsburgh Medical Centers quality improvement committee provided approval for this project.

Results: A total of 64 patients had a least one pharmacist visit in the time frame assessed. The majority of patients were middle-aged (49.5 years), male (54.9%), black (51.6%), low-income ($640/month), and housed (59.3%). The most common conditions seen were hypertension (94% of patients), diabetes (45%), and dyslipidemia (39%). A total of 48 patients had two or more pharmacist visits in the time frame assessed. In the year prior to the initiation of the pharmacist-run program, patients had an average of 7.4 visits/year (range 2-16) of which 45% were overdue for medication refills (avg 3.4/year; range 0-7). In the year after the initiation of the pharmacist run program, patients had an average of

11.1 visits/year (range 7-16) of which 40% were overdue for medication refills (avg 4.4/year; range 0-8). After the intervention, patients had an average of 50% more visits/year after the initiation of the pharmacist visits ($p=0.0001$). The decrease in the percent of visits where the patient would have been overdue for refills was not statistically significant ($p>0.05$).

Conclusion: The appointment-based pharmacist-run collaborative care program successfully increased the number of patient visits per year, though did not significantly decrease the number of patient visits where patients were out of medicines. In this somewhat transient and resource-limited population, it is important for the BFC to continue to evaluate new ways of improving patient access to timely, appropriate care. Pharmacists serve a key role in expanding access, especially in areas of physician shortage and need. Future studies should evaluate the impact on health outcomes of using pharmacists to expand access in these settings.

3-033

Category: Ambulatory Care

Title: Assessing heart age in patients with limited access to healthcare at free community health screenings

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Purpose: Heart disease is a leading cause of death in the United States. A validated risk calculator has been developed to determine the percent chance of someone dying from a cardiovascular event within the next 10 years. A modified Framingham Risk Score (General Cardiovascular Risk for Men and Women) is utilized when laboratory data is unavailable. Individuals with limited access to health insurance and/or primary care providers may not receive adequate preventative treatment for cardiovascular disease resulting in unappreciated cardiovascular risk. The purpose of this study is to measure the cardiovascular risk in patients who have limited healthcare access by comparing their Framingham heart age to actual age.

Methods: The investigational review board approved this retrospective review of existing data from multiple university sponsored Community Health Screening events. The Community Health Screening events targeted adults over the age of 18 who were homeless or of lower socioeconomic status with very little or no health insurance. Participants were recruited with advertisements placed at homeless shelters, food banks, vocational schools, and the local Department of Health and Welfare. Each voluntary participant was educated about the purpose of the screenings and asked to complete an informed consent. Voluntary participants received a series of preventative health screenings; conducted by students from a variety of health care disciplines. All students were supervised by their corresponding licensed faculty member. A progress note was used to document findings during the various screening stations. The various stations included; blood pressure assessment, height and weight, a brief physical exam, a brief dental exam, a nutrition assessment, glucose level, HIV testing, Hepatitis C testing, immunizations for influenza and hepatitis A and B, depression screening, audiology evaluation, and a medication review. After completion of the screening a copy of each progress note was made and securely stored within the university. Data for this project was gleaned from these progress notes and entered into a blinded excel database for analysis. An interactive online tool was utilized to calculate Framingham heart age (accessible at www.framinghamheartstudy.org/risk/gencardio.html). The calculation provides an estimate of an individuals heart age based on current age, blood pressure, presence or absence of treatment of hypertension, smoking status, body mass index (BMI), and presence or absence of diabetes. Patients were assumed to be on blood pressure treatment if they had any blood pressure lowering medication listed during the medication review. Patients were classified as diabetic if their random blood glucose level was greater than 200 or any medication used to treat

diabetes was on their medication list. The primary outcome was the mean difference in chronological age versus calculated Framingham heart age. Secondary outcome was to describe any gender differences that may exist in this population (ie. if either gender had higher cardiovascular risk). Results are expressed as mean age with corresponding standard deviations. A paired students t-test determined the statistical significance between heart age and actual age and reported as a p value with 95 percent confidence interval. A analysis of repeated measures ANOVA determined the significance of any interaction between gender and heart age. SAS statistical software was utilized for this analysis.

Results: During 6 different screening events, 162 patients presented for screenings. Data was incomplete for 34 of the individuals and one individual was excluded because their age was greater than 85 which exceed the validity of the modified Framingham risk score. The remaining 128 individuals were included in the heart age analysis. The mean age of participants was 45.14 yrs (SD 12.77 yrs), while the mean heart age was 51.05 yrs (SD 12.69 yrs). The difference between the actual age and heart age of the participants in the health screening was 7.3 years (p less than 0.0001; 95 percent CI -8.91 to -5.70). A one-way ANOVA demonstrated chronological age similarity between genders (p equals 0.87). The analysis of repeated measures ANOVA demonstrated no significant interaction between gender and heart age (p greater than 0.47), but there is an effect across genders (p less than 0.0001) indicating that both genders have equally elevated heart age as compared to their chronological age.

Conclusion: Patients with limited healthcare access who presented to community health screening events demonstrated a significantly increased Framingham heart age compared to their chronological age regardless of gender. This study suggests these individuals have unappreciated risk of developing early heart disease and may not have adequate resources to appropriately address this risk. Whether this risk is significantly different from individuals who do have adequate access to healthcare was not determined by this study and is needed to determine the clinical significance or our results.

3-034

Category: Ambulatory Care

Title: Evaluation of warfarin management in patients with atrial fibrillation and the potential impact of dabigatran at a Veterans Affairs Medical Center

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Purpose: To assess the quality of international normalized ratio (INR) control at the Providence VA Medical Center's Anticoagulation Clinic, contribute to the existing data on warfarin use in the elderly, and evaluate the potential impact of dabigatran at a Veteran's Affairs Medical Center.

Methods: This retrospective chart review was approved by Institutional Review Board and Research and Development Committees of the Providence VA Medical Center. Patients included were newly diagnosed with atrial fibrillation and were followed in the Anticoagulation Clinic at the Providence VA Medical Center from January 1, 2005 to December 31, 2010. The primary outcome was time in therapeutic range (TTR) over 12 months. This was calculated as the fraction of INRs within range. Secondary outcomes included number of hemorrhagic or ischemic strokes, transient ischemic attacks, major or minor bleeding events, and the number of patient falls. The follow up period was one year. Patients greater than 65 years of age were included. These were stratified into three groups: age 65 - 74 (n equals 14), age 75 - 84 (n equals 19), and age greater than 85 years (n equals 15). Patients with liver disease, those who received less than 12 months of warfarin therapy, and patients with mechanical heart valves were excluded. Baseline characteristics included age, sex, race, CHADS2 score, and concurrent medications with known warfarin and/or dabigatran interactions. The following co-morbidities were recorded: Stents, history of deep vein thrombosis, myocardial infarction, transient ischemic attack (TIA), stroke, hypertension, congestive heart failure, diabetes, and major bleeding. Each patient's most recent serum creatinine was recorded. The Bleeding Risk Index, occult blood and complete blood counts were assessed for patients with documented major or minor bleeding. VA national pricing was used for warfarin and dabigatran. Local cost information was used for provider time and laboratory monitoring. Hospitalization cost estimates were obtained from the Health Economics Resource Center. Differences in outcomes by age were analyzed with Wilcoxan Rank Sum or Fisher's Exact test as appropriate.

Results: The overall mean TTR was 64.58%. Mean TTR was 58.69%, 61.74%, and 67.73% for patients aged 65 - 74, aged 75 - 84, and greater than 85 years old, respectively. This difference was not significant. There was no statistically significant difference in secondary endpoints between the age

groups. The cost of medications, laboratory monitoring, provider visits, and hospitalizations in this sample was approximately $74,000 during the one year follow-up period.

Conclusion: The average TTR was consistent with national averages. The oldest age group had higher mean TTR than the two younger age groups. Based on evaluation of patient comorbidities and concomitant medications, it was estimated that approximately 50% of patients with non-valvular atrial fibrillation in this sample may be appropriate candidates for dabigatran. If extrapolated to include all patients with non-valvular atrial fibrillation managed in this Anticoagulation Clinic, annual drug acquisition costs alone may increase by more than $300,000 at the Providence VA Medical Center. It is unclear if dabigatran use will result in reduced overall healthcare costs in this population.

3-035

Category: Ambulatory Care

Title: Evaluation of a pharmacy new patient clinic at a Veterans Health Administration hospital

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Purpose: New patients are continually being enrolled into the Veterans Health Administration (VHA) healthcare system. These patients are often taking medications which were initially prescribed by non-VHA providers, and many of these medications are not on the VHA formulary. Additionally, many patents have extensive medication lists which can be time consuming to review. Pharmacists are well equipped to review medication lists of new patients and to make formulary recommendations for those patients wishing to obtain their medications from the VHA Pharmacy. To fulfill this need, a Pharmacy New Patient Clinic was recently established as a new service at the William S. Middleton Memorial Veterans Hospital. This project was completed to evaluate the Pharmacy New Patient Clinic in terms of medications reviewed, formulary conversions, and other recommendations made by the pharmacist provider. The patient encounter also provided an opportunity to review pharmacy policies and procedures that may be important for patients to effectively use pharmacy services.

Methods: This study was approved for exemption by the local institutional review board and approved by the VHA Research and Development Committee. A retrospective chart review of patients contacted by the Pharmacy New Patient Clinic was completed. Patients contacted between October 22, 2010, and March 18, 2011, were included in this review. Data collected included information regarding number of medications the patients were taking, number of formulary conversions made by the pharmacist, and number of consult recommendations made and consults placed as a result of the Pharmacy New Patient Clinic encounter. Additionally, the number and types of changes made by general medicine providers to orders entered by the pharmacist were reviewed. Descriptive statistics were utilized to assess data gathered.

Results: Over the period of review, 117 patient records were reviewed, of which 26 did not participate in the Pharmacy New Patient Clinic due to inability to contact the patient or the patient declining the offer. Thirty-one face-to-face clinic visits and 86 telephone clinic interviews were completed during the reviewed period. There was an average of 5.09 medications including 1.33 non-formulary or restricted medications per patient. A formulary conversion was made by the pharmacist for approximately 22% of the patients, with a total of 33 formulary conversions made by the pharmacist. Common classes of medications for which conversions were made were statins, phosphodiesterase-5 inhibitors, and intranasal corticosteroids. Changes to orders entered by the pharmacist were infrequently made by patients general medicine providers.

Conclusion: A Pharmacy New Patient Clinic service was effectively established at a VHA facility and both telephone and face-to-face encounters appear to be effective methods for providing this service. Services of this nature offer pharmacists the opportunity to become involved in the enrollment of new patients into healthcare systems and establish themselves as part of the health care team from the initiation of health care. The Pharmacy New Patient Clinic service will be continued at this facility in the future, though satisfaction assessments of general medicine providers and patients will be important to more completely assess the service and determine areas for continued improvement.

3-036

Category: Ambulatory Care

Title: Evaluating prescriber adherence to current dosing recommendations in statin-fibrate combination therapy at the Providence Veterans Affairs Medical Center (PVAMC)

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Purpose: Combination statin and fibrate therapy is commonly used to treat mixed dyslipidemia particularly targeting triglycerides and LDL-cholesterol. When these agents are used individually there are risks of adverse side effects but when used in combination there are increased risks of hepatotoxicity, myopathy and in severe cases rhabdomyolysis. The Third Report of the National Cholesterol Education Program in Adult Treatment Panel (NCEP-ATP III) and the Veterans Affairs Pharmacy Benefits Management (PBM) Guidelines do not recommend routine use of this combination therapy unless the benefits outweigh the risks. Current dose recommendations are available for lovastatin, simvastatin and rosuvastatin with maximum doses of 20mg, 10mg and 10mg respectively when given in combination with gemfibrozil. The purpose of this study was to identify the percentage of HMG-CoA reductase inhibitor (statin) prescriptions, which were consistent with the VA PBM guidelines in combination with a gemfibrozil in the VA setting.

Methods: The Institutional Review Board and Research & Development Committee approved this retrospective medical record review of data collected, using the computerized patient record system (CPRS), from all patients on combination statin-fibrate therapy at the Providence Veterans Affairs Medical Center (PVAMC) from November 2005 to November 2010. The primary outcome was to evaluate the percent of prescriber adherence to PBM guidelines for statin-fibrate combination therapy. The secondary outcomes were to compare lipid goals achieved by level of statin dose (recommended versus high-dose), and to evaluate the use of VA and non-VA lipid lowering medications. Inclusion criteria were: patients greater than 18 years of age, diagnosis of hyperlipidemia/dyslipidemia and coronary heart disease/coronary heart disease risk equivalent on simvastatin, rosuvastatin, lovastatin and twice daily gemfibrozil for at least 6 weeks with no history of concomitant therapy 3 months prior to treatment initiation between November 2005 to November 2010. Exclusion criteria included: patients who had contraindications to the medications, once daily gemfibrozil therapy and/or on fenofibrate therapy. Descriptive statistics were used to assess adherence to the guideline recommendations for statin-fibrate dosing. Chi-square test or Fishers Exact test were performed to compare the LDL and TG goals achieved between the recommended and high-dose statin groups at 30, 60 and 90 days post-initiation of therapy for each statin. Baseline characteristics included: age, gender, statin and fibrate doses, other lipid lowering medications, liver function tests (LFTs), creatine kinase (CK), serum creatine

(Scr), thyroid stimulating hormone (TSH), low-density lipoprotein cholesterol (LDL), triglycerides (TG), total cholesterol and high-density lipoprotein cholesterol (HDL).

Results: Of the 194 patients reviewed, 62 patients met inclusion criteria. Twenty-four patients were prescribed a recommended statin dose, while 38 patients were prescribed a high dose statin . Therefore 61% of the statin prescriptions were not consistent with the PBM guidelines for statin-fibrate combination therapy. A total of 23 patients were receiving other lipid lowering medications, 10 in the recommended statin dose group and 13 in the high statin dose group. The other lipid lowering medications included: fish oil (10), niacin (8), colestipol (1), ezetimibe (2) and another non-VA prescribed statin (2). There was a decrease of 4.0 mg/dl in LDL, 41.1 mg/dl in TG and increases in total cholesterol of 0.4 mg/dl and HDL of 1 mg/dl. No statistically significant difference was observed between the recommended and high statin dose groups in LDL, total cholesterol, and HDL. There was a significant difference in triglycerides (P equals 0.007) in favor of the high statin dose group. No differences were observed in other lab values collected.

Conclusion: Despite warnings in the medical literature and published VA guidelines regarding dose limits in statin-fibrate combination therapy, only 39% of the statin prescriptions were consistent with VA PBM dose guidelines. No difference was observed in the mean change in lipids between the correct and high statin dose groups when given in combination with gemfibrozil 600mg BID. A significant difference was observed in the mean change in triglycerides at 90 days between the correct and high statin doses; however, the triglyceride goal was not achieved in either group. The difference may be attributable to the higher statin dose used. Therefore with increased risk of adverse effects and no additional benefit in achieving lipid goals at statin doses above the recommended guidelines, it is recommended that prescribers should prescribe within the recommended guidelines when statins are given in combination with gemfibrozil and alternative agents (niacin, fish oil) are added to the lipid therapy.

3-037

Category: Ambulatory Care

Title: Comparison of efficacy and tolerability between niacin extended-release and sustained-release niacin

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Purpose: Dyslipidemia is highly correlated with coronary heart disease, which is the leading cause of death in the United States. There are many lipid-lowering medications; Niacin has been proven to decrease LDL-C and triglycerides as well as increase HDL-C. While there are several prescription and non-prescription niacin products, they all differ in efficacy, toxicity and metabolism. Whether Niaspan and Slo-Niacin are comparable with respect to efficacy or safety still remains unclear, as this study is not head to head. The purpose of this study was to evaluate efficacy and safety outcomes following a conversion from Niaspan to Slo-Niacin.

Methods: This was a retrospective cohort study of pharmacy records and laboratory results using data extracted from the VA Desert Pacific Healthcare Network (VISN 22) data warehouse. Patients who were previously on Niaspan and switched to Slo-Niacin between 9/1/2010 1/4/2011 were included in the analysis. Patients were excluded from the study analysis if they had an ICD-9 code of liver dysfunction/hepatitis, hemodialysis, and/or myopathy; no pre or post conversion labs within 6 months; changes in other lipid medications; and if patients were on Slo-Niacin for less than 2 months. This was a preliminary analysis of the conversion process. Primary endpoints included: lipid panel (total cholesterol, LDL-C, HDL-C, and triglycerides). Secondary endpoints included: AST/ALT, CPK, A1C, discontinuation rates and reports of flushing. Descriptive statistics, and paired t-test were performed.

Results: 241 patients met inclusion and exclusion criteria and were used in data analysis. There was a statistically significant ($p<0.05$) reduction in mean LDL-C following conversion to Slo-Niacin (84.5 mg/dL vs. 81.2 mg/dL). There was a statistically significant ($p<0.05$) increase in mean HDL-C following conversion to Slo-Niacin (40.2 mg/dL vs. 41.8 mg/dL). There was a statistically significant ($p<0.05$) increase in mean triglycerides following conversion to Slo-Niacin (131.6 mg/dL vs. 142.6 mg/dL). There was no statistically significant ($p=0.7677$) decrease or increase in mean total cholesterol following conversion to Slo-Niacin (151.3 mg/dL vs. 150.8 mg/dL). There was no statistically significant ($p=0.1798$) decrease or increase in mean AST following conversion to Slo-Niacin (26.05 unit/L vs. 26.86 unit/L). There was no statistically significant ($p=0.1022$) decrease or increase in mean ALT following conversion

to Slo-Niacin (25.45 unit/L vs. 27.13 unit/L). Twelve patients (4.9%) discontinued niacin and no adverse drug reactions of flushing were reported.

Conclusion: Preliminary results reveal that Slo-Niacin is well tolerated and is equally efficacious compared to Niaspan. While some results were statistically significant, this is not likely to be clinically significant. Further evaluation will be conducted to assess the full extent of the efficacy and tolerability of the niacin conversion once the conversion has been completed.

3-038

Category: Ambulatory Care

Title: Impact of inpatient smoking cessation counseling on three month quit rates

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Purpose: Smoking is the leading cause of preventable deaths in the United States and has been linked to an increased risk of cancer, chronic obstructive pulmonary disease, and cardiovascular disease. The ability to identify patients at the time of hospitalization offers a key opportunity to initiate smoking cessation interventions at a time when patients are focused on their health and may be more likely to making a lifestyle change. The health benefits of smoking cessation are well documented and begin to occur almost immediately, i.e. within 2 to 12 weeks of quitting, lung function begins to improve. The purpose of this study was to determine three month quit rates based on smoking cessation counseling provided, diagnosis at the time of admission, and nicotine dependence.

Methods: The study was approved by the Institutional Review Board. It was designed as a randomized, prospective, single center study to evaluate the three month quit rates in patients that had been hospitalized. All patients admitted to the hospital were screened for smoking status by the nursing staff. Patients with a positive smoking status were interviewed by a clinical pharmacist and invited to participate in the study. To be included, patients had to be willing to quit and receive their first counseling session prior to discharge. Once patients agreed to participate, they were randomized into one of two groups. Group A received smoking cessation from a clinical pharmacist before leaving the hospital and was offered pharmacotherapy for smoking cessation, while group B was given simple written information and instructed to follow-up with the smoking cessation clinic in pulmonary rehabilitation. All patients in both groups completed a Fagerstrom test for nicotine dependence, a readiness to quit tool, and questions regarding smoking habits and beliefs. Each participant was contacted three months after discharge to assess quit rates.

Results: A total of 71 patients participated in the study. The average age was 47.7 years, with a range from 20 to 87 years. Sixty-six percent were male. The majority of the patients (65.7%) reported that their hospital stay was very important in their desire to quit. Ninety-seven percent scored above a 16 on the readiness to quit survey, indicating that they were ready to quit. Thirty-nine percent scored in the medium to very high nicotine dependence on the Fagerstrom questionnaire. The majority of the patients had attempted to quit smoking in the past, the average number of quit attempts was 4.6, with a range of zero to thirty. Out of the 71 patients that were randomized, only 50 patients were reached via telephone to calculate quit rates at the 3 month post discharge period. Of the fifty patients that

completed the study, 40% quit at 3 months (22.5% in group A and 27.5% in group B). Out of the patients randomized to follow-up with the clinic, no patients reported to the clinic. The most common medication prescribed for smoking cessation was nicotine replacement therapy.

Conclusion: This study confirmed a 40% quit rate at three months post discharge, but failed to show a correlation between quit rates and smoking cessation counseling. This study confirms that some patients may have quit based on the above factors. However, getting patients to attend the first smoking cessation class was challenging. Patients reported many reasons for not being able to attend including, transportation, money and time.

3-039

Category: Ambulatory Care

Title: Comparison of prescribing patterns and risks with metoclopramide

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Purpose: Metoclopramide is indicated by the Food and Drug Administration (FDA) for symptomatic gastroesophageal reflux and for diabetic gastroparesis. However, it should be used for no longer than 12 weeks in duration unless the benefit outweighs the potential for tardive dyskinesia (TD). The prescribing patterns and patients at risk for developing TD from metoclopramide were described for two groups within a family medicine clinic: patients receiving metoclopramide for greater than 12 weeks (longer than FDA-approved length of therapy, or LTALT) versus those receiving metoclopramide for 12 weeks or less (FDA-approved length of therapy, or ALT).

Methods: A retrospective chart review was performed of electronic health records from September 2008 to August 2010 after institutional review board approval. All patients who had received at least one electronic prescription of metoclopramide over the previous two years were included. Demographic data was obtained and patients at increased risk for TD identified, including age (greater than 65 years), female gender, diabetes, and those receiving medications known to cause TD. Prescribing patterns were identified, including diagnosis for receiving metoclopramide, dose regimen, duration of treatment, and whether the dose was changed during the course of treatment. Finally, data was captured regarding physician analysis of adverse effects, including documentation of use of the Abnormal Involuntary Movement Scale (AIMS) or any other assessment of involuntary movements. The two groups were compared using descriptive statistics or unpaired t-tests when interval data was used.

Results: Of the 124 patients included, 90 patients were in the LTALT group and 34 were in the ALT group. Patients in the LTALT group were more likely to be 65 years or older versus those in the ALT group (31 percent versus 21 percent) and more likely to be female (80 percent versus 56 percent). Patients in the LTALT group were also more likely to have a diagnosis of psychiatric comorbidity or diabetes (60 percent versus 47 percent). A correct diagnosis was entered for 38 percent of the patients in the LTALT group versus 27 percent of the patients in the ALT group. Patients in the LTALT group received metoclopramide an average of 13 months more than those in the ALT group (p less than 0.05). The difference in average daily doses for the two groups was not statistically significant, and doses were changed infrequently. Also, the groups were comparable regarding concomitant medications that could cause extrapyramidal reactions. Of note, 17 percent of the patients in the LTALT group were documented as being assessed for involuntary movements versus 6 percent in the ALT group. No patients were assessed with a documented AIMS test.

Conclusion: Patients receiving metoclopramide for longer than the FDA-approved length of treatment were more likely to be older and more at risk for developing TD. Although patients in this group were

more likely to be assessed for involuntary movements, the overall assessment for both groups was low. No patient in either group was assessed with the more rigorous AIMS test.

3-040

Category: Ambulatory Care

Title: The Impact of a Pharmacy Student Delivered Hypertension Education Program in Disease Awareness

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Purpose: Hypertension affects over 75 million Americans and is one of the most prevalent disorders in the United States. Current national recommendations for the prevention and treatment of high blood pressure emphasize lifestyle modifications. A survey of 20 states in 2005, conducted by the Center for Disease Control, found that patients with high blood pressure (confirmed by two or more visits to a health professional) had made significant changes in their eating habits, reduced the use of sodium, reduced or eliminated the use of alcohol, were exercising and were taking antihypertensive medication. A hypertension management program overseen by pharmacy students and clinical pharmacists was started at the SHARING Clinic, student-run free clinic, at the University of Nebraska Medical Center. As part of the program therapeutic adjustments were made along with patient education. The purpose of this project is to focus on the educational component of this hypertension management program by evaluating the effectiveness of patient education by pharmacy students.

Methods: Patients that were diagnosed with hypertension were randomly selected to participate in the program and these patients were to be seen every two to three weeks. Prior to starting the program each patient was given a pre-test to assess their basic understanding of hypertension. Four education modules were designed by pharmacy students as part of the learning plan for selected patients. At each visit, pharmacy students provided patient education on one learning module. Various educational hand-outs published by the Department of Human Services, National Institute of Health, and the American Heart Association were provided to each patient as reference material for each module. Interpreters and hand-outs written in Spanish were provided to Spanish speaking patients. The first educational module oriented each patient to their individual blood pressure goal, defined hypertension, and underlined the importance of controlling blood pressure. Module two emphasized the importance of low sodium intake, the DASH diet and limiting alcohol consumption. Module three focused on the positive effects of exercise, how to exercise effectively for each patients individual needs, and smoking cessation. Module four highlighted important take home points on how to manage hypertension, how to prepare for each appointment with their primary care provider, and aspects of routine care that is essential for overall health. After the completion of all four educational modules, each patient completed a post-test to assess if there were any gaps in learning points of the program.

Results: To date, two patients have completed the educational program, four patients have completed two educational modules and four patients have completed only the first module. The average pre-test score was 5 out of 10. The first patient to complete the program scored 6 out of 10 on the pre-test and 7 out of 10 on the post-test. The second patient initially scored 4 out of 10 on the pre-test and scored 9 out of 10 on the post test. A couple of barriers became apparent at the beginning of this project: language and missed appointments. Spanish interpreters of different levels of experience are provided to Spanish speaking patients. Not all interpreters were fluent in Spanish. Some Spanish speaking patients had a difficult experience understanding the educational module that was being translated by the interpreter. The literacy level is also low in some of the Spanish speaking patients and the hand-outs provided in Spanish were not effective reference material. Many patients also missed multiple appointments. These patients stated that either transportation was an issue or that it was too much effort to come to the clinic for the extra appointments.

Conclusion: Early results suggest that a pharmacy student delivered education module can improve patient awareness of how to manage hypertension. Continued efforts are needed to overcome language barriers and assistance is needed to help patients make their appointments.

3-041

Category: Chronic / Managed Care

Title: Physician community pharmacist collaborative care in diabetes management

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Purpose: Collaborative practice between community pharmacists and physicians play an integral role in achieving treatment goals in various diseases. Diabetes a metabolic disease where attaining treatment outcomes is suboptimal in majority of the patients either due to disease complexity or due to poor compliance and patient counseling. Several studies demonstrated that pharmacist interventions improve diabetes outcomes but collaborative practice between community pharmacists and physicians foster the medical therapy management services. Hence, objective of this study is to evaluate the effectiveness of pharmacist physician collaborative practice in diabetes management.

Methods: Prior to participation in this randomized prospective study in a community pharmacy setting an informed consent was obtained for eligible patients. The inclusion criteria included adults with type II diabetes mellitus (DM) older than eighteen years of age with HgbA1C greater than 6.5%. The exclusion criteria included gestational DM and patients with type I DM. The agreement protocol consisted of a primary care physician referring patients to the pharmacist managed clinic. The tasks of the pharmacist under the defined protocol include self-monitoring of blood glucose, diabetes education, medication counseling, compliance testing, laboratory monitoring, dosage adjustments and therapy recommendations to the primary care physician. Study was conducted over a three month period where baseline fasting blood glucose (FBG) was obtained and patients were also assessed about their medication compliance. Patients were then seen in the clinic once monthly and a phone follow-up was performed at least twice monthly. The primary endpoint was the impact of the three month participation on the FBG. Secondarily, patients compliance and knowledge about their medications, regular self-monitoring of blood glucose, and adherence to regular exercise and smoking cessation were evaluated.

Results: A total of 25 patients were enrolled in this study with baseline age of 59.46 11.03 (mean years Standard deviation SD) and FBG of 155.07 48.11 (mean SD). After three month follow-up, FBG decreased from 155.07 mg/dl at baseline to 125 mg/dl. The secondary endpoints including patient compliance with medication (p equals 0.001), regular self-monitoring of blood glucose (p equals 0.072), patient knowledge about their medications (p equals 0.003), awareness about disease state and complications (p equals 0.002), adherence to well balanced diet (p equals 0.001), and adherence to regular exercise (p equals 0.003) and smoking cessation (p equals 0.09) were all reduced after three month follow-up.

Conclusion: This study demonstrates that the physician-pharmacist collaborative care was successful in reducing FBG and improving patients satisfaction and quality of care. A positive impact of community pharmacist on achieving the goals was evident by an improvement in diabetes outcomes among all enrolled patients. Pharmacists tasks arent only limited to the practice of medication dispensing but it includes various responsibilities as improving patient awareness about the disease and drugs and enhancing monitoring of disease progression.

3-042

Category: Chronic / Managed Care

Title: Adherence to antihypertensive treatment and the impact on blood pressure control

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Purpose: Despite a multitude of available antihypertensive therapies, hypertension control remains a challenge. One of the biggest barriers to hypertension control in primary care settings is the lack of adherence to prescribed antihypertensive medications. The goals of this study were to: 1) examine patient adherence to hypertension medications using Pharmacy claims data, 2) determine if good adherence is associated with improved blood pressure control and 3) identify patterns and predictive indicators of adherence.

Methods: The institutional review board approved this retrospective study of patients, 18 years and older, who were continuously enrolled at Kaiser Permanente Southern California (KPSC) in 2010 with documented hypertension, per KPSC Hypertension registry, and who received at least two antihypertensive prescriptions in 2010. The first antihypertensive dispense date in 2010 was identified as the index date and to be eligible, patients must have at least one blood pressure reading between the index date and end of the study (defined as 12/31/2010, disenrollment or death). Prescription claims data were used to evaluate patient adherence to the antihypertensive treatment. Medication adherence was calculated using the Proportion of Days Covered (PDC). A PDC of at least 80 percent was classified as adherent. Blood pressure measurements, documented in the electronic medical record throughout the study year, were averaged for each patient to determine blood pressure control. An average blood pressure of less than or equal to 140/90 was defined as blood pressure control. The primary outcome measure was blood pressure control and this outcome measure was used to study differences in patients identified as adherent versus non-adherent. In addition we evaluated factors associated with good adherence including age, gender, race, presence of other chronic conditions, number of prescribed medications, number of outpatient clinic visits, out of pocket medication expenses and use of mail order pharmacy services. Descriptive statistics (chi-square and t-test) were used to evaluate differences in baseline characteristics between adherent and non-adherent patients. Multivariate logistic regression was used to estimate the odds-ratio for adherence on blood pressure control.

Results: Among the 508,942 hypertensive patients enrolled in the study, 439,103 (86.3 percent) patients were identified as adherent with a calculated PDC of 80 percent or higher. Blood pressure was

controlled in 78.4 percent of the adherent patients and 73.3 percent of the non-adherent patients (P less than 0.001). Newly diagnosed hypertensive patients, in 2010, were less adherent than patients with longer standing hypertension, 2009 or earlier (14.1 percent versus 9.3 percent, P less than 0.001). Average systolic and diastolic blood pressures were 1.5/3.7 mmHg lower in the adherent patients (P less than 0.001). Adherence was higher among patients who were older (64.8 percent versus 58.8 percent, P less than 0.001) and those with chronic conditions (Diabetes 32.6 percent versus 28.4 percent, Congestive Heart Failure 6.9 percent versus 3.6 percent, Chronic Kidney Disease 21.9 percent versus 13.7 percent, Coronary Artery Disease 20.4 percent versus 12.4 percent, all with P less than 0.001). Interestingly, adherent patients were taking more medications (mean of 9.2 percent versus 7.7 percent, P less than 0.001) and more likely to use mail order pharmacy services (36.7 percent versus 22.8 percent, P less than 0.001) than non-adherent patients. In the multivariate model, adherent patients were 45 percent (95 percent confidence intervals: 42 percent to 48 percent) more likely to have controlled blood pressure than non-adherent patients.

Conclusion: A majority of hypertensive patients on oral medications were adherent to their therapy. Adherence to the antihypertensive medications is associated with lower blood pressure and higher rates of blood pressure control. Overall, adherent patients were older, with more chronic conditions, taking more prescribed medications and more likely to use mail order pharmacy services. The effect of the higher rates of blood pressure control on secondary outcomes such as cardiovascular events must be determined in further studies.

3-043

Category: Chronic / Managed Care

Title: Claims-based algorithm targeting Medicare Advantage Prescription Drug (MAPD) members with chronic obstructive pulmonary disease (COPD) for care intervention

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Purpose: COPD is a chronic and debilitating disease that affects over 12 million Americans, especially those older than 45 years of age. Some COPD patients incur excessively high costs and are responsible for driving healthcare utilization and expenditures for the larger population. Targeted interventions tailored to the specific needs of various patients could potentially improve COPD care, reduce healthcare costs, and facilitate better disease management. The purpose of this study is to develop a simple algorithm/approach using medical and pharmacy claims to identify Medicare Advantage Prescription Drug (MAPD) COPD patients that are costly or at-risk for high cost to aid intervention.

Methods: Medical and pharmacy claims were extracted for individuals aged 40 years and older enrolled in a Humana MAPD plan between January 1, 2009, and December 31, 2009. From these members, those with at least one International Classification of Diseases, 9th Revision, Clinical Module (ICD-9-CM) diagnosis code for COPD (491.xx, 492.xx, 496.xx) in any position were considered the base population. A hierarchical method of classification was then used to group members by exacerbation severity, from most severe to those with no indication of exacerbation. Individuals were considered to have a COPD exacerbation based on the following: 1) A hospitalization with a COPD principal diagnosis with at least a secondary diagnosis of respiratory failure (ICD-9-CM 518.81, 518.83, or 518.84) or COPD with an intensive care unit stay as a proxy for respiratory failure, 2) A hospitalization with a COPD principal diagnosis with no respiratory failure, 3) An emergency room (ER) visit for COPD, 4) An outpatient visit with a primary COPD diagnosis and concurrent use of an antibiotic or oral corticosteroid (OCS) within 7 days of diagnosis, or 5) No outpatient visit with a primary COPD diagnosis, but concurrent use of an antibiotic and OCS within 7 days of one another. Based on these hierarchical categories, study groupings were mutually exclusive. Members with COPD, but no indication of exacerbation that were further divided into groups based on their OCS or antibiotic use were retained to draw comparisons. Demographic characteristics, severity and comorbidities, healthcare costs, Medication Therapy Management eligibility, and COPD medication use within the groups were summarized.

Results: Of 194,611 members diagnosed with COPD in 2009, approximately one third (57,985 members) were classified as having a COPD exacerbation. Of those with exacerbation, about 50 percent (24,006

members) were identified based on a COPD outpatient visit with concurrent OCS and/or antibiotic use, 21,090 (36 percent) based on a hospitalization, 6,173 (10.6 percent) due to an ER visit, and the remaining 6,716 (11.5 percent) through concurrent antibiotic and OCS use alone. The median age ranged from 71 to 73 years. As expected, both all-cause costs (mean of 19,587 dollars; standard deviation of 22,600 dollars) and COPD-related healthcare costs (mean of 16,782 dollars; standard deviation of 21,825 dollars) were highest for those with a hospitalization. Costs were lower as the level of exacerbation severity decreased and were lowest in those with no indication of exacerbation. For those with a hospitalization or ER visit, RxRisk scores were high (5.4 and 6.3, respectively) as compared to groups with no indication of exacerbations (4.3 to 4.5). Charlson Comorbidity Index scores were also slightly higher for exacerbation patients, indicating that the algorithm differentiated members on comorbidity status. Among patients in groups with exacerbations, only 40 to 64 percent of individuals used long-term controller medications. Only 11 to 22 percent were eligible for Humanas current Medication Therapy Management intervention, for which members qualify based on use of 8 or more Medicare Part D medications, anticipated yearly drug spend of 3000 dollars, and at least 3 of 4 defined chronic conditions.

Conclusion: This algorithm provides a simple approach to identifying costly COPD patients within an MAPD plan using both pharmacy and medical claims. By categorizing members based on health care utilization, health plans can potentially target and tailor interventions appropriately to effectively intervene and optimize care.

3-044

Category: Chronic / Managed Care

Title: Mean differences in days to first hospital admissions and length of stay among COPD patients using SABA and LABA

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Purpose: To evaluate the number of days to first hospital admission and length of stay (LOS) among COPD patients starting treatment with either short-acting beta 2 - agonists (SABA) or long-acting beta 2 - agonists (LABA).

Methods: A retrospective cohort analysis of COPD patients initiated on SABA or LABA therapy using a 5% Medicare COPD national sample from 2006-2008. To be included, patients had to be continuously enrolled in Medicare Parts A, B, and D; have more than 2 claims for COPD diagnosis (ICD-9) during 2006, and have no prior COPD therapy for at least six-months before treatment initiation. Mean differences in days to first hospitalization and LOS during the 6-months follow-up period were reported using t-tests and ordinary least squares regression adjusting for age, gender, ethnic group, comorbidities, previous hospitalizations, specialist visits, oral corticosteroid use, and number of spirometry tests.

Results: From the total 3,017 COPD patients included for analysis, 70% were SABA users and 30% were LABA users. At treatment initiation, patients in the SABA group were older (78.5 vs. 77.0 years of age, LABA) and had more comorbidities like chronic heart failure, anemia, diabetes and depression. SABA patients also were more likely to have at least one hospitalization than LABA patients, 40% vs. 32% during the six-month follow-up. During follow-up, significant differences in mean days to first admission (64 days vs. 86 days; p-value less than 0.05) and LOS (6.44 days vs. 3.2 days; p-value less than 0.05) were reported between SABA and LABA users, respectively. Adjusted regression results remained significant for both: with SABA group having first hospitalization 13 days earlier than LABA group, and 1.75 higher LOS days compared to LABA group (p-value less than 0.05).

Conclusion: Among Medicare beneficiaries with COPD in 2006-2008, patients who began LABA therapy had delayed first hospital admissions and shorter LOS compared to patients who began SABA therapy after six-month treatment. Further research evaluating longer-term outcomes would be valuable.

3-045

Category: Chronic / Managed Care

Title: Health care costs in a Medicare population of COPD patients treated with beta-agonists

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Purpose: To evaluate total health care costs among COPD patients after six-month treatment with long-acting beta 2 - agonist (LABA) or short-acting beta 2 - agonist (SABA) therapy.

Methods: A 5% national sample of Medicare enrollees from 2006-2008 was used to identify beneficiaries diagnosed with COPD. New-start COPD patients were defined as patients with no prior COPD therapy for ≥ six-months before LABA or SABA initiation, and continuously eligible for parts A, B and D for at least 18 months. COPD patients enrolled in Medicare Advantage, diagnosed with asthma and/or younger than 65 years old were excluded. The study outcome measure was total health care costs measured as a sum of inpatient, outpatient and pharmacy costs from Part A, B and D during the six-month follow-up to the treatment period of 6 months. Differences in total costs were reported using t-tests and a multivariate regression model (type of model) adjusted for confounders such as therapy choice (LABA or SABA), age, gender, ethnic group, and Charlson comorbidity index (CCI).

Results: A total of 3,017 COPD patients were included in the analyses. Around 70% of the COPD patients were classified as SABA group (2,134 patients) and 30% as LABA group (883 patients). We observed significant differences in unadjusted total cost for the LABA group vs. SABA group ($6,000USD vs. $8,000USD). Similar results were observed after performing a multivariate analysis. LABA therapy was associated with a 17% lower health care costs compared with the SABA therapy group (p-value 0.001) adjusting for confounders. In contrast, higher number of spirometry tests, physician visits and CCI were associated with increased total health care expenditures.

Conclusion: The findings of this study suggest that the COPD patients using LABA therapy have lower costs compared to those on SABA.

3-046

Category: Chronic / Managed Care

Title: Evaluation of optimizing heart failure medications by a pharmacist and nurse driven heart failure protocol within a Veterans Affairs health care system

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Purpose: A rising number of patients are being diagnosed with heart failure (HF) with approximately 550,000 new cases being diagnosed each year. Research has shown angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARB) and beta-blockers (BB) slow disease progression and improve mortality in HF patients. Still, many HF patients are not at the goal doses of these medications. A pilot HF protocol was implemented at a rural VA medical center to ensure all primary care heart failure patients were on guideline therapy. The protocol, driven by both pharmacists and chronic disease management (CDM) nurses, allowed the titration of ACE-Inhibitors, ARB and BB to goal doses. The primary objective of this study was to compare the effectiveness of a newly approved HF protocol driven by both pharmacists and nurses to the standard care of providers within the same health system serving a similar patient population. Data for the number of hospital admissions or urgent care visits due to HF exacerbations and adverse events associated with therapy was also analyzed.

Methods: The institutional review board approved this retrospective chart review. Patients with New York Heart Association Class II or stable Class III systolic dysfunction HF (ejection fraction less than 40%) were included. Patients were excluded if they were less than 18 years of age. Data for baseline characteristics as well as ejection fraction, blood pressure, heart rate, serum potassium, serum creatinine, serum urea nitrogen, allergies or adverse drug events to protocol medications, urgent care visits or hospitalizations, and dose of protocol medications was analyzed. Patients were reviewed from November 15, 2010 to May 15, 2011.

Results: Patients managed with the HF medication titration protocol had a higher rate of achieving goal ACE-inhibitor or ARB doses compared to the standard of care (53% vs 30%). A higher rate of goal BB doses was also observed (47% vs 27%). The site that utilized the program had fewer urgent care visits or hospitalizations (n=4) compared to the standard of care site (n=6). No adverse events were encountered during the titration of HF medications.

Conclusion: A heart failure medication titration protocol driven by pharmacists and CDM nurses is an effective way to achieve goal or optimal doses of HF guideline medications.

3-047

Category: Clinical Service Management

Title: Use of a Virtual Congestive Heart Failure (CHF) Clinic to Avoid Readmissions

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Purpose: When CMS added 30 day readmission rates for CHF to the Hospital Compare website, we were all tasked with addressing the issues that center around incomplete hospital care requiring a return hospital visit. While we have been fortunate to consistently fall into the no different than U.S. national rate on this metric, the goal is always to exceed the national rate and if possible, be in the top 10% of reporting hospitals. To address CHF 30 day readmissions, we were tasked with reviewing our internal systems. A performance improvement team was created and our processes and our data was reviewed. In January 2010, the Tenet Health System Bundle to Prevent Avoidable Readmissions for Heart Failure (HF) was presented to each of the hospitals. Our performance improvement team utilized the educational content of the toolkit along with the data and process analysis and developed the virtual CHF clinic at Doctors Hospital of Manteca. Our virtual clinic is unique in that it utilizes the Pharmacy Department Staff as the operators of the virtual clinic. While the patient is still in house, a multidisciplinary group works with the patient, but lead education is conducted by pharmacy staff. All follow-up after discharge is conducted by Pharmacy as well. Doctors Hospital of Manteca is a 73-bed acute care community hospital in Northern California. The majority of our inpatient beds are Medical/Surgical in nature. In addition we have an 8-bed critical care unit. The performance improvement team that is currently working on this project consists of nursing (medical, surgical and critical care), pharmacy, utilization review, infection control, respiratory therapy and Quality. To review our CHF readmission data, establishing a baseline for future performance initiative To review of CHF process, including care provided in house and care provided after discharge. To utilize the Tenet Health System Bundle to prevent avoidable readmissions for HF To reduce the number of 30 day CHF readmissions to zero

Methods: The performance improvement team met every two weeks. During team meetings, HF data and HF education was reviewed by the performance improvement team. The THS bundle to prevent avoidable readmissions for HF was reviewed by the performance improvement team. Based on the HF bundle, a gap analysis was completed cross-referencing data and educational tools. The gap analysis identified the following: 1. Although the patient receives education on the disease of HF and what to do to avoid exacerbation of HR, the method of education delivery and quality of education was inconsistent. 2. There was no formal process established that made contact with the patient after discharge to ensure that basic readmission avoidance tools were being utilized. The following was created based on the gap analysis: 1. Pharmacist attends bed huddle to identify CHF patients. 2. Pharmacist provides CHF education to patient prior to discharge. 3. HF education checklist was created for the pharmacist to use. 4. The patient and RPh sign this checklist, representing comprehension 5. HF zone magnets and pill minders are given to the patient 6. Patient contact numbers are obtained prior to

discharge 7. Pharmacist contacts the patient weekly via phone to inquire on the status of medication availability, weight and follow-up MD appt. 8. Any issues identified are referred to the MD for immediate follow-up

Results: From Qtr 4 2009 to Qtr 2 2010, our readmissions have declined by 600%. Actual same diagnosis readmissions dropped to 1 from 6 in the most recently reported quarter. There are no shifts or trends to our all-cause readmission data we are not getting worse. involvement in ambulatory care clinics devoted to the likes of asthma, anticoagulation and heart failure. By utilizing the pharmacist, medication issues can be resolved immediately post-discharge and any other issues are referred immediately to the MD, with whom the pharmacist already has a relationship with when providing clinical services related to inpatient care.

Conclusion: Pharmacists are uniquely qualified to provide education in HF as evidenced by their involvement in ambulatory care clinics devoted to the likes of asthma, anticoagulation and heart failure. By utilizing the pharmacist, medication issues can be resolved immediately post-discharge and any other issues are referred immediately to the MD, with whom the pharmacist already has a relationship with when providing clinical services related to inpatient care.

3-048

Category: Clinical Service Management

Title: Piloting clinical pharmacy services in the emergency department of a community hospital

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Purpose: Patient care can be compromised in the emergency department through an increase in medication errors and adverse drug events. This is partially due to the fact that pharmacists traditionally do not provide clinical services in this department. Several studies have shown that pharmacists can have a significant impact in the emergency department; however, there is little data available in the community hospital setting. The purpose of this pilot study was to assess the impact of clinical pharmacy services in the emergency department of a community hospital.

Methods: A prospective pilot study to incorporate a pharmacist into the emergency department staffing model was conducted by one pharmacist from December 2010 to January 2011. Data was collected on pharmacist interventions for patients admitted to the emergency department. Pediatric and pregnant patients were excluded. Intervention data was collected on a paper form which included the documentation category, amount of time spent and outcome for each intervention. After completion of the pilot study, a survey was distributed to the emergency department staff in February 2011 which assessed expectations of the emergency department pharmacist, opinions of services provided and the perceived value of these services. Patient satisfaction scores and potential cost avoidance were also assessed. The data was analyzed using descriptive statistics and reported in aggregate form.

Results: During the 33 day pilot study, 327 interventions were documented for 210 patients. The top five intervention categories were patient education, drug information, order clarification, dosing consults and miscellaneous. Patient education made up 68 percent of the interventions and increased patient education scores for the emergency department by 22.4 percent. The aggregate estimated cost savings was 36,954 dollars. Thirteen surveys were completed with a return rate of 25 percent. Patient education and drug information were viewed as the most valuable pharmacy services by the nursing staff and drug interaction screening and medication recommendations were the most valuable for physicians. The impact on medication costs and time spent with patients was less clear to the staff overall.

Conclusion: The demand for pharmacy services in the emergency department continues to rise and may become necessary to comply with the Joint Commissions Patient Safety Goals and regulations for

accreditation. This study showed that pharmacists can have an immediate impact in the emergency department of a community hospital by increasing patient education and decreasing healthcare costs. Additionally, the survey data showed that our emergency department staff value clinical pharmacy services. The information from this study will be used to justify a full time pharmacist position at our institution. Further studies assessing the impact of an emergency department pharmacist in a community hospital need to be completed.

3-049

Category: Clinical Service Management

Title: Lund integrated medicines management- model and health economic outcomes

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Purpose: The Lund Integrated Medicines Management (LIMM)-model is a systematic approach to individualize and optimize drug treatment in elderly patients admitted to hospital, developed in the south of Sweden. It includes systematic activities based on structured and evidence based tools for patient and health care communication and for medication reconciliation and review. Clinical pharmacists work in a multi professional team. The model is the base for three PhD dissertations and 18 publications or manuscripts and has been shown to improve process and patient outcomes. We wanted to investigate putative health-economic benefits from the LIMM-model.

Methods: Data from two publications and one manuscript was used for economic evaluation of the model. We designed a probabilistic decision tree model for evaluating tools for a systematic medication reconciliation and review process at initial hospital admission in order to avoid readmission due to medication errors (Hellstrm 2011), and a medication report for patients discharged from hospital to primary care in order to reduce the medication errors with subsequent outpatient contacts hospitalisations as a consequence(Midlv 2008). Both studies showed significant reductions in medication errors. The model estimated costs and utility loss from medication errors needing medical attention. Costs were based on actual resource use (patient charts) and time studies for medical report reviews. Utility losses in terms of quality adjusted life years (QALY) for the conditions that needed medical attention were taken from the literature. An annual time perspective was used with costs relevant for county councils and municipality care.

Results: The first part of the model estimated the total cost for the intervention arm to USD467 including the cost for pharmacist time of USD54. This was USD377 lower than the in the non-intervention group, which together with 0.004 QALYs gained indicated that the medication reconciliation and review process was a dominant alternative. Hence, due to the cost saving and the increased health the probability that the intervention would be cost-effective at a zero willingness to pay would be 85%. The second part of the model, the estimated total cost was USD155 lower than the in the non-intervention group, which together with a small but positive QALYs gain indicated that preparing a medication report was a dominant alternative. The probability that the intervention would be cost-effective at a zero willingness to pay would be 98%.

Conclusion: The two parts of the LIMM-model were both cost saving. A total investment of USD54 would give USD580 back. The LIMM-model is used at 6 hospitals in the south of Sweden and are spreading more north and to Norway. This result will hopefully facilitate the spread further.

3-050

Category: Clinical Service Management

Title: Implementation of a pharmacist-led, multidisciplinary inpatient diabetes management team

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Purpose: The overwhelming prevalence of diabetes in Mississippi has a major impact on our healthcare system. It has been estimated that between 30 and 40 percent of all hospitalized patients have hyperglycemia resulting in one to three additional admission days. Tight control of blood glucose in the hospital has been shown to decrease infection rates and improve mortality. Specifically, risk of infection has been shown to be significantly higher in patients undergoing coronary artery bypass grafting (CABG) procedures if serum blood glucose levels are elevated. The purpose of this report is to describe the implementation process and to evaluate the success of a pharmacist-led, multidisciplinary Diabetes Management Team (DMT) at a 564-bed medical center through evaluation of post-operative serum blood glucose data collected on patients undergoing coronary artery bypass grafting (CABG).

Methods: Post-operative serum blood glucose data was collected from January 2008 through December 2010 for cardiovascular surgery patients undergoing CABG at Baptist Health Systems in Jackson, Mississippi. Data was collected prior to and after the implementation of the DMT(November 2008) in order to evaluate its success. The primary outcome was the number of patients with post-operative day one (POD 1) and post-operative day two (POD 2) serum blood glucoses greater than 200 mg/dL, with a secondary outcome focusing on the reduction in sternal surgical site infection (SSI) rates.

Results: Regarding patients undergoing CABG, the absolute risk reduction for serum blood glucoses greater than 200 mg/dL on POD 1 and POD 2 was 28.5% with a 95% confidence interval (0.20-0.36) after DMT intervention. The relative risk reduction was 72.1% with a 95% confidence interval (0.60-0.80), and number needed to treat was 3.5 patients. CABG sternal SSI rates decreased from 6.57% in 2008 to 5.16% and 3.18% in 2009 and 2010, respectively.

Conclusion: Improvements in glycemic control can be accomplished by implementing a pharmacist-led, multidisciplinary team that is responsible for daily hyperglycemic therapy management and care coordination in the setting of cardiovascular surgery, specifically patients undergoing CABG. Pharmacists can be an integral component to the success of achieving tight glycemic control in the inpatient setting. Inpatient glycemic control provides an ideal opportunity for collaboration between physicians, pharmacists, and other healthcare providers.

3-051

Category: Clinical Service Management

Title: Pharmacist discharge medication reconciliation and counseling in a community hospital

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Purpose: Patient discharge counseling performed by pharmacists has been shown to reduce patient readmission rates. Because of these findings, our pharmacy department was given the task of medication counseling at patient discharge. The purpose of this study was to evaluate the pharmacy resources needed to provide discharge medication reconciliation and counseling in a community hospital. At the same time we evaluated the number and types of interventions made by the pharmacists during the discharge medication reconciliation process.

Methods: Pharmacists were asked to document time spent and interventions made when performing discharge medication reconciliation and patient counseling activities. In addition, pharmacists were also asked to document the reason the intervention was necessary. This data was collected over a time period of approximately 3 months, Monday through Friday during day shift. A total of 294 patients were counseled during the study. This study was deemed by the institutional review board (IRB) not to need IRB approval as it did not meet the definition of human subject research.

Results: Pharmacists documented an average of 12 minutes per patient discharge medication reconciliation activity (range: 1 to 90 minutes) and an average of 11 minutes per patient discharge medication counseling activity (range 1 to 90 minutes). Pharmacists performed an average of 1 intervention per patient during the study (range 0 to 11). Interestingly patients who had at least one intervention averaged 2.4 interventions per patient. Patients with no interventions generally were those admitted with no home medications. The top reasons pharmacists performed interventions were for medications missing from the discharge reconciliation form and other missing information (missing prescriptions, dose or frequency). The top reason pharmacists intervened on medications that were present prior to admission was omission of the medications from the discharge reconciliation form and other missing information (dose or frequency).

Conclusion: The results of our study show that pharmacists spent an average of 23 minutes per patient on discharge medication reconciliation and counseling. Our facility has an average of 30 discharges daily. To counsel all patients discharged in an average day at our institution, an additional 11.5 hours of pharmacist time per day would need to be dedicated to this service. Adding this service would also require the addition of weekend clinical services. We also showed that the pharmacists intervention was necessary to prevent medication errors at discharge, with an average of one intervention per patient. We found that this was most important in patients who were admitted to the hospital who were already taking medications regularly at home and that the top reason for intervention was omission of medications from the discharge medication reconciliation.

3-052

Category: Clinical Service Management

Title: Pharmacist liaison initiative: a bridge to decentralization and beyond

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Purpose: The Department of Pharmacy at the Lahey Clinic Medical Center, a 317 bed teaching hospital in Burlington, Massachusetts, implemented a Pharmacy Nursing liaison initiative in January, 2010.The basis for this program was to promote dialogue between these two departments to improve relationships, and ultimately deliver the most optimal, team based patient care. To be able to condense and present facts and updates in an easy to follow, predictable format is a valuable, morale enhancing tool that provides a bridge to decentralization and to our management team.

Methods: In late 2009, with input from staff pharmacists and senior management, a voluntary sign-up process began in the Pharmacy Department whereby pharmacists were given the opportunity to identify a medical unit that represented a specialty area or clinical area of personal interest. Once assignments were finalized, a gradual three month roll out process began starting in January, 2010. Pharmacist liaisons were assigned clinical staff mentors who attended the initial nursing staff meeting with each liaison at the respective medical unit. This gradual process allowed for the evaluation of feedback and constructive criticism from both sides before all clinical areas went live in April, 2010. The monthly liaison document template (adapted from Duke University's tool) contains the following sections: Customer Service Issues, Formulary Management, Medication Shortage Updates, Medication Safety Issues, and a Miscellaneous section that includes changes to everyday pharmacy practice, protocols, or other notable concerns unique to that particular unit. This monthly update is then conveyed to each floor with the expectation that each pharmacist liaison attends a monthly nursing staff meeting. In the event that this is not possible, alternate arrangements may be made such as a one to one meeting with the nurse manager or clinical educator. A copy of this document is left with the nurse manager, and posted on the unit's News to Use board.

Results: In the seventeen months since its inception, pharmacy and nursing have greatly benefitted from this initiative. Increases in requests for pharmacy in-services, provided by our clinical pharmacists, as well as pharmacy residents, have been noted. One early goal was to increase the use of nursing to pharmacy communication sheets scanned into our order entry system, and this has been accomplished. Increased use of these sheets has decreased phone call volume to our central pharmacy area, and helped to streamline our operations, and ensure documentation of medication administration related

events. There have also been improved medication error reporting, and positive feedback from both nursing and pharmacy representatives.

Conclusion: The pharmacist liaison initiative has become a valuable practice improvement at our institution. It has truly paved the way for improved pharmacy and nursing relations, and will continue to evolve as the dynamics of patient care initiatives at our institution grow and develop within this ever changing health care environment. It is anticipated that the liaison role will continue to be a necessary link to pharmacy management, and will only enhance and complement our upcoming decentralization initiative, and this bridge will be even stronger in the years to come.

3-053

Category: Clinical Service Management

Title: Implementation of a comprehensive clinical pharmacy practice model

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Purpose: The goal of ASHPs Pharmacy Practice Model Initiative (PPMI) is to foster the creation of an innovative hospital pharmacy practice model. The PPMI focused on developing a practice model that optimizes the use of pharmacy resources for patient care-related services. Banner Baywood Medical Center is a 342 bed community hospital with a practice model consisting of centralized medication distribution and order verification with clinical pharmacy services provided by 5 Clinical Specialists. Existing Clinical Specialist responsibilities include pharmacy consults, patient chart review guided by a target medication list, and per protocol interventions. The objective of this study was to determine the impact of implementing a comprehensive clinical pharmacy practice model in line with ASHPs Pharmacy Practice Model Initiative on medication use based on several pre-specified outcomes.

Methods: The outcomes measured included the number and type of pharmacy consults, per protocol interventions, and Heart Failure Education Clinic referrals. The integrated pharmacy practice model was piloted on the telemetry floor for 4 weeks. One pharmacist was assigned to each of three units. The pharmacist was responsible for order verification, clinical pharmacy consults, medication reconciliation and discharge instruction for patients classified as high risk, patient chart reviews and coordinating referrals to the medication management clinic. All patients admitted to the telemetry floor from January 10 to February 4 were included. Pharmacy interventions were tracked electronically using ad hoc charting. Ad hoc charting is a method of concurrent charting of interventions in the electronic medical record. The number and type of pharmacy interventions during the pilot were compared to the number and type of interventions completed in the previous 4 weeks on the telemetry floor. The number of patients attending their Heart Failure Education Clinic appointments in the Medication Management Clinic were also recorded and compared to previous rates of attendance. The number of interventions was adjusted for patient discharge and statistical analysis was done using the chi-squared test. Case management had previously been responsible for setting up patient appointments to the Heart Failure Education Clinic prior to discharge. During the pilot, the pharmacists made patient appointments in collaboration with case management and educated patients on the rationale and content of the Heart Failure Education Clinic.

Results: There were a total of 662 pharmacy interventions during the 4 month period preceding the PPMI pilot and 913 interventions during the 4 week pilot. After adjusting for patient discharges this resulted in 1.27 interventions per patient discharge in the preceding 4 weeks and 1.95 interventions per

patient discharge during the pilot ($p<0.001$). Fifty seven charts were reviewed for medication reconciliation. Of those charts reviewed, the pharmacist updated the medication history and restarted necessary home medications in collaboration with the hospitalist (49%), updated the medication history (35%), restarted home medications (4%). This indicated that of the patient charts reviewed for medication reconciliation only 12% required no pharmacist intervention. The rate of patient attendance to the Heart Failure Education clinic upon discharge was previously 50%. This was increased to 63% during the pilot.

Conclusion: Implementing ASHPs Pharmacy Practice Model Initiative facilitates comprehensive pharmaceutical care. Our facility was able to significantly increase the number of pharmacy interventions per patient discharge. Clinical pharmacists had a positive impact on increasing the number of patients attending their Heart Failure Education Clinic appointments following discharge. Also during the pilot, pharmacists were able to improve the medication reconciliation process through reviewing and updating medication histories and restarting necessary home medications in collaboration with the units hospitalist. Areas for future investigation include determining the impact on patient length of stay, patient satisfaction, and cost avoidance/cost saving.

3-054

Category: Clinical Service Management

Title: Medicines reconciliation on admission of adults to hospital

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Purpose: The aim of medicines reconciliation at the point of hospital admission is to ensure that medicines prescribed on admission correspond to those that the patient was taking before admission. Medication errors pose a risk of harm to hospital inpatients, leading to increased morbidity, mortality and economic burden to health services. Errors occur most frequently on transfer between care settings and predominantly at the time of admission. The aim of this clinical audit was to determine the average time it takes, the number of discrepancies highlighted per medicine reconciliation, and analyse the rapid assessment tool policy for a non-elective patient admitted to hospital. The rationale for clinical audit was to maintain and improve on good professional standards by evidence based results, improve efficiency of the pharmacy service and enhance the quality of care using a patient focus; highlight the importance of patients at high risk of poor care due to the complicated continuity between primary and secondary care; implement new policies based on these results and re-audit to ensure improvement had been achieved.

Methods: A pilot of the audit was carried out by one designated pharmacist in order to ensure the data collected was readily obtainable and appeared to produce practical results suitable for analysis. The success of the pilot endorsed the method to follow for audit. The data collection process involved two full time specialist emergency care pharmacists reconciling patients medications on the 57 bed admissions unit. The pharmacists were given guidelines to follow through the audit period whereby, all patients had to be prioritised into RED/AMBER/GREEN categories, as per hospital guidelines using the medical notes where available. The time taken to prioritise was recorded for analysis. All RED patients medicine reconciliations were completed first, followed by AMBER, and then GREEN. The time taken to complete each medicine reconciliation, as well as the number of discrepancies per medicine reconciliation was recorded. After verifying this list against the current prescription chart in the hospital, any discrepancies were accounted for and actioned appropriately through communication by suitable documentation.

Results: The data collected was complete, accurate, and collected through the busy and quiet periods. It is representative of a normal five day medicines management pharmacy working week and there were no exceptional circumstances through this period which may have skewed the raw data. All 130 patients seen by a pharmacist had a full medicine reconciliation completed within 24 hours of non-elective admission to hospital. There were no patients throughout the week who were not seen by a pharmacist and/or a member of the multidisciplinary team within this period. In total it took 110 minutes to prioritise the 130 patients with an average time to prioritise of 0.85 minutes per medicine reconciliation.

If medicine reconciliation is not carried out for the green patients, as per hospital guidelines, this would have saved 93 minutes pharmacist time throughout the week. By factoring in the time taken to prioritise the green patients (n=22) the total time saved would be 74.3 minutes throughout the week, and 3.37 minutes per green patient. The average number of discrepancies per medicine reconciliation for a red patient was 4.3, with a range from 0 to 16. The average number of discrepancies per medicine reconciliation for an amber patient was 2.3, with a range from 0 to 14. The average number of discrepancies per reconciliation for a green patient was 0.9, with a range from 0 to 6. On average, irrespective of priority there were 2.9 discrepancies per medicine reconciliation completed. This data validates the benefits of employing the prioritising/targeting policy as there is noticeable reduced risk of discrepancies per medicine reconciliation for green patients. Patients targeted as red, amber, and green equated to 40% (n=52), 43% (n=56), and 17% (n=22) respectively. The average time taken to complete medicine reconciliation for a red patient was 15.3 minutes, with a range from 4.85 to 38.85 minutes. The average time taken to complete medicine reconciliation for an amber patient was 10.0 minutes, with a range from 2.85 to 20.85 minutes. The average time taken to complete medicine reconciliation for a green patient was 4.2 minutes, with a range from 1.85 to 8.85 minutes. This includes the time taken to prioritise all patients. On average, irrespective of priority it took 11.1 minutes of a pharmacists time to complete a medicine reconciliation.

Conclusion: The evidence base for this audit suggests that professional standards need to be maintained with re-audit within 12 months. The efficiency of the pharmacy service is excellent, with a focus on patient care and prioritising those patients at high risk first. Prioritising and patient targeting is a useful tool when resources are limited e.g. staff sickness. Time can be saved by reconciling medicines for patients with urgent needs as per rapid assessment tool policy. However, if time permits green patients medicine reconciliations should still be carried out as there are still 0.9 discrepancies per patient. On average, red patients medicine reconciliations take the longest time, with amber and green patients taking less time respectively. This advocates the utilisation of the prioritising/targeting policy. On average it takes a pharmacist 11.1 minutes per medicine reconciliation which is 3.9 minutes below the figure delineated in national guidelines. The evidence base supports the increased involvement of pharmacists in medicines reconciliation. The number of discrepancies between hospital and home medication is reduced after pharmacist involvement compared with standard care, thus reducing risk to the patient and the economic burden on the healthcare provider.

3-055

Category: Clinical Service Management

Title: Implementation of automated performance review process for clinical pharmacists

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Purpose: The expanded role of clinical pharmacists as a privilege-specific patient care provider requires an ongoing evaluation of the individuals performance and competence related to the clinical privileges granted. This ongoing evaluation of a clinical pharmacist performance requires management, administrative and clinical provider resources. The advent of the electronic medical record and web-based server technology for the storage and ready access of information presents an opportunity to enhance this evaluation process. This project was implemented to provide an automated mechanism for monitoring, evaluating, documenting, and reporting the professional performance of clinical pharmacists granted clinical privileges practicing in ambulatory care.

Methods: Ambulatory clinical pharmacists practicing in a tertiary healthcare system with institutional approved clinical privileges developed specific criteria to evaluate their practice performance. The criteria focused in the following areas: documentation of the pharmacist- patient care encounter, medication reconciliation, diseases state management goals, laboratory values used in assessment, and pharmacotherapy plan. A sample of patients with combined encounters by an ambulatory clinical pharmacist were randomly selected from the electronic medical record database; names of selected patients identified were distributed from a website to designated clinical pharmacists to be reviewed by established criteria; all reviews were complied with comments from the reviewer and automatically feedback anonymously.

Results: Ten clinical pharmacists utilized the automated review process from Feb11 to Jun11, to conduct the peer review evaluations of eight pharmacists. A total of 222 encounters were reviewed in the timeframe, averaging 44 encounters per month, which equated to approximately 5 reviewed encounters per pharmacist per month. There were 16 deficiencies identified in the timeframe, of which all were related to documentation in the electronic medical record. Clinical pharmacist staff were asked to evaluate the automated process; including access to the website and time spent on reviews. Overall ease of process and impact on patient care activities was positive.

Conclusion: An automated performance review process for clinical pharmacists practicing in ambulatory care was successfully implemented. The process provided a mechanism for identification of professional practice trends that impact on quality of care and patient safety that is continuous and efficient.

3-056

Category: Clinical Service Management

Title: Current state and problems of instructing patients undergoing outpatient chemotherapy in drug management

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Purpose: Chemotherapy for breast cancer is widely performed not only for advanced and recurrent stages but also as pre- and postoperative adjuvant therapy. With the recent advancement of drugs for supportive therapy, various chemotherapies have become performed at outpatient clinics. At our Breast and Endocrinological Surgery Department, chemotherapy has mostly been performed at the outpatient clinic since 2000, but there are problems in performing chemotherapy here, such as limited time for consultation with physicians and securing beds and spaces for preparation. An outpatient chemotherapy room was newly prepared in January 2006, and conditions of chemotherapy support by full-time pharmacists and nurses were established. To perform safe and comfortable outpatient chemotherapy, it is considered favorable for experts of various professions to form a team and perform treatment. Our Breast and Endocrinological Surgery group also practices this through study meetings and joint conferences. Herein, I introduce the current state of our hospital and report problems and future prospects from a pharmacistfs viewpoint.

Methods: Since our Breast and Endocrinological Surgery Department performs chemotherapy at the outpatient clinic from the first treatment, explanation of the chemotherapy content by staff other than physicians has been performed on the day of injection. Full-time pharmacists have to demonstrate their specialty for not only the explanation of drugs used in chemotherapy, but also designing countermeasures against adverse reactions and investigating interactions. Thus, we decided to attend the obtaining of informed consent by the physician in charge with a full-time nurse, and explain the dosing schedule, types and development timing of adverse events, and careful points in daily life after receiving chemotherapy. Information obtained from patients is feedback to the attending physician each time.

Results: Through the explanation taking a sufficient time before chemotherapy initiation, we could cope with patientsfanxiety for treatment.However, currently, the instruction of patients by pharmacists is performed only before chemotherapy initiation, and when a patient asks a question, we provide on explanation each time.

Conclusion: We are planning to have patients monitor adverse events by themselves for early discovery as well as interviewing patients every visit to collect patient information, aiming at contributing to safe and effective chemotherapy.

3-057

Category: Clinical Service Management

Title: Specialty pharmacy program implementation in a multispecialty group practice: patient identification, enrollment and process flow

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Purpose: The use of high-cost medications (or specialty medications) in the ambulatory setting is expanding. Typically, such medications, such as erythropoietin stimulating agents, are available only through specialty pharmacy arrangements and provided directly to the patient. Where specialty medications must be administered by injection in a health-care setting, institutions have been limited to either using the patient's supply brought in from home (a practice known as white bagging) or supplying the medication through clinic stock without reimbursement from the insurance company. Such practice has brought forth concerns regarding the safety of allowing patients to bring in home medication and the lost revenue from inability to bill insurers. Lahey Clinic has therefore entered into a specialty pharmacy arrangement to avoid safety concerns and allow for reimbursement. Herein we describe the implementation of a specialty pharmacy program in a multispecialty, multisite group practice with particular emphasis on patient identification, enrollment, and process flow.

Methods: Lahey Clinic patients are eligible for specialty pharmacy services if they are receiving darbepoeitin in the Hematology, Oncology or Nephrology (non-dialysis) departments at the Burlington or Peabody campus, and are required to obtain darbepoeitin through a particular specialty pharmacy arrangement. New patient identification was performed through screening upcoming appointment records for eligible patients scheduled to receive darbepoeitin in the clinic. Patients were also identified if they received darbepoeitin in the clinic but the charge was rejected by their medical insurance coverage, indicating that the patients medication was under a specialty pharmacy benefit. Once a patient was identified, medication prior authorization was obtained through the patient's insurance company and the physician sent an outpatient prescription to the Lahey Clinic outpatient pharmacy which adjudicated the script with the patients insurance company. For subsequent visits for that patient, the clinic notified the pharmacy of the patient visit and the dose of the medication administered, and prescription adjudication was performed by the outpatient pharmacy.

Results: As of the first six months (11/1/2010 4/30/2011), 12 distinct patients were identified as eligible to enroll in the program, a process that involved clinic staff as well as the pharmacy, billing and nursing departments. These 12 patients received an aggregate total of 45 doses of medication. We identified

opportunities related to patient identification and revenue capture affected by the retrospective nature of the process and the geographic location of the departments in relation to the pharmacy.

Conclusion: Implementation of a specialty pharmacy program for darbepoetin involved coordination of efforts from a variety of disciplines within a clinic setting. Future efforts will focus on streamlining the process and identifying mechanisms to facilitate patient identification and copayment capture.

3-058

Category: Clinical Service Management

Title: Integrating clinical services with dispensing functions in a community hospital

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Purpose: Changes in the healthcare system and reimbursement place more emphasis on the importance of patient safety, education and a customized plan of care. The pharmacy services have been evolving to meet the new demands, and the change of the paradigm in the pharmacy practice is warranted. In community hospitals where the clinical pharmacy resources are limited, yet standard of care practices have to be upheld, the challenge is to utilize all the available resources to meet the goal.

Methods: We evaluated pharmacy resources in our 240 bed hospital with average occupancy of 130 beds. Staff consists of one clinical pharmacist and 7.3 Full time equivalent (FTE) staff pharmacists who perform traditional dispensing functions covering 2 shifts, 7days per week. Our plan was to gradually introduce the clinical initiatives that could be done by the staff pharmacists, and triage the issues that needed advanced interventions or escalated evaluation to the clinical pharmacist. First the anticoagulant initiative was introduced. Dose adjustment interventions for elevated INR values, low molecular weight heparins (LMWH) dose adjustment based on renal function, in addition to patient education on use of anticoagulant; were explained. Then we introduced the antimicrobial steward ship (ASP). Pharmacists were trained to screen the culture and sensitivity for the restricted antibiotics (ABX) and refer the inappropriate use to the clinical pharmacist for follow up. Gradual introduction of dose adjustment for renally eliminated ABX, and dose adjustment for prolonged infusion ABX were introduced. Staff also monitored the time and appropriateness of antimicrobial and thrombosis prophylaxis (DVT prophylaxis) for the surgical care improvement project (SCIP) core measure, as well as timing of beta blockers (BB) to avoid delay of therapy due to unavailability on formulary. The medication related risk of fall evaluation and patient education was also introduced, as well as the heart failure initiative for patients drug therapy evaluation, in addition to monitoring laboratory values for many other drugs for active intervention to modify drug therapy. Staff had to be trained on accessing and interpreting laboratory values as they were needed, restricted antibiotic was divided into three groups, based on spectrum of activity and each group was assigned to one pharmacist who received education on how to evaluate blood levels, the culture and sensitivity and type of intervention that needs to be done. Creatinine clearance calculation and the use of on line kinetic calculators were explained. Simple algorithms and protocols were implemented to be followed for clinical decisions. Step by step instructions and standardized forms for patient education were developed. This approach ensured that each patients targeted drug therapy was reviewed, and proper interventions were done.

Results: Starting at the second half of year 2008 the pharmacist newly targeted clinical interventions by pharmacists increased from 216 in 2008 to 10,290 in 2010 Total intervention increased from 6522 in 2008 To 17387 in 2010 Cost saving/ avoidance progressively increased from $118,159 in 2008 to $342,680 in 2010

Conclusion: Involving staff pharmacists in clinical duties; improve patient care, optimize drug therapy, utilize existing resources, reduce adverse events (ADR), and health care cost, in addition to increasing employee satisfaction. Education, simplified algorithms and gradual addition of new assignments is a key to success. Expansion of participation in monitoring and improving the scores in many of the core measures in the hospital as well as implementing new initiatives is possible as pharmacist become more confidant and attentive to the health system issues.

3-059

Category: Critical Care

Title: Pharmaceutical and economical role of clinical pharmacist in emergency and critical care medicine

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Purpose: In emergency and critical care medicine ward of Tokushima University Hospital, critically-ill patients receive high quality specialized medical treatment such as ventilator therapy or blood purification therapy and so on. Pharmacists were assigned since the ward establishment, and work actively with doctor and co-medical staff. At April 2008 in Japan, critical-care patient is made the calculation of clinical pharmacy services. We introduce and verify the case report of pharmacist distribution in the therapy of critically-ill patients and economic benefit of the hospital by management of drugs in the ward.

Methods: From May 2008 to April 2011, we classified the contents of activity in categories (dose, administration method, dosing rate, incompatibility, adverse effect, and others), and consider the role of pharmacist in emergency and critical care medicine. We counted the prevention amount of loss by management work of drugs in the ward.

Results: Among the providing drug information, the dose made up 48.5% and the incompatibility was 21.1%. Antibacterial drug accounted for 97.4% in the dose category, which indicate that there are many patients with severe infection in the ward or pharmacists conduct therapeutic drug monitoring of anti-MRSA drugs. Eighteen % of incompatibility category, we work at the time of line lack after removal of central venous catheter in getting better patient. We could prevent an average of around 100 thousand yen per month in loss of the ward.

Conclusion: We need to develop the efficient work tool and contribute to more treatment of patients in emergency and critical care medicine and prevention of loss in the hospital.

3-060

Category: Critical Care

Title: Impact of pharmacist participation in multidisciplinary rounds in a medical intensive care unit in a non-teaching community hospital

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Purpose: Multidisciplinary patient care rounds enhance communication, reduce error and improve patient outcomes. The impact of a pharmacist rounding within a multidisciplinary team is well documented in teaching institutions. This project was designed to determine the impact of pharmacist participation in multidisciplinary rounds in a medical intensive care unit in a non-teaching community hospital.

Methods: Beginning January 4th 2010, multidisciplinary rounds began in the medical intensive care units (total beds 20). Participants included an ICU-based hospitalist, a pharmacist and the patients primary nurse. A daily checklist was developed and utilized by the team to ensure appropriate quality and safety measures were met. At the conclusion of daily rounds, a pharmacist documented number of patients seen, time spent and number and type of accepted therapeutic recommendations. Therapeutic recommendations were categorized and a financial value was assigned for any recommendations resulting in direct cost savings. Examples of recommendations with direct cost savings included: drug discontinuation, use of less costly therapeutic alternatives, converting non-formulary medications to formulary medications and intravenous to oral conversions. Quality and safety data was also collected. Examples of recommendations associated with quality and safety improvements included: core measures compliance, venousthromboembolism prophylaxis, anticoagulation, and renal dose adjustments. Quality and safety data was used to calculate estimated cost avoidance. Data was collected and analyzed for one year.

Results: A pharmacist participated in multidisciplinary rounds for 1919 patient days and 1665 recommendations were accepted (0.83 accepted recommendations per patient per day). The three most common recommendation categories were renal dose adjustments/drug-drug interactions (517), antimicrobials -- correct regimen, dose, route, and duration (512), and anticoagulation -- correct agent, dose, and bridging (155). 576 accepted recommendations were associated with cost savings. Direct cost savings attributable to accepted recommendations were $36 779 creating a savings of $64.71 per hour of pharmacist time. Although not associated with direct cost savings, the majority of accepted recommendations (1343), presented cost avoidance and quality compliance opportunities including: drug-drug interactions (279), addition or modification of venousthromboembolism prophylaxis (74) core

measures catches (43), and prevention of potentially serious adverse drug events (32). Estimated cost avoidance associated with the project exceeded $500 000.

Conclusion: Pharmacist participation in multidisciplinary rounds in medical intensive care units in a non-teaching community hospital produced reductions in drug costs, improved quality and safety and presented significant cost avoidance opportunities.

3-061

Category: Critical Care

Title: Survey of the critical care nursing staff for critical care pharmacist benefit

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Purpose: A dedicated critical care pharmacist has been in place at St. Joseph's Health Services of RI since November 2007. A survey was undertaken to assess the nursing staff's feedback on the pharmacy services provided. The results would be helpful in recognizing those services that nursing find more beneficial.

Methods: The survey was constructed to assess the critical care pharmacist's distribution and clinical services to the nursing staff. The nurse was asked to evaluate each service as very beneficial, beneficial, not beneficial, or not applicable. The survey was created in "survey monkey" with a link on the hospital's homepage. Notice of the survey was posted in the critical care unit only and a password provided for access by the staff. The clinical nurse manager for the unit assisted in spreading the word to the staff. The survey was available over an eighteen day period.

Results: There were 28 regularly scheduled members of the critical care nursing staff. During the survey, two nurses were on leaves of absence and another had just resigned. Nineteen of the 25 remaining nurses completed the survey for 76% participation. The results of the distribution phase included order entry at 99% (combined total of very beneficial and beneficial) and stat order entry at 94.5% (combined total). The results of the clinical phase included allergy verification at 96% (combined total) followed by several functions with a combined total of 95%. These clinical functions that were tied included adverse drug reaction assessment, crushable medications, drug interactions, empiric antibiotic coverage based on gram stain, medication profile review, medication reconciliation, and renal dosing. Drug information placed third with a combined 94.5%. The top three clinical services that were graded the highest in the very beneficial category were pharmacist participation in rounds (90%), IV compatibilities (89%), drug information (84%) and allergy verification (80%).

Conclusion: The nurses' responses to the pharmacist's distribution assistance on the unit highlighted general order entry and then stat order entry to be of the most benefit. The nurses' responses then highlighted pharmacist participation in clinical rounds, IV compatibilities, drug information, and allergy verification as the most important individual clinical activities. The data has helped to reinforce the benefit of an interdisciplinary approach to the management of the patient in the critical care unit. The pharmacist as a member of this team can provide more timely medication management and improved patient outcomes in conjunction with the physician and nurse. In order to be effective in the critical care

unit the pharmacist needs to be able to identify and respond to the needs of both the physicians and nurses in individualizing care of the patient.

3-062

Category: Critical Care

Title: Pheochromocytoma presenting as a cerebral hemorrhage: a case report

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Purpose: This case report describes the management of a patient with a pheochromocytoma, presenting with a cerebral hemorrhage, an unusual manifestation related to this type of rare adrenal gland tumor. The patient, a 50-year-old African American male, initially presented to the Emergency Department unresponsive and with a blood pressure of 240/110 mm Hg. He was emergently intubated and CAT scan of the head showed a left cerebral hemorrhage. The patient was taken to the neurosurgical suite and had an external ventricular drain placed for management of his intracranial hemorrhage. The post-surgical course was complicated by uncontrolled blood pressure despite receiving numerous intravenous and oral antihypertensive agents titrated to maximal doses; this led to the suspicion of the presence of a pheochromocytoma. Evaluation of a subsequent 24-hour urine collection revealed significantly elevated metanephrines, normetanephrines, and total metanephrines levels. Radiographic studies confirmed bi-lateral adrenal pheochromocytomas. Treatment was started with phenoxybenzamine 10 mg orally twice daily, titrated to a dose of 100 mg orally twice daily. The patient was also prescribed labetalol 200 mg orally twice daily titrated to 600 mg orally three times a day for blood pressure control. Once the patients blood pressure was stabilized he was started on metyrosine 250 mg orally four times a day titrated to 500 mg orally four times a day in order to decrease the level of endogenous catecholamines and in preparation for surgery. The patients hospital course was complicated by other co-morbid conditions; however, after 2 months of blood pressure control, the patient was cleared for surgery. Pheochromocytoma is a rare catecholamine-secreting tumor of the adrenal glands. Although this type of tumor is often accompanied by complications in other organs, intracranial hemorrhage is an uncommon and unusual complication. This case demonstrates the importance of a thorough evaluation for identification of secondary causes of uncontrolled hypertension. There have been no randomized, controlled trials addressing optimal medical treatment of a pheochromocytoma, therefore, the best evidence available is from retrospective studies, patient series, and case reports. Although surgical resection of the tumor is the only curative therapy for pheochromocytoma, key aspects of pre-operative management include reducing and stabilizing the blood pressure along with reducing the amount of circulating catecholamines. This case illustrates successful use of phenoxybenzamine in combination with labetalol and metyrosine for a patient with bi-lateral adrenal pheochromocytomas. The clinical management of uncontrolled hypertension prior to surgical resection to reduce the risk of intracranial hemorrhage is a clinically significant intervention by pharmacists in the critical care setting. This case has been approved by the Institutional Review Board.

Methods: n/a

Results: n/a

Conclusion: n/a

3-063

Category: Critical Care

Title: Implementation of a pharmacist driven severe sepsis 24 hour management bundle in the intensive care unit

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Purpose: In the United States, severe sepsis is the leading cause of death in non-cardiac intensive care units (ICUs). There is growing evidence supporting the timely implementation of the 6 hour resuscitation and 24 hour management bundles which are collectively known as the severe sepsis bundles. The purpose of this study is to evaluate outcomes in ICU patients following the implementation of a pharmacist driven severe sepsis 24 hour management bundle.

Methods: Phase I will consist of a retrospective chart review of 30 severe sepsis, septic shock patients from April 1st 2009 to April 1st 2010. Phase II will consist of a prospective review of severe sepsis, septic shock patients from January 3rd 2011 to March 25th 2011 where all four components of the 24 hour bundle will be evaluated by the clinical pharmacist. The primary objectives include evaluating compliance with the 6 hour and 24 hour severe sepsis bundles and assessing mortality before and after implementation of the pharmacist driven 24 hour bundle. Secondary objectives include assessing patient outcomes, determining compliance with components of the 6 hour and 24 hour bundles, and assessing differences in bundle compliance based on where the patient was first diagnosed (emergency room versus floor). Statistical analyses will compare retrospective and prospective data and include the chi-square test for independence (with Yates Continuity Correction) for categorical data, the independent-sample t-test for continuous data, and the Mann-Whitney U test for differences between two independent groups on a continuous measure.

Results: Thirty patients were reviewed and 28 patients were included for Phase I; 30 patients were included for Phase II. In terms of primary objectives, overall 6 hour bundle compliance increased from 7 percent to 17 percent; however, no significant difference was found between groups (p equals 0.503). Overall 24 hour bundle compliance significantly increased from 25 percent to 83 percent (p less than or equal to 0.001) following Phase II. A 7 percent reduction in hospital mortality was noted following Phase II; however, this was not statistically significant (p equals 0.806). Secondary objectives included evaluating individual bundle components. No significant differences were found between groups in terms of component compliance with the 6 hour bundle. Significant differences in 24 hour bundle component compliance included low dose steroid administration for septic shock (p equals 0.007) and drotrecogin alfa assessment (p equals 0.006).

Conclusion: Pharmacist involvement with the 24 hour bundle significantly improved individual components as well as overall compliance. Indirectly, by creating awareness at sepsis collaborative meetings where both ED and ICU staff are present, an increase in the 6 hour bundle components and overall compliance was achieved, but not to an acceptable degree. Knowing that most benefits in mortality come from compliance with the 6 hour bundle, our future goal is to further increase compliance by developing a sepsis response team to ensure both the 6 hour and 24 hour bundles are met within the specified time frame.

3-064

Category: Critical Care

Title: Evaluation of short-term outcomes after t-PA administration in rapid responders

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Purpose: To evaluate short term outcomes in patients who rapidly respond to t-PA versus other responders at 30 hours and to assess the safety outcomes associated with t-PA administration.

Methods: This study was conducted as an IRB approved retrospective chart review between January 1, 2005 and December 31, 2010. Patients with a diagnosis of ischemic stroke were reviewed for inclusion. The NIHSS score from baseline was compared to the repeat score within 30 hours; if it improved by 4 points the patient was categorized as a rapid responder. If not then they were placed into the other responder group. Lengths of stay and disposition status were used to evaluate the short-term outcomes. In order to define and appropriately evaluate length of stay and disposition, the following will be assessed as secondary endpoints: medical complications, hospitalization costs, and mortality.

Results: A total of 193 patients (rapid responders n = 102 and other responders n = 91)receiving intravenous t-PA for treatment of ischemic stroke were included in the study. The rapid responders had a significantly shorter length of stay, 4.8 vs. 9.3 days ($p = 0.0048$). Patients who had a rapid response to t-PA were more likely to go home, (64% vs. 20%, $p < 0.001$). The other responders had a greater incidence of being transferred to hospice or having death as an outcome. There was a statistically significant difference in the incidence of symptomatic hemorrhage between the rapid responders, 4.8%, and the other responders, 9.3%, $p = 0.006$. Medical complications occurred less frequently in the rapid responder group; which, in combination with a shorter length of stay, led to a lower cost of hospitalization compared to the other responders, approximately \$46,000 vs. \$74,000 ($p = 0.0013$).

Conclusion: A repeat NIHSS score within 30 hours may provide insight to a patients hospital course. Rapid responders are associated with lower acute hospitalization costs due to shorter length of stay and less medical complications. Rapid responders are discharged home and have fewer transfers to hospice and death compared to other responders.

3-065

Category: Critical Care

Title: Evaluation of corticosteroid use in septic shock patients

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Purpose: Sepsis remains a major clinical problem associated sometimes with end organ damage and may be complicated by impaired corticosteroid (CS) production. Giving CS could potentially benefit patients although its role in septic shock remains controversial despite the use for many years. Hence, the purpose of this study was to assess the role of CSs in intensive care unit (ICU) patients with septic shock on the total length of ICU stay, morbidity, and mortality.

Methods: We conducted a retrospective multicenter observational study in three Lebanese university hospitals from July 1, 2010 to January 30, 2011. Inclusion criteria men and women aged 18 years and above if they have had septic shock, and admitted to the ICU. Exclusion criteria patients with autoimmune diseases requiring lifelong CSs or are immunocompromised. 294 patients were screened where 59 patients have met the eligibility criteria and were studied. The primary endpoint was evaluation of CS use on mortality and morbidity in septic shock. Secondary endpoint included evaluation of CS use on the total length of ICU stay. Patients were grouped into two categories: patients taking steroids and those not taking steroids (control). Data collected included dose and duration of CS use, serum creatinine, liver function tests, and complete blood count. Vital signs were monitored to evaluate the need for fluids or inotropes and to evaluate further the need of steroids. Data are expressed as frequencies, and evaluation of primary and secondary outcomes utilized analysis of linear regression.

Results: Baseline characteristics between the two groups were comparable except that smoking was higher in the steroid group versus the control (P equals 0.034) and higher percentage of previously healthy patients were in the control group versus septic shock patients on CSs (P equals 0.236). Only 23 percent of the patients with septic shock received steroids. All cause mortality was higher in septic shock patients on CSs versus control (82 percent versus 67 percent, P equals 0.001) but mortality due to multiple organ failure was higher in the control group versus septic shock patients on CSs (67 percent versus 53 percent, P equals 0.142). Reversal of septic shock was higher in the septic shock patients on CSs versus control (13 percent versus 7 percent, P equals 0.609), and longer ICU stay was seen in the control group versus septic shock patients on CS (P equals 0.263).

Conclusion: Low dose of Hydrocortisone doesnt reduce the rate of mortality in patients with septic shock but is associated with higher reversal rate. Administration of CSs reduces the rate of mortality due to target organ failure in these patients.

3-066

Category: Critical Care

Title: Monitoring and treatment practices for sedation, analgesia and delirium in a large cohort of ICUs

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Purpose: Few data describe monitoring practices for sedation, analgesia and delirium (SAD) in the ICU. Our objective is to leverage a large, ICU clinical database to describe both the monitoring and treatment patterns related to SAD in critically ill patients.

Methods: Retrospective, descriptive study of ICU patients monitored by an eICU program in 2008. Inclusion criteria included: adult ICU patients, monitored by an eICU Program with comprehensive documentation and discharged from the hospital in 2008. Comprehensive documentation was defined as: use of a pharmacy interface for accurate documentation of all medication orders in the clinical information system (CIS) and routine documentation of nursing flowsheet data (vital sign and infusion as well as nursing assessments of pain, sedation and delirium) into the CIS. Descriptive statistics were used to report frequency of: SAD-related assessments, SAD-related medication use and adherence with sedation and pain goals. Adherence with sedation treatment goals was assessed by determining the difference between each pair of documented sedation treatment goal and score, customized by sedation scale. Matching scores and goals were defined as 'at goal' with differences classified as undersedation or oversedation as warranted by the sedation scale used.

Results: 53,124 patients from 63 ICUs across the United States. 56.1% were male; the average age was 62.8 (SD=16.9); and the average APACHE III score was 55.2 (SD=26.7). 33% were ventilated at least once during the ICU stay. Pain was frequently assessed in all ICU types, averaging 11.6 per patient day (ppd). Cardiac medical ICUs assessed pain most frequently (16.8 times ppd) with mixed ICUs assessing least frequently (9.2 times ppd). Sedation assessments were documented 7.3 times ppd in all patients and 9.3 times ppd in ventilated pts. Delirium assessments were only documented 0.03 times ppd. Orders for opioids were common, with 36% of patients having at least one order for a continuous infusion opioid. 29% received a continuous infusion benzodiazepine (midazolam more frequently than lorazepam) and 21% propofol. Only 1,527 patients (2.9%) had an order for dexmedetomidine. Orders for neuroleptics were present in 7.4% of all ICU patients. Neuromuscular blockers (NMBs) were used in 450 (0.9%) of patients. Most patients receiving NMBs also received continuous infusion sedatives and opioids (375 patients; 83%). 3 patients (0.7%) received a continuous infusion NMB but did not have continuous infusion sedation or opioids documented. Of all sedation assessments with concurrently documented

sedation goals, the majority were at goal (66.6%), 26.5% represented oversedation, 6.9% represented undersedation.

Conclusion: Two-thirds of sedation scores were equal to the treatment goal. Oversedation was more common than undersedation in this cohort of ICU patients from 2008. Sedation assessments are performed much less frequently than pain assessments in the ICU while delirium assessments were virtually never documented.

3-067

Category: Critical Care

Title: Implementation and evaluation of a computer based tight glycemic control protocol in a mixed medical and surgical intensive care unit population utilizing a continuous quality improvement process

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Purpose: Hyperglycemia is a common occurrence in the intensive care unit patients, both with and without a history of diabetes. In 2001 a large, single-center study showed morbidity and mortality benefits using an insulin infusion protocol to maintain blood glucose levels of 80 mg/dl 110 mg/dl in a surgical intensive care unit. A recommendation from a national organization was published in 2008 suggesting that critically ill patients should have their blood glucose levels maintained as close to 110 mg/dl as possible. Since that recommendation was published, other trials have had mixed success at safely achieving normoglycemia using a variety of algorithms and glycemic targets. Severe hypoglycemia with blood glucose less than 40 mg/dl was noted in many of the trials. The tight glycemic control protocol developed at Jeanes Hospital focused on reducing the incidence of severe hypoglycemia while maintaining blood glucose levels close to the normal range.

Methods: In 2006 the Critical Care Committee at Jeanes Hospital designed a computer-based tight glycemic control protocol for the intensive care unit that focused on minimizing the amount of severe hypoglycemia that was noted in several trials while maintaining the blood glucose within a range of 80 mg/dl-140 mg/dl. All intensive care unit nurses were trained in the correct use of the protocol which consisted of entering current capillary blood glucose results, date and time into a spreadsheet. The computer protocol would calculate the insulin infusion rate and insulin bolus based on the current blood glucose level, change in blood glucose level, insulin infusion rate and change in time from the previous measurement. The individual protocols generated performance data including hypoglycemic events, average capillary blood glucose and percentage of time within target glycemic range. The performance data was used in monthly reports to modify the equations in the protocol. In 2010 extensive modifications were made to the protocol to adjust the target glycemic range to 100 mg/dl -140 mg/dl with the goal of further reducing the incidence of severe hypoglycemia.

Results: The initial versions of the tight glycemic control protocol in 2006 resulted in a rate of severe hypoglycemia in 4.2% of patients while maintaining an average blood glucose of 147 mg/dl. Further modifications were made between 2007 and 2010 resulting in a rate of severe hypoglycemia in 3.4% of patients while maintaining an average blood glucose of 122 mg/dl. The protocol was extensively modified l in July of 2010 resulting in a rate of severe hypoglycemia of 0% while maintaining an average blood glucose of 132 mg/dl through May of 2011.

Conclusion: By utilizing continuous quality improvement data to monitor and modify a tight glycemic control protocol we were able to successfully reduce severe hypoglycemia while achieving control of elevated blood glucose levels.

3-068

Category: Critical Care

Title: Dexmedetomidine in adult intensive care unit patients: an evaluation of medication utilization, guideline compliance, efficacy, and safety

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Purpose: Dexmedetomidine (dex) is a selective alpha-2 agonist used in intensive care unit (ICU) patients for sedation and agitation control. To ensure proper patient selection due to safety and cost considerations, Massachusetts General Hospital (MGH) implemented a revised pharmacy approval guideline for dex in December 2010. This guideline broadened indications for use, redefined inclusion/exclusion criteria, and increased maximum dosage and length of use. The purpose of this study was to evaluate the utilization of dex and compliance to the guideline, as well as record patient outcomes and safety of dex.

Methods: The institutional review board approved this retrospective chart review. Patients at least 18 years of age admitted to a MGH ICU with an active order for dex from December 2010 to March 2011 were included for analysis. Patients were excluded if they never received the medication or dex was initiated in the operating room and continued while admitted to the ICU. The primary outcome was rate of guideline compliance based on adherence to inclusion criteria (including proper indication and trial of other medications prior to dex), exclusion criteria, and length of use. Secondary outcomes included rate of patients successfully extubated while receiving dex, and rate of adverse drug reactions (ADRs). Descriptive statistics were used for data analysis.

Results: A total of 55 patients were reviewed with a mean dex dose of 0.428 mcg/kg/hr and a mean duration of 30.25 hours. The surgical ICU and cardiac-surgical ICU accounted for 36% and 27% of dex utilization respectively. Dex was used for peri-extubation in 73% of patients and prevention of intubation in 11% of patients, while no patients were administered dex for the indication of shivering. The overall rate of non-compliance for MGH dex guideline was 40%. Twenty percent of non-compliance was due to guideline exclusion criteria, such as concurrent use of more than one vasopressor (14.5%) or acute heart failure (7.3%). Fifty-eight percent of patients receiving dex for peri-extubation were extubated within 36 hours. In this group, 11% were reintubated within 24 hours. Diastolic blood pressure less than 50 beats per minute occurred in 49% of patients. Eight percent of patients with ADRs required discontinuation of dex.

Conclusion: Overall utilization of dex was appropriate based on guideline indications, dosing parameters, and length of use. The majority of non-compliance was due to initiation of dex despite existing exclusion criteria. Further analysis is required to determine if guideline compliance was associated with higher success rates and less ADRs.

3-069

Category: Critical Care

Title: Dexmedetomidine medication use evaluation in the intensive care unit at a large community teaching hospital

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Purpose: Sedative and analgesic medications are routinely administered to mechanically ventilated patients in the intensive care unit (ICU) to reduce pain and anxiety and to allow patients to tolerate invasive procedures. Unfortunately, these medications especially benzodiazepines, have been associated with increased ventilator time, increased stay, and potentiate the risk of developing acute brain dysfunction (i.e. delirium and coma). Dexmedetomidine is an alpha-2 adrenoreceptor agonist with a unique mechanism of action, providing sedation, anxiolytic properties, analgesia, and attenuation of the stress response with no significant respiratory depression. The purpose of this study was to evaluate past use of dexmedetomidine and based on usage patterns, develop a protocol that will become an order set at the hospital.

Methods: The institutional review board approved this retrospective, chart review of 72 patients that was ordered at least one dose of dexmedetomidine while in the intensive care unit from June 1, 2009 to July 31, 2010. Data was collected using the hospital's electronic medical records program. Patients were excluded if they were on room air (n equal 5) or never intubated (n equal 12). The primary study outcome was time (in days) once the medication was initiated to extubation in patients receiving dexmedetomidine versus midazolam. Secondary outcomes evaluated were patient selection based on cardiac function (ejection fraction less than 30 percent or heart block), medical intensive care unit (MICU) vs. cardiovascular intensive care unit (CVICU) vs. surgical intensive care unit (SICU) usage, indication for use, initial administration (with or without loading dose), and adverse events.

Results: A total of 55 patients met criteria for inclusion in the study and had at least one dose of dexmedetomidine. The average time to extubation was 7.45 days (median 4 days, range 0 to 42 days) with dexmedetomidine compared to 8.15 days with midazolam (median 6 days, range 0.33 to 36 days). Two of the seven patients (9.7 percent) with an ejection fraction less than 30 percent experienced an adverse event (hypotension) that required discontinuation of the medication. Of the patients who received the medication 47 percent were in MICU, 32 percent were in CVICU, and 18 percent were in SICU. The indications for use were as follows: ventilator weaning (n equals 11), ventilator dysyncrony (n equals 4), inadequate sedation (n equals 11), sedation (n equals 41), delirium tremens (n equals 2), status post surgery (n equals 20), and not noted (n equals 12). Six out of the 72 patients received a loading dose when already on sedation or pain medication; one of the six patients experienced an

adverse event (hypotension. Twelve (16.7 percent) patients who received dexmedetomidine experienced an adverse event. Bradycardia occurred in six patients, hypotension in five patients, and one patient had increased agitation that required the addition of another sedation medication.

Conclusion: The use of dexmedetomidine in the ICU reduced intubation time which decreases the length of stay in the ICU and the risk for associated delirium thereby decreasing healthcare related costs. Appropriate patient selection and administration may have prevented the adverse events that occurred. It is important that patients are evaluated before initiating dexmedetomidine to ensure appropriate patient selection. Due to the adverse event profile, cardiac studies should be performed to determine presence of heart block and ejection fraction. Loading doses should be avoided in patients who are already on sedation/pain medications. Monitoring parameters are necessary for nursing staff to improve the ease and safety of use. It is recommended that dexmedetomidine be utilized based on a specific ICU protocol due to its potential benefits on decreasing ventilator time. It should be a restricted medication that can only be ordered by an ICU attending or after review and approval from a clinical pharmacist.

3-070

Category: Critical Care

Title: A retrospective study on the safety and efficacy of a protocol-directed therapy for diabetic ketoacidosis/hyperosmolar hyperglycemic state at a community hospital

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Purpose: Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS) are serious acute metabolic complications of uncontrolled diabetes. Successful treatment of DKA and HHS involves a multi-disciplinary approach. There are limited reports describing outcomes associated with a protocol-directed therapy for DKA/HHS in a community hospital. This study assesses the safety and efficacy of a protocol-directed therapy for DKA/HHS.

Methods: This is a retrospective study involving a medical chart review of 464 patients who presented to the emergency department or admitted to the intensive care unit (July 2010 to April 2011) in a community hospital. The study included 30 adult (18 years old) patients who were treated with the protocol-directed therapy for DKA/HHS. Time to resolution of DKA/HHS was the primary outcome. Additional outcomes included time required to sustain blood glucose 200 mg/dL, time to anion gap closure, number of hours in ICU, number of days hospitalized, and related adverse events.

Results: The mean number of hours for time to resolution of DKA/HHS was 27.7 hours, time to BG 200 mg/dL was 8.6 hours, time to anion gap closure was 15.7 hours, ICU length of stay was 30.7 hours, and hospital length of stay was 4 days. Related adverse events included a blood glucose 60 mg/dL (3.7%) and a plasma potassium <3.0 mEq/L (14.8%) during continuous insulin infusion. Hypoglycemia was entirely due to deviation from drip rate adjustment recommendations. The hypokalemia was due to inadequate or delay in potassium replacement (50%) and a lack of routine monitoring (25%).

Conclusion: Based on the results of the study, the protocol-directed therapy for DKA/HHA was effective and feasible in a community hospital. Hypoglycemic events were primarily due to deviations from the protocol requiring further education to the providers on its appropriate use. Comprehensive recommendations on potassium replacement prior to and status-post insulin infusion should be implemented to minimize hypokalemia events.

3-071

Category: Drug-Use Evaluation

Title: A retrospective medication use evaluation of recombinant factor VIIa in trauma and medical patients requiring INR reversal at Mercy San Juan Medical Center

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Purpose: Activated recombinant Factor VIIa (NovoSeven, rFVIIa) was approved by the Food and Drug Administration (FDA) for the treatment of bleeding episodes and to prevent bleeding episodes during surgical interventions in patients with hemophilia A or B with inhibitors to Factor VIII or Factor IX and in patients with congenital Factor VII deficiency. The recommended dose for this patient population is 90mcg/kg intravenously and may be repeated in two hours if the patient is still bleeding. However, activated recombinant factor VIIa is widely used in hospitals for indications other than those approved by the FDA. Due to the high cost of a single dose of recombinant factor VIIa, most institutions have developed dosing guidelines and recommendations for appropriate use of rFVIIa. We do not, however, have an institution-wide recommendation and dosing guideline, and hence the purpose of the study was to review the clinical practice for use of activated recombinant factor VIIa at Mercy San Juan Medical Center and to develop dosing guidelines and recommendations.

Methods: Mercy San Juan medical center (MSJMC) is a 370 bed level II trauma center located in Carmichael, California. MSJMC also has cardiac services as well as a neuroscience program. This study was a retrospective chart review of patients who received rFVIIa between January 2008 and December 2009 at MSJMC.

Results: During the study period, 68 patients qualified for the chart review process. Five were excluded from the study as most of the data could not be located in the chart or the charts could not be located. There were nineteen (30%) trauma patients and thirteen (21%) patients admitted for cardiac surgery. Thirty one (49%) patients were admitted to the medicine/neurosurgery service. Fifty-six (89%) patients received rFVIIa doses of 90mcg/kg and 7 patients were given lower doses ranging from 45mcg/kg to doses that were based on the vial size of 2.4 mg. Three patients received two extra doses at 2 to 4 hours after the first dose; each of the repeat doses were the same as the initial dose. Fifty-eight (92%) patients received transfusion of blood products prior to Novoseven administration, whilst thirty-seven (59%) patients continued to receive blood transfusion after Novoseven administration. Of the three patients who received repeat doses of Novoseven, only one did not receive additional transfusions. Forty-one (65%) patients were not on anticoagulants such as Coumadin prior to admission, 21 patients were on Coumadin, and one patient had no home medications listed. Twenty one patients had an arterial pH of

less than 7.35 and of those only 12 (57%) received additional blood products transfusions after receiving Novoseven. And thirteen patients had a pH of greater than 7.4, with only 5 (38%) that received additional blood transfusions. In all, 26 (41%) patients received vitamin K prior to rfVIIa and of those only 12 (46%) of them had been on Coumadin at home. Of the 63 study patients, 45 survived to be discharged either to a step down facility or home with family, and 18 patients expired.

Conclusion: At MSJMC, more medical/neurosurgical patients received rFVIIa during the study period than trauma or cardiology patients. Fewer patients in the trauma and cardiology group received vitamin K prior to rFVIIa, and we believe this was because bleeding had to be controlled immediately in the operating room. More medicine/neurosurgery patients could benefit from Vitamin K administration, since in most of the cases, surgery was delayed until the INR was less than 1.5. Due to the high cost of rFVIIa, all doses should be rounded to the nearest vial size. Five patients were excluded from the study because we could not find any documentation of the dose being administered. This subset of patients was identified using drug charge codes that indicated that a Novoseven dose was dispensed from the pharmacy. To avoid any potential wastage, we recommend dispensing undiluted Novoseven vials so that unused vials can be returned to the pharmacy and not charged to the patient. Fifty-seven percent of patients with a pH less than 7.35 received additional blood transfusions after rFVIIa doses. pH abnormalities should be corrected whenever possible before any rFVIIa doses are administered. To avoid any thromboembolic side effects after rFVIIa administration, patients should be monitored closely with adequate DVT prophylaxis measures. Dialysis shunts/tubing, intraveneous lines and endotracheal tubes should be flushed as frequently to prevent occlusion.

3-072

Category: Drug-Use Evaluation

Title: Evaluation of an intravenous immune globulin guideline at a tertiary academic medical center

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Purpose: Intravenous immune globulin (IVIG) provides anti-inflammatory and immunomodulatory effects and has demonstrated clinical benefit in a number of disease states. The purpose of this study is to evaluate the impact of an inpatient IVIG utilization guideline, focusing on ideal body weight (IBW) dosing and indications for use.

Methods: Adult inpatients who received IVIG from October 2010 to April 2011 were evaluated. The evaluation received investigational review board approval. Data included patient demographics, patient actual and ideal body weight, and the dose of IVIG administered. Pharmacist-driven interventions were also captured. Endpoints included the indication for IVIG use, number of grams dispensed, and orders blocked for non-institutional approved indications.

Results: During the study period, 145 cases of IVIG use were evaluated, comprising a total of 117 patients. Hypogammaglobulinemia and infection status post hematopoietic stem cell transplant were the most common indications for use, comprising 80 cases (55 percent). Pharmacist-driven intervention occurred on 99 percent of all orders. A total of 8,523 grams were dispensed based on IBW, which when compared to actual body weight (ABW), resulted in an aversion of 2,403 grams. Non-institutional indications were successfully blocked for 3 cases, resulting in an aversion of 550 grams.

Conclusion: An IVIG utilization guideline with a focus on IBW dosing and indications for use resulted in an overall reduction in grams of IVIG dispensed and increased compliance with institutional approved indications.

3-073

Category: Drug-Use Evaluation

Title: The appropriateness of quetiapine use in a county health-system

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Purpose: Quetiapine (Seroquel) is an atypical antipsychotic agent classified as a dibenzothiazepine. The FDA indications include schizophrenia, acute manic/mixed bipolar disorder, depression with bipolar disorder and as an adjunct for major depressive disorder (MDD). The extended release is the only formulation indicated for MDD. The non-FDA indications consist of insomnia, delirium, Gilles de la Tourettes syndrome and Parkinsons disease-psychotic disorder. Quetiapine was identified as one of the top purchases on the formulary of a county health-system which primarily serves the indigent. It has become a common practice in the private sector to use quetiapine as a sleep aid. The purpose of this study was to evaluate the use of quetiapine within a county health-system, spotlighting its use in insomnia. Due to rigid budgetary restraints, the use of quetiapine in insomnia should be circumvented. There are safer and more cost effective agents available on the formulary. The review will evaluate the need to restrict the use of quetiapine to certain indications and or services.

Methods: A retrospective review was conducted using both inpatient and outpatient utilization of all quetiapine prescriptions dispensed from January through June 2010. A utilization report for quetiapine was requested from the Information Technology department. The following information was included in the report: demographics, diagnoses, date of service, physician, dose, frequency, number of doses and refills. Each prescription was reviewed through an electronic chart review.

Results: Two hundred and fifty-five charts were reviewed, one hundred were inpatient and one hundred and fifty-five were outpatient. Forty percent of the patients were male and sixty percent were female. Insomnia was indicated for only eight percent of the inpatients and two percent of the outpatients. Twenty six percent (67/255) of the patients were prescribed quetiapine for MDD. Among the patients who received quetiapine for depression, fifty-one percent had tried and failed two selective serotonin reuptake inhibitors (SSRI) or tricyclic antidepressants (TCA). Thirty-one percent tried only one antidepressant and eighteen percent did not try an antidepressant. The extended-release tablet is the only formulation that has FDA indication for MDD; however ninety-four percent of the patients were prescribed the immediate release tablet.

Conclusion: The evaluation revealed that quetiapine use for insomnia in the county health-system was minimal and therefore no changes regarding this indication were implemented. Its use in Major Depressive Disorder however did not follow American Psychiatric Association (APA) guidelines, which suggest failing two trials of two agents from the same antidepressant class before changing to an

antidepressant in a different class. Prior to moving to a second-generation antipsychotic, the guidelines recommend weighing the advantages versus the disadvantages of this treatment strategy. In an effort to reduce purchases for quetiapine and its use in MDD, an educational communication was sent out to all medical staff. The communication addressed the importance of following the APA guidelines as well as utilizing the appropriate formulation of quetiapine for MDD as indicated by the FDA. A review will be conducted in 6 months to assess compliance and changes in quetiapine utilization.

3-074

Category: Drug-Use Evaluation

Title: To investigate the relationship between use of short acting inhalational anaesthetics and rates of day case surgery in England

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Purpose: The National Health Service (NHS) in England is under considerable financial pressure following the severe economic downturn, and a target of 20 billion pounds has been set for the NHS to save over the next few years. Medicines expenditure in the NHS rose to 12.3 billion pounds in 2009 of which over 30% was spent in hospitals. Approximately 14 million pounds is spent each year on inhalational anaesthetics comprising both short acting (desflurane and sevoflurane) and long acting (isoflurane) agents. The short acting agents are two to four times more expensive than isoflurane, but because of their faster action and quicker recovery times they are suited to short procedures. Whilst multiple factors may influence day case rates a relationship with the use of short acting anaesthetics would be expected. This study aims to investigate if such a relationship exists, since the inappropriate use of short acting anaesthetics represents a waste of resources.

Methods: Data on the use of the inhalational anaesthetic agents isoflurane,sevoflurane, and desflurane used in all acute hospitals in England for the financial year 2006/7 was obtained from the NHS information centre. This data had been gathered as part of the contracting process for agreeing the price hospitals will pay for medicines. The number of units of short acting anaesthetics desflurane and sevoflurane was combined and expressed as a percentage of all inhaled anaesthetics used for each hospital. Activity data for each hospital, which included the numbers of day cases performed and admissions, for the same time period was downloaded from the NHS Hospital Episodes Statistics website www.hesonline.nhs.uk. The variability in the proportion of short acting anaesthetics used across all hospitals was compared to variability in hospital day case activity. The proportion of short acting anaesthetics used in each hospital was paired with day case rates for the hospital and linear regression analysis undertaken.

Results: Complete data was obtained for 157 acute hospitals in England. Huge variation was found in the proportion of short acting anaesthetics used in hospitals (1.32% to 100%) with a mean value of 59.71% (S.D. 26.54%). Whilst the mean day case rate expressed as day cases/elective admissions was similar at 52.16% the variation was much less with an S.D of 11.29%. The mean day case rate expressed as day cases/all admissions was lower at 33.3% (S.D. 9.09%). When each hospital's proportion of short acting anaesthetics was paired with the hospital's day case rate performance no correlation was seen (Proportion short acting anaesthetics versus day cases/elective admissions R2 = 0.0006, and proportion short acting anaesthetics versus day cases/all admissions R2=0.003).

Conclusion: The wide variation in the use of short acting anaesthetics in acute hospitals in England, and the complete lack of correlation with hospital day case rates suggests short acting anaesthetics may not be being used optimally in some hospitals. Since Desflurane is twice as expensive and Sevoflurane four times as expensive as Isoflurane, it may be possible to rationalise the of use of these short acting anaesthetics in some hospitals and deliver potential savings.

3-075

Category: Drug-Use Evaluation

Title: Alvimopan decreases length of stay in bowel resection surgery

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Purpose: Alvimopan was approved for formulary addition by the Pharmacy and Therapeutics Committee (P&T) in September of 2009. Although use of alvimopan would be associated with an increase in drug costs (up to $950 for full course), published data suggested its use was associated with a decrease in length of stay (LOS) of approximately one day. With the formulary addition of alvimopan, P&T requested a case review to assess its impact on LOS to determine if it was enough to mitigate the increase in drug cost associated with its use. We conducted a retrospective review of bowel resection surgery cases to determine if alvimopan would have an affect on length of stay in our patient population.

Methods: An accelerated GI recovery pathway which included alvimopan in addition to early ambulation and early nasogastric tube removal was implemented. A pharmacy based protocol was developed and approved by P&T to assure compliance. Patients were reviewed retrospectively to assess length of stay and number of doses of alvimopan administered prior to GI recovery. This data was compared to length of stay data for usual care patients derived from our QI departments case review database. Initially alvimopan was restricted to use in open procedures since a reduction in length of stay for laparoscopic procedures had not been demonstrated. Interim analysis of the patients with open procedures showed a large enough decrease in length of stay to allow us to evaluate its use in laparoscopic procedures as well. The restriction to open procedures was removed and laparoscopic procedures were also included in data collection.

Results: A total of 33 patients undergoing bowel resection surgery with primary anastomosis received alvimopan between 9/29/09 and 5/31/11. For open procedures (n=23), review of cases showed an average LOS of 4.1 days. The average LOS for patients who did not receive alvimopan (n=117) was 8.47 days. Average LOS for laparoscopic patients who received alvimopan (n=10) was 3.3 days. The average LOS for laparoscopic patients without alvimopan (n=25) was 4.8 days. The average number of doses of alvimopan administered for all patients was 4.5 (cost=$286). The total cost of care (LOS savings @ $969/day minus drug cost) was reduced by an average of $3949 for open procedure patients who received the accelerated pathway (55% cost reduction). The total cost of care for laparoscopic procedure patients who received the accelerated pathway was reduced by an average of $1168 (37% cost reduction).

Conclusion: Implementation of an accelerated GI recovery pathway which included the use of alvimopan decreased length of stay and total cost of care in bowel resection surgery patients with primary anastomosis.

3-076

Category: Drug-Use Evaluation

Title: Weight management using a meal replacement strategy: reports of a pharmacist managed prior authorization program

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Purpose: Over the past 10 years, obesity has become recognized as a national health threat and a major public health challenge. Obesity is not only a risk factor for the development of cardiovascular disease, diabetes and certain types of cancer; it is also associated with increased health care costs and reduced quality of life. Harris County Hospital District (HCHD) is an integrated public health care system for Harris County, Texas which is the nation's third most populous county. Patients at HCHD are at an increased risk for obesity and its complications. The Adult Weight Management clinic is a referral clinic within the healthcare system. Patients were offered the option of using partial meal replacement for calorie reduction. Partial meal replacement was described as replacing two meals a day with a shake-like supplement and eating a well balanced third meal. Nutritional products prescribed to the patients in the Weight Management Clinic are restricted through a pharmacist managed prior authorization program (PAP). Criteria were developed and approved through the Pharmacy and Therapeutics Committee and Medical Board. This study was conducted to determine if preliminary data suggests that non-fat milk-based nutritional supplement in a meal replacement program is effective for weight loss in obese patients.

Methods: A retrospective medical record review was conducted at a county hospital system outpatient clinic between January 2010 and June 2010 for all patients prescribed meal replacement therapy for the treatment of obesity. The Weight Management Clinic physician would fax a request for the nutritional product to the clinical pharmacist managing the PAP. To receive a prescription, patients had to be under the care of the physician in the Obesity Management Program for one year and also had to have a BMI greater than or equal to 30 mg/kg2. The clinical pharmacist would review the request and note the approval in the patients profile. The nutritional product should not be dispensed without an approval noted. The approval expires every 6 months and a new request must be submitted for continued use. Patients were required to sign a contract of understanding regarding criteria for remaining in the meal replacement program. Criteria included monthly weigh-ins and weight loss of at least 2 pounds each month. If the criteria were not met, patients no longer received prescriptions for meal replacements. The following information was collected: patient demographics, weight, and prescription refill history.

Results: Of the 37 patients enrolled in the weight management clinic, the mean age was 49.54 years with 84% female and 16% male. Sixty-two percent of the patients were African-American, 21% were Hispanic and 17% were Caucasian. The mean weight of all 37 patients was 294.51 78.73 lbs at baseline. Three months after the initiation of this program, 15 patients were still enrolled in the program. These patients lost an average of -10.2 8.64 lbs (p=0.0004273, 303.87 86.30 lbs from 293.67 81.21 lbs). Six months after the initiation of the program, three patients were still enrolled in the program. These patients had an average weight loss of -14.17 lbs 9.72 lbs compared to baseline (p=0.25, 312.97 141.66 lbs to 298.8 134.71lbs). Overall, 35 patients were dismissed after 6 month from the program due to failure to uphold the terms of the contract. The reasons for dismissal were as follows, 22.9% (8/35) of the patients gained weight, 51.4% (18/35) neglected to show up for monthly weigh-ins, 22.9% (8/35) had insufficient weight loss and 2.9% (1/35) suffered from intolerance to the nutritional product. Prescription compliance was dismal with 8.1% (3/37) of patient never picking up their prescription, 56.8% (21/37) of patients filling their prescription once, 21.6% (8/37) filling their prescription twice, 10.8% (4/37) filling three times and 2.7% (1/37) filling five times. There was also a consistent decrease in the number of times patients returned to the clinic for a weigh-in.

Conclusion: Meal replacement therapy was an effective method for weight loss for patients who remained compliant with the program. The greatest source of concern is the plethora of risk factors for the development of cardiovascular disease found in these patients. Seventy percent of the patients were hypertensive, 43% had hyperlipidemia, and 38% were diabetic. Future research should explore methods to make clinic-based, partial meal replacement programs for weight loss more effective, especially among ethnic-minority groups.

3-077

Category: Drug-Use Evaluation

Title: Assessing the Appropriate Use of Proton Pump Inhibitors Prescribed in a Veteran Outpatient Population

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Purpose: Proton pump inhibitor (PPI) therapy has been proven to be effective in the treatment of gastroesophageal reflux disease (GERD) and erosive esophagitis. However, the overuse of this therapy can impact patient care by increasing the risk of clostridium difficile infections, community acquired pneumonia, and spine and wrist fracture. The purpose of this study was to evaluate the current practice in PPI prescribing in the James H. Quillen VA Medical Center outpatient clinic setting.

Methods: The institutional review board approved this retrospective chart review of 200 medical charts sampled of Veterans prescribed an outpatient PPI between April 1, 2010 and October 1, 2010. Patients prescribed a PPI in the inpatient setting or with a documented PPI allergy, adverse drug event or contraindication to PPI therapy were excluded. Data collection included patient demographics, PPI therapy prescribed, dose and frequency, indication for PPI use, duration of therapy, follow-up to therapy, and potential drug-drug interactions. Therapy was deemed appropriate if it included all of the following: follow-up assessment of therapy in 4 to 8 weeks after initiation of PPI, FDA approved indication for use, FDA approved initial dose of PPI, and no concomitantly prescribed interacting medications. For financial analysis, an estimated cost of five dollars per 30-day fill of a PPI prescription was used to determine the projected cost of providing inappropriate PPI therapy annually to the Veteran population. The primary outcome of this study is to assess the incidence of potentially inappropriate PPI prescriptions in the outpatient population. A secondary objective is to assess the financial cost associated with providing inappropriately prescribed PPI therapy to our Veteran population. Descriptive statistics were used to analyze all data collected.

Results: Ninety percent of therapy was found to be potentially inappropriate. Lack of proper follow-up to therapy was the most common reason for therapy to be deemed inappropriate (96%). Average time to first follow-up after initiation of therapy was 344 days. The projected financial impact of providing these prescriptions to the study sample is an estimated $11,000 annual cost.

Conclusion: There is a high incidence of potentially inappropriate PPI therapy among the study population. Follow-up after initiation of therapy is the greatest area for improvement to help maximize the appropriate use of therapy.

3-078

Category: Drug-Use Evaluation

Title: Impact of an anti-microbial stewardship program on the use of anti-MRSA agents (linezolid & daptomycin) at a community hospital

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Purpose: An antimicrobial stewardship program (ASP) approved by the Pharmacy and Therapeutics Committee was implemented in our 201 bed facility. One of the program's goals was to address the increasing use of linezolid and daptomycin. Anti-MRSA agents comprised the majority of total anti-infective drug expenditures. Concern regarding overuse and resistance to these anti-infectives had emerged.

Methods: Criteria for use was developed for both linezolid and daptomycin and shared with medical staff as part of the ASP program. Physician orders for these drugs were prospectively evaluated upon order entry by a pharmacist. Orders were required to meet criteria for use prior to dispensing. Pharmacists and infectious disease physicians met routinely to review patient specific therapies for MRSA. Interventions were made based on optimal clinical and pharmacoecomic options. Program impact was measured retrospectively through electronic medical records. Patients with a MRSA infection were identified via reports generated from the pharmacy order entry system. Any patient receiving either linezolid or daptomycin 6 months prior (PRE) or 6 months after (POST) implementation of the ASP were included. Drug expenses were expressed in utilization cost per pharmacy adjusted patient day (APD). Defined daily doses (DDD) per 1000 patient days were used to compare the volumes of linezolid and daptomycin use over time. A two-tailed Fisher's Exact test was used for the statistical analysis of the categorical data.

Results: A total of 85 patients were reviewed from October 2009 to December 2010. There were 44 patients in the linezolid group (23 PRE and 21 POST). Patients meeting approved criteria for use increased from 26% to 71% [p = 0.0006]. The percentage of patients on linezolid followed by an ID physician increased from 61% to 90% [p = 0.037]. Use of oral therapy increased from 37% to 57% [p = 0.0001]. In the daptomycin group, a total of 41 patients were reviewed (26 PRE and 15 POST). Patients that met approved criteria for use increased from 54% to 93% [p = 0.013]. Differences between percentage of patients followed by an ID physician (100%) or baseline creatinine kinase measurement were not statistically significant. Drug cost based on utilization per APD day decreased by 49% for linezolid and 53% for daptomycin over prior year. Anti-infective drug class spend overall was reduced by 21.4%.

Conclusion: Implementation of an antimicrobial stewardship program that included criteria for use for linezolid and daptomycin helped improve appropriate use of these drugs. Post implementation, patients receiving linezolid were more likely to be followed by an infectious disease physician and to be converted to oral therapy. Drug costs (total and for each agent) were reduced from the prior year.

3-079

Category: Drug-Use Evaluation

Title: Assessment of the impact of pharmacy education of the prescribers on fluconazole use for managing candidiasis in adult patients in a community hospital

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Purpose: To assess the impact of pharmacy education of the prescribers on the use of fluconazole for management of candidiasis in adult patients in a community hospital.

Methods: Per 2009 Infectious Diseases Society of America (IDSA) guidelines, the empiric therapy for managing candidiasis includes fluconazole with a loading dose of 800mg, then 400mg daily for 7-14 days. However, for esophageal candidiasis, oral thrush, symptomatic cystitis, and candiduria, 200-400mg daily dosing would be acceptable. Antifungal therapy is not recommended for candida/yeast isolated from bronchial secretions (considered colonized). In early 2010, we did an initial retrospective assessment of fluconazole use in 70 adult patients in our 114-bed community hospital to evaluate prescriber compliance with the IDSA guidelines. Our goal was to identify any specific practice group of physicians who were not compliant with the guidelines so that we could educate them and optimize patient care. Three independent physicians assisted in the assessment and delineation of fluconazole use into the following categories: a) appropriate for indication and dosing regimen, b) appropriate for indication, but the dosing was sub-optimal, and c) inappropriate. In that study, approximately 20 percent of the patients received fluconazole inappropriately for yeast in bronchial washings, and unclear indications. These findings were shared with the prescribers in our Pharmacy and Therapeutics Committee in November 2010 and then all other prescribers in our hospital via a summary letter and educational materials seeking improvement in the use of fluconazole. A follow-up evaluation of the impact of pharmacy education of the prescribers on appropriate use of fluconazole was conducted during late 2010 through May 2011 in 67 different adult patients The objective of this study was to compare the findings on fluconazole use in the 70 patients from the initial study (Pre-education group) (28 males, 42 females, mean age 64 plus minus standard deviation (SD) 20.4 years-range-19-95 years) with the 67 patients from the follow-up study (Post-education group) (22 males, 45 females, mean age 62 plus minus SD 19.2 yrs-range 26-95 yrs). All the patients received fluconazole for 3 consecutive days or longer. Data comparisons were made using the Chi-Square method and Students t-test, as appropriate for the parameters with a P-value of less than 0.05 considered significant. Calculations of

the mean, range, standard deviation and percentages of various parameters were performed using Microsoft-Excel software. This study was exempt from Institutional Review Board approval.

Results: The impact of pharmacy education of the prescribers on the use of fluconazole was as follows. Pre-education versus (vs.) Post-education: Category a)-Use appropriate: Fifty-three percent (37 of 70) vs. Sixty percent (40 of 67, P=Not significant (NS); Category b)-Use appropriate but dosing was sub-optimal: Twenty-one percent (15 of 70) vs. Twenty-eight percent (19 of 67, P=NS); Category c)-Use inappropriate: Twenty-six percent (18 of 70) vs. Twelve percent (8 of 67, P less than 0.05). The inappropriate use of fluconazole was for candida in bronchial washings with no other systemic indication. The mean initial (Day 1)fluconazole dose improved from 207mg plus minus SD 93mg, range of 100-400mg to 252mg plus minus SD 142mg, range 100-800mg, P=0.03. The mean daily dose and dose range also showed improvement: 181mg plus minus SD 83mg, range 100-400mg vs. 222mg plus minus SD 117.4mg, range 100-800mg, P=0.02. Overall, there was an improvement in appropriate use of fluconazole in categories (a) and (b) combined from 74 percent (52 of 70) to 88 percent (59 of 67, P less than 0.05) of patients, and a reduction of 14 percent in inappropriate use. However, the mean length of therapy remained unchanged: 6 days vs. 5.7 days. Pre-education vs. post-education results of the fluconazole use by different prescriber groups were as follows: Categories (a) and (b) combined: hospitalists: 83 percent (34 of 41) vs. 87 percent (25 of 30, P=NS), private internal medicine: 74 percent (14 of 19) vs. 83 percent (15 of 18, P=NS), surgery: 25 percent (2 of 8) vs. 100 percent (14 of 14, P less than 0.05), and infectious diseases (100 percent, n=2 vs.5).

Conclusion: Overall, the pharmacy education of the prescribers about the appropriate use of fluconazole per IDSA guidelines for managing candidiasis helped in reducing inappropriate use, and increasing the appropriate use, and the mean initial and daily doses to provide optimal therapy in our hospital. Among the prescriber groups, the surgeons (though small in number) showed significant improvement in complying with the appropriate use of fluconazole. However despite the education, the inappropriate use of fluconazole for presumptive yeast in bronchial washings continues.

3-080

Category: Drug-Use Evaluation

Title: Assessment of appropriateness of vancomycin use for managing systemic infections in adult patients in a community hospital

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Purpose: To assess the appropriateness of vancomycin use for managing systemic infections in adult patients in a community hospital to optimize therapy and pharmacy resources.

Methods: The prevalence of resistant strains of many gram positive bacteria most notably Staphylococcus Aureus has been on the rise possibly due to the overuse of vancomycin in recent years. Intravenous vancomycin should be used only for treating serious infections due to gram-positive organisms that are resistant to beta-lactam antibiotics or in patients who are allergic to them. Some practitioners use vancomycin empirically for treatment of a single blood culture positive for coagulase negative staphylococcus, cellulitis without abscess, etc, and continue therapy in patients whose cultures are negative for susceptible gram-positive organisms without de-escalating when clinically appropriate. This practice may lead to development of resistance to vancomycin, and may impact valuable pharmacy resources which could be used for more appropriate clinical services. We evaluated the appropriateness of vancomycin use in our 114-bed community hospital during September and December 2010. This retrospective chart review study included 101 medical-surgical and intensive care unit (ICU), non-dialysis adult patients who received at least three days or longer of intravenous vancomycin therapy empirically. The data collection included: demographics (50 males, 51 females, mean age 64 plus minus standard deviation (SD)18.5 years (yrs), range 25-98 yrs), mean days on vancomycin therapy 4.7 plus minus SD 2.5 days, range 3-17 days), admitting physician service, indication from progress notes, and pharmacy consult-associated workload to figure pharmacy impact. Appropriateness of vancomycin usage was evaluated using the 2009 Infectious Diseases Society of America (IDSA)/American Society of Health-System Pharmacy (ASHP) consensus guidelines for vancomycin dosing and monitoring and our Health-System-specific Inpatient Empiric Antibiotic Recommendations for Adults. Vancomycin use was then categorized as appropriate or inappropriate. Appropriate indications included: beta-lactam allergy, positive MRSA per culture and sensitivities, sepsis, pneumonia in ICU and or septic, cellulitis with abscess, rule out endocarditis or meningitis, urosepsis, history of MRSA, and post surgical trauma. Inappropriate indications were cellulitis without abscess, pneumonia in non ICU, etc. The impact on

pharmacy resources was figured as follows: a) Pharmacists time commitment of forty-five minutes for each initial pharmacy vancomycin dosing and monitoring consults including writing orders and progress notes, and fifteen minutes per day for follow-up dosing and documentations, b) patient charges of approximately US $113 per vancomycin level ordered, c) vancomycin drug cost per gram per patient, and d) 2,080 hours per year as equal to 1 full time employee (FTE). The nursing time to administer vancomycin and the supplies were not used for this evaluation. Calculations of the mean, range, standard deviation and percentages of various parameters were performed using Microsoft-Excel software. This study was exempt from Institutional Review Board approval.

Results: Overall, 81 of 101 patients (80 percent) received vancomycin per guidelines. The remaining 20 of 101 (20 percent) patients received vancomycin inappropriately during the 2 months of this study. The top three indications of inappropriate use were cellulitis without abscess (5 of 20), cellulitis with no beta-lactam allergy (4 of 20) and pneumonia in non-ICU (4 of 20). The remaining 7 of 20 patients had vancomycin for antibiotic prophylaxis, aspiration pneumonia, etc with no clear need for vancomycin. The patient charges related to the inappropriate use were as follows: vancomycin trough levels US$2,354, and vancomycin drug cost US$14,671. The pharmacists time involved managing inappropriate vancomycin dosing and monitoring was 1,905 minutes or 31.75 hours (0.02 FTE for 2 months). The annualized patient charges for the vancomycin trough levels and drug cost combined were US$102,149, and the pharmacists workload was 0.09 FTE (=190 hours per year). The pharmacists spent approximately 1.6 hours per patient during the hospital stay (mean 4.35 days) managing inappropriate vancomycin therapy which could be utilized for other clinical services. Inappropriate vancomycin use per physician services was as follows: a) hospitalists 14 of 72 (19 percent), b) private internal medicine, 3 of 14 (21 percent), and c) surgery, 3 of 15 (20 percent).

Conclusion: Overall, the majority of patients in our hospital received vancomycin appropriately per 2009 IDSA/ASHP guidelines. The main reasons for inappropriate use were for cellulitis without abscess and use in patients without beta-lactam allergy. The inappropriate use was similar among the various practitioners. The pharmacists workload impact managing inappropriate vancomycin therapy was substantial and could be utilized to provide other needed clinical services. Moreover, the patient charges related to unnecessary vancomycin trough levels and drug costs could also be avoided by using vancomycin appropriately per guidelines. We plan to share the results of this study with the prescribers and seek improvement in prescribing vancomycin appropriately.

3-081

Category: Drug-Use Evaluation

Title: Drug Utilization Review of Intravenous Immunoglobulin in a tertiary care center in Lebanon

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Purpose: Based on the guidelines of the Joint Commission international (JCI) for conducting a drug utilization evaluation, we studied the usage of IVIG at our tertiary care hospital due to: its high cost, repeated supply shortages and the potential for its use in clinical situations where there is limited or no convincing data for significant benefit.

Methods: The use of immunoglobulins has expanded substantially over the past several years. There are currently 7 clinical indications for which IVIG has been licensed by the United States Food and Drug Administration. Labeled indications are: treatment of primary immunodeficiencies such as common variable immunodeficiency (CVID); prevention of bacterial infections in patients with hypogammaglobulinemia and recurrent bacterial infections; prevention of coronary artery aneurysms in Kawasaki disease (KD); prevention of infections, pneumonitis, and acute graft-versus-host disease (GVHD) after bone marrow transplantation; reduction of serious bacterial infections in children with human immunodeficiency virus (HIV); increase of platelet counts in idiopathic thrombocytopenic purpura to prevent or control bleeding; to improve neuromuscular disability and impairment and for maintenance therapy to prevent relapse in chronic inflammatory demyelinating polyneuropathy (IDP) infection caused by B-cell chronic lymphocytic leukemia. The Clinical pharmacists reviewed retrospectively the charts of all patients admitted over a 2.5 months period (1/2/2011- 21/4/2011) for IVIG administration. The following data were collected: Prescriber, Indication and dose. The indications were compared for its evidence of benefit with the United HealthCare policy for IVIG updated May 2011.

Results: A total of 1276 g were dispensed at a cost of $138,148 for 28 patients. The indication for IVIG use was not clearly documented; it was extrapolated from the admission and progress notes. -12 patients received 677g (53%) of IVIG for labeled indications (2 for ITP, dosing criteria were met), 1 for BMT (dosing criteria were met), 1 for primary immunodeficiency (Bruton disease, dose used was higher -600mg/kg- than the recommended dose of 200-400mg/kg) , 5 for the prevention of infection and acute GVHD after BMT (dosing criteria were met) and 3 for chronic IDP (dosing criteria were met). -8 patients received 423g (33%) of IVIG for proven beneficial indications, 2 for Guillian Barre syndrome (category Ia evidence), one for intractable childhood epilepsy (Category Ia evidence), 3 for myasthenia gravis (category Ib-IIa evidence), one for Rota viral enterocolitis (category Ib evidence) and 1 for staphylococcal

toxic shock (category III evidence). -8 patients received 176g (14%) of IVIG where current evidence based medicine does not support its use (1 for Evans syndrome, 4 for Acute Lymphoblastic Leukemia, 1 for neurosarcoidoisis, 1 for Neonatal hemolytic jaundice, and one for Acute Disseminated Encephalomyelitis)

Conclusion: Adherence to labeled indications is mandatory to ensure the rational use and cost savings on IVIG. A multidisciplinary approach is needed that includes Oncologists/hematologists, Neurologists, and Infectious disease specialists to develop preprinted orders for IVIG which include the indications where the potential benefit from its use has been well documented.

3-082

Category: Drug-Use Evaluation

Title: Value of pharmacy review of patient medication profiles prior to the initiation of tolvaptan

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Purpose: The following case will demonstrate the importance of pharmacy review of patient medication profiles prior to starting tolvaptan on a patient for hyponatremia. An eighty year old female patient was re-admitted to our facility two weeks after aortic valve replacement surgery for worsening hyponatremia. A chief complaint for this admission from the patient is weakness and a 7.3 kilogram weight loss over the previous week with her current serum sodium on admission was 117 millimoles per liter. The patient had a previous re-admission one week prior to this admission for volume overload and had been taking bumetanide four milligrams twice daily. The patients pre-surgery laboratory screening showed a serum sodium level of 133 millimoles per liter four weeks earlier. The primary service attempted to correct the patients hyponatremia initially with fluid restriction of 1000 milliliters per day. On admission day five, the primary service asked for a consult from our renal service to assist in managing this patients hyponatremia. The renal consult recommendation was to continue fluid restriction and diuretic therapy. The patients serum sodium had recovered to 125 millimoles per liter. On day 6, there was no change in the patients serum sodium level and tolvaptan was ordered for the patient. The patient received 15 mg on admission day 6 and day 7 prior to a dose escalation to 39 mg on day 8. The patient did show a final elevation in her serum sodium level to 131 mmol per liter after her third dose. Pharmacy review of this case occurred on what would have been the fourth treatment day for this patient. This patient had been receiving amitriptyline as a medication that she had been on from home. Tricyclic antidepressants are documented as being able to cause hyponatremia. Further review of the patients profile also showed consults on this admission and a prior admission from Urology for urinary retention, which is also a known adverse side effect of amitriptyline. The patients tricyclic antidepressant was stopped at the request of pharmacy and the patients serum sodium level continued to increase slightly to 133 mmol per liter, which was her initial pre-surgery baseline. An additional medical condition that can also contribute to hypervolemic hyponatremia would be congestive heart failure. The patient was evaluated by cardiology and had a new diagnosis of mild congestive heart failure with elevated brain natriuretic peptide levels in the 300-600 picograms per milliliter range after the attempt to correct her sodium with tolvaptan. This case report demonstrates the importance of pharmacy review of medication profiles for potential drug induced hyponatremia before using a high cost agent vasopressin antagonist agent. Blue book actual wholesale price for tolvaptan is $309 for both the 15 mg or 30 mg oral dose and the cost of conivaptan is $687 for a 20-mg intravenous dose. Clinically the patient had a response with this agent, but this case does illustrate the difference between correcting an underlying pathological problem and treating a number. The case patient had one potential iatrogenic cause for hyponatremia in a tricyclic antidepressant and one medical condition, heart failure, which were not addressed prior to the use of a vasopressin antagonist. Tolvaptan was

accepted to our facilitys formulary of accepted drugs after this patient admission and the review of this patient case assisted in establishing criteria and restrictions for use.

Methods: N/A

Results: N/A

Conclusion: N/A

3-083

Category: Drug-Use Evaluation

Title: Implementation of heparin induced thrombocytopenia guideline

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Purpose: Heparin induced thrombocytopenia (HIT) is a potentially life threatening condition resulting from the formation of antibodies towards heparin. At this large, tertiary care, teaching hospital, HIT is typically treated by discontinuing all heparin products, including low-molecular weight heparin (LMWH), and initiating an argatroban infusion, which comes with significant cost. The hospital's clinical practice guideline on use of argatroban was recently updated and expanded into a new guideline for diagnosis and treatment of HIT. Diagnostic criteria and clinical evaluation for HIT were added due to high interprescriber variability leading to over-consideration of HIT. This all inclusive HIT clinical practice guideline also incorporates additional options for treatment of HIT such as fondaparinux.

Methods: A drug use evaluation was conducted to gather usage data on argatroban after implementation of the new clinical practice guideline. A list of patients receiving argatroban, fondaparinux, and dabigatran for a five month period was retrieved using the pharmacy computer system. Patients who were not evaluated or treated for HIT were excluded. Demographic data for each patient was collected as well as relevant laboratory values, duration of argatroban or alternative treatment use and number of doses dispensed. Argatroban usage post HIT guideline was compared to argatroban use data collected from a prevous drug use evaluation.

Results: 268 patients were identified as having received at least one dose of argatroban, fondaparinux or dabigatran from January 1 to May 31 2011. 60 of these patients were identified as being evaluated or treated for HIT and were included in the evaluation. 46 patients were identified as having received at least one dose of argatroban. A total of 150 bags of argatroban were dispensed totaling 295 patient days. The average number of bags per patient decreased from 4.2 (range 1-21) to 3.3 (range 1-15) and the average duration of treatment decreased from 7.3 days (range 1-34) to 6.4 days (1-29). The average number of bags per month decreased from 55 before the guideline to 30 after the guideline. The total amount spent was $174,300.00, averaged to $34,860.00 per month, extrapolated to $418,320.00 per year. The estimated cost savings per month was $30,000.00 or approximately $360,000.00 annually. Four patients were switched to dabigatran and one to fondaparinux from argatroban. Twelve patients were treated with fondaparinux only five of which had a previous history of HIT. Two patients received dabigatran, but were not treated for HIT.

Conclusion: Implementation of a comprehensive HIT clinical practice guideline considerably reduced the use of argatroban and resulted in significant cost savings. Other factors including availability of the serotonin release assay result within 24 hours and changes in argatroban distribution within the pharmacy department may have also contributed to the decrease in argatroban usage.

3-084

Category: Drug-Use Evaluation

Title: Evaluation of the use of acenocoumarol in a Lebanese tertiary care hospital

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Purpose: Vitamin K inhibitors are the most widely prescribed oral anticoagulants. In Lebanon, acenocoumarol is the only available coumarin derivative. As compared to warfarin, acenocoumarol has a shorter half-life and lower plasma concentration due to extensive first pass metabolism. The objective of this study is to evaluate the use of acenocoumarol in a Lebanese tertiary care hospital.

Methods: We conducted a retrospective chart review of 97 patients receiving acenocoumarol at Rafic Hariri University Hospital between January and May 2011. A data collection form including all pertinent information (demographics, concurrent anticoagulant/antiplatelet, indication, dose, INR and relevant lab monitoring, and bleeding incidence) was used. Patients were followed up until discharge. Assessment of appropriate therapy was based on INR as an indirect measure of efficacy and safety. INR target per indication was based on ACCP recommended therapeutic goals for oral anticoagulation.

Results: The patient population was 55% females and 45% males with an average age of 61 plus/minus 14 years. The average dose of acenocoumarol prescribed was 2.5 plus/minus 1 mg. The most common indications for acenocoumarol were prevention of stroke in atrial fibrillation (47%)and deep venous thrombosis treatment (23%).77% of patients were taking other anticoagulant and/or antiplatelet. A total of 551 INR measurements were taken with only 29% within the target range per indication. Only 9.3% of patients had INR more than 75% in the therapeutic range. Upon discharge, only 34% of patients had a therapeutic INR per indication. 42% of patients had baseline liver function tests measured. 5 patients (5.1%), 4 were also on low dose aspirin (75-162mg), had bleeding episodes in the hospital.

Conclusion: This evaluation of the use of acenocoumarol shows that our hospital needs interventions that can lead to improved patient care. A clinical pharmacist can ensure appropriate dosing and follow-up of patients receiving acenocoumarol. The development of an anticoagulation pharmacy service in the hospital may help in optimizing patient outcomes. For selected patients, the other orally available anticoagulant, dabigatran, can be an alternative to acenocoumarol.

3-085

Category: Drug-Use Evaluation

Title: Medication use evaluation through analysis of current prescription of proton pump inhibitors in Seoul veterans hospital, South Korea

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Purpose: As acid-suppressive drugs, Proton Pump Inhibitors (PPIs) are one of the most widely used drugs for management of gastro esophageal reflux disease (GERD) and peptic ulcer disease. However, recent studies indicate that high dose or long term use of proton pump inhibitors increase risk of bone fractures and cause hypomagnesaemia, particularly in individuals 50 years of age or older. Therefore, we investigated proton pump inhibitors prescription of outpatients and evaluated medication use for prevention of bone fractures and hypomagnesaemia in elderly patients.

Methods: This study was retrospectively performed, using Electronic Medical Record (EMR) system for the outpatients who received proton pump inhibitors used in Seoul veterans hospital (Omeprazole, Lansoprazole, Rabeprazole, Ilaprazole, Revaprazan) during 1 year from May 1, 2010 to April 30, 2011. The primary outcomes were average duration of proton pump inhibitors (PPIs) per prescription, age of patients, prescription rates of clinical departments. The secondary outcomes were total medication period for same patient during 1 year, clinical departments that prescribed long term PPIs with higher frequency. And the period was divided into four groups, less than 90 days, 90 to 179 days, 180 to 269 days and 270 days or more per patient.

Results: A total number of proton pump inhibitors prescription (PPIs) was 16102 and the average period of PPIs medications was 44.8 days per prescription. The ratio of medication period, less than 60 days was 65 percent, 60 to 89 days was 24 percent and 90 days or more was 11 percent. The average age of the outpatients received PPIs was 67.5 years. The elderly patients 50 years of age or older were occupied 96 percent among total outpatients in this study. The percentage of PPIs prescription each clinical department was that the department of gastroenterology was 45.4 percent, otolaryngology was 16.5 percent and neurology was 7.5 percent. Total medication period for same patient during 1 year, less than 90 days was 54 percent, 90 to 179 days was 19 percent, 180 to 269 days was 10 percent and 270 days or more was 17 percent. And the average period per patient during 1 year was 125 days. Long term (270 days or more) prescription rate of each clinical department was investigated that neurology was 53 percent, gastroenterology was 21 percent and otolaryngology was 7 percent.

Conclusion: In this study, we found that most of patients were 50 years of age or older and the average of total medication period per patient during one year was 125 days. The average of total medication period each clinical department was the department of gastroenterology was 141 days, whereas, the department of neurology was 244 days which was much longer term than main clinical department. Furthermore, 2 percent of them prescribed 3 times per day. It was higher frequency compared with the department of gastroenterology (less than 0.05 percent). Therefore, pharmacists should monitor use of proton pump inhibitors (PPIs) not only elderly patient but also clinical department to prevent hypomagnesaemia, increasing bone fracture risk by long term medication and to promote appropriate drug therapy. Additionally, it is needed for careful prescription that specific program in Electronic Medical Record (EMR) system should alarm about individual total medication days of proton pump inhibitors during treatment period not a prescription.

3-086

Category: Drug-Use Evaluation

Title: Unmet needs at hospital pharmacy for the care and treatment compliance in Spanish patients with Multiple Sclerosis

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Purpose: The EMHOPHAR Study was design to evaluate the type of management performed by Spanish hospital pharmacists with patients with multiple sclerosis (MS). The main purpose of this work is to assess the unmet needs at the hospital pharmacy and the treatment compliance fulfilled by MS patients treated with disease-modifying therapies (DMT).

Methods: Epidemiological, observational and multicenter study involving 24 hospital pharmacists that included 237 patients with relapsing-remitting (RRMS) or secondary progressive MS (SPMS) treated with DMT. Pharmacists complete a questionnaire on management actions and unmet needs at hospital pharmacy. Adherence was assessed using Morisky-Green test.

Results: 21,1% of pharmacists do not have adequate educational materials for MS available and in 16% of cases there were no adequate space to assure confidentiality. Only in 21% of cases a specific protocol to monitor adverse events exists and only in 32% to monitor treatment compliance. Pharmacists stand out as major unmet needs: educational material, adherence and compliance training, staff shortages and increased workload. Mean age of patients was 40.19.4 years and 65.8% were women. Average time from MS diagnosis was 7.55.6 years. 226 patients (95.4%) had RRMS. 145 patients (61.2%) had not reported relapses during last year, while the average among the remaining 38.8% was 1.8 relapses per year. Most patients (62.4%) had minimal disability assessed by EDSS disability scale (grades 0-2.5). 81.4% were treated with interferon- and 18.1% with glatiramer acetate. Overall patient compliance was 77.1%. There is a slight trend towards higher compliance in patients with SPMS (87.5% vs 76.4%, p=0.681). Treatment compliance was significantly higher among patients with no relapses during last year (82.9% vs 67.4%, p<0.05) and among patients aged over 40 years (85.1 % vs 68.3%, p<0.05). No significant differences in compliance were observed depending on whether or not the pharmacy provided a suitable location for administration training (76.9% vs 78.6%, p=0,890), between genders (84,1% man vs 73,6% woman, p=0,195), nor between treatments (82.6% glatiramer acetate vs 76.6% interferon-, p=0,783). According to main unmet needs described by pharmacists, there was trend towards lower compliance in patients attended at centres with excessive workload (68,6% vs 80,2%, p=0,167) and in those with lack of educational materials (75,2% vs 84,6%, p=0,435). In 19.8% of cases, there was a

discrepancy between pharmacist perception on patient compliance and the one estimated by Morisky-Green test.

Conclusion: It is necessary to improve educational materials and operational protocols regarding workload to provide adequate follow up on Spanish MS patients. Almost 25% of MS patients were not objectively compliant with DMT. Compliance was related to age, lack of recent relapses and type of the disease.

3-087

Category: Drug-Use Evaluation

Title: Zoledronic acid prescription pattern in outpatient care

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Purpose: Skeletal-related events (SRE) are associated with a decrease in quality of life and increase in medical cost. Zoledronic acid (ZA) is an intravenous bisphosphonate approved for SRE prevention in advanced malignancies involving bone. Breast cancer (BC), prostate cancer (PC) and multiple myeloma (MM) are the neoplastic disorders most frequently associated with SRE. In these cases the use of oral bisphosphonates such as clodronate and ibandronate (approved for this indication in Europe) is limited due to tolerability and poor adherence. The objective of this study was to observe the prescribing pattern of ZA in a tertiary care institution and the associated resources use at the day care unit.

Methods: An electronic retrospective chart review study was conducted. BC, PC and MM patients who received at least one dose of ZA from January 2009 until December 2010 in oncology day care unit were included. Data were obtained from the computerized physician order entry system. A data collection form was designed to record the patient demographics, cancer diagnosis, concomitant chemotherapy treatment and route of administration, total number of ZA administered doses, renal adjustments and dosing schedules. The patients follow-up period was defined from the administration of the first dose of ZA until February 2011.

Results: A total of 260 patients were included in the study. 42.3% (110 patients) with BC, 19.2% (50 patients) with PC and 38.5% (100 patients) with MM. Mean age was 63 (SD=15) in the BC group, 73 (SD=8) in the PC group and 67 (SD=12) in the MM group. Median duration of treatment was 435 days, 228 days and 301 days respectively, and median number of doses received was 15, 8 and 11. ZA was the only intravenous (IV) administered drug in 1420 out of 2211 doses (64.2%) in BC, 309 out of 452 doses (68.3%) in PC and 135 out of 1204 doses (11.2%) in MM. IV chemotherapy and ZA co administration throughout all the follow-up period occurred in 23 BC patients (20.9%), 7 PC patients (14.0%) and 40 MM patients (40.0%). Renal dose adjustment was done in 33.6 % (37) BC patients, 36.0% (18) PC patients and 32.0% (32) MM patients. The most frequent ZA dosing schedule was every 4 weeks (46.4%, 46.0% and 74.0% respectively). Alternative dosing schedules identified were: every 3 weeks (10.0%, 22.0%, 7.0%), every 3 or 4 weeks (17.3%, 22.0%, 9.0%) and over 4 weeks administration (26.4%, 10.0%, 10.0%).

Conclusion: ZA prescription among outpatients included in this study was appropriate and met the approved FDA/EMA indications. Approximately 65% of BC and PC patients came to the oncology day care unit exclusively for the ZA administration. The 3 weekly schedule was most often prescribed with IV chemotherapy co administration and the 4 weekly regime as IV monotherapy. No differences in the renal adjustment requirements were found between different diagnosis patients. Home administration of IV ZA should be strongly recommended because of an easy drug administration, an improved treatment adherence and ensured close monitoring, as well as a saving on day care unit resources.

3-088

Category: Emergency Medicine / Emergency Room

Title: Retrospective analysis of clinical interventions provided within a collaborative practice agreement in a private community emergency department setting

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Purpose: Delayed culture results and delayed abnormal lab values for patients who have been discharged from an emergency department represent a difficult follow-up problem. The delay has significant potential for continuity of care failure, as well as poor clinical outcomes. To avoid time lags & optimize care, process improvement of results review was identified as a clinical activity well-suited for emergency department pharmacists. The emergency department pharmacist is available to monitor the delayed culture & lab results of discharged patients, identify any necessary clinical treatment changes or additions, counsel patients on these newly identified clinical results and review initiated therapy for accuracy relative to guidelines & best practice. The purpose of this project was to retrospectively review the implementation of a collaborative practice agreement (CPA) in an emergency department setting, examine the accuracy of pharmacist driven clinical interventions through a quality assurance process and analyze one year post-implementation data for patient volume & clinical interventions.

Methods: A team of two emergency department pharmacists developed a collaborative practice agreement and a quality assurance process to implement a culture and lab follow-up service in March 2009. The CPA included background outlining the need for a formal pharmacist driven program, policy & practice guidelines and a process for documentation of results in the patients electronic medical record. The agreement was limited to practicing with Emergency Physicians Professional Association (EPPA) in the emergency department at Mercy Hospital located in Coon Rapids, Minnesota. Clinical practice limitations were agreed upon between the practicing pharmacists and the physician group. Pharmacists were required to review culture and lab reports daily, make therapeutic decisions based on the findings, initiate antibiotic therapy when appropriate and provide timely documentation of their conclusions in the patients electronic medical record. Analysis of pharmacists conclusions were categorized into the following: contact of patient for new antibiotic initiation, contact of patient without new antibiotic initiation, no contact from pharmacist or a negative result was documented.

Results: During a one year study period from January 1 to December 31, 2010, following implementation of the CPA, approximately 2100 results required pharmacists attention for review and interpretation. Of those results, 7.6% required new antibiotic initiation by the pharmacist, 1.9% required antibiotic discontinuation, 9.5% required contact without initiation of a new antibiotic, 52.9% were determined appropriate therapy and 26% were negative cultures requiring no action by the pharmacist.

During the quality assurance process no errors made by the pharmacists were identified. This data was confirmed by the medical director of the emergency department. The therapeutic decisions were tracked and trended for quality assurance and adherence to the CPA.

Conclusion: A pharmacist-initiated collaborative practice agreement in an emergency department setting was successfully developed & implemented. Quality assurance measures validate that pharmacists deliver appropriate and accurate care in this unique practice setting. Development of a CPA provides an opportunity for increased involvement in patient care for pharmacists in an established emergency department pharmacy program.

3-089

Category: Emergency Medicine / Emergency Room

Title: Evaluation post-implementation of a multi-disciplinary developed pneumonia algorithm in the emergency department

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Purpose: The ED (emergency department) management of a patient presenting with pneumonia has great impact on the morbidity, mortality, and successful management of these patients. In a fast pace, busy, crowded, emergency department, the recognition of different types of pneumonias (hospital acquired, healthcare acquired, community acquired) may be challenging especially with increasing emergence of antimicrobial resistance. Barriers such as limited documentation and records, inadequate patient history and multiple distractions, make it difficult for an ED physician to make a correct diagnosis and choose the correct antibiotic combination. In 2010, a taskforce was started to perform auditing and retrospective review of antibiotic selection. As a result, our compliance to core measures has improved. In 2011, in order to further facilitate the appropriate selection and cost effectiveness of antibiotics based on our antibiogram, a collaborative effort was made to develop a pneumonia pathway to streamline this whole process at St. Josephs Regional Medical center. St. Josephs Regional Medical Center is a level II, 650 bed urban tertiary care teaching hospital with approximately 124,000 annual patient visits with approximately 18% admissions. The purpose of this study is to evaluate the efficacy of a multi-disciplinary pneumonia algorithm developed in the ED, improve appropriate antibiotic selection in accordance with the Pneumonia Antibiotic Consensus Recommendations of the Center for Medicaid and Medicare services National Pneumonia Project.

Methods: A retrospective chart review of CAP patients for the entire hospital between the months of January 2010 and May 2011 was conducted. To help increase appropriate antibiotic selection, a collaborative team was made to develop a Pneumonia algorithm, the team consisted of ED physician champions, ED chairman, a quality improvement nurse, ED performance improvement coordinator, ED nurse manager, Infectious Disease clinical pharmacist and an ED clinical pharmacist. Prior to developing the algorithm, the Pneumonia Antibiotic Consensus Recommendations of the CMS National Pneumonia Project was posted around the physician stations to raise awareness. In order to decrease confusion with all possible combinations of antibiotics that could be used, the pneumonia algorithm helped to simplify and divide patients in to different categories. Patients were divided by: (1) Intensive Care Unit vs. floor admissions; (2) Pseudomonas risk vs. No Pseudomonas risk; and (3) Penicillin allergy vs. No

Penicillin allergy. This created eight categories of patients, each with a specific recommendation for antibiotics, consistent with the CMS recommendations. It was also found in our review of antibiotic usage, that the most effective antibiotic based on our most recent antibiogram, was not being utilized. For example, ciprofloxacin with 66% and gentamicin with 77% susceptibilities were being used for pseudomonas aeruginosa double coverage as opposed to tobramycin which was 91% susceptible. Also, we found that piperacillin/tazobactam was being overused in our hospital, in situations in which broad spectrum coverage was not required. In order to decrease the selection pressure on our hospital workhorse antibiotic piperacillin/tazobactam, cefepime was promoted in appropriate situations where anaerobic coverage was not needed. This study evaluated patients being admitted for pneumonia from January 2010 to May 2010 (n=438) and was compared to patients starting from January 2011 to May 2011 (n=447). A retrospective list was generated and reviewed for appropriate antibiotic selection at least four times a month from MedHost, the electronic charting tracking system used in the ED. The pneumonia algorithm was developed at the end of November and implemented in December 2010. Physicians and residents were educated though staff meetings, department bulletins and policy manuals, and posting of the algorithm at physician stations. Charts were reviewed on a bimonthly basis by a multidisciplinary quality team, and physicians were notified in cases where they did not comply with the recommendations of the algorithm.

Results: Overall usage of antibiotics was compared from 2010 to 2011 in the months of January to May. It showed a decrease of piperacillin/tazobactam, ciprofloxacin and gentamicin usage by 47%, 31% and 74% respectively and an increase of cefepime and tobramycin usage by 94% and 97% respectively. Antibiotic usage based on utilization of the pneumonia algorithm from 2010 to 2011 in the months of January to May, showed a 68% and 72% decrease of piperacillin/tazobactam and ciprofloxacin usage, no significant change in gentamicin and an increase of 98% and 100% of cefepime and tobramycin usage respectively. From 2009-2011 in the months of January to May, the average percentage of appropriate antibiotic selection was 76%, 95.2% and 95.4% respectively.

Conclusion: Our results support the use of a simplified algorithm, which was well accepted by the ED physicians in increasing clinical decision support. We met our goal in decreasing the usage of piperacillin/tazobactam, ciprofloxacin, and gentamicin and increasing the usage of cefepime and tobramycin. Implementation of the pneumonia algorithm decreased reliance on piperacillin/ tazobactam as a first line agent for all pneumonias and ensured that patients are receiving the most cost-effective combinations of antibiotics. Antimicrobial stewardship in the ED will further encourage the correct combination of antibiotics which can improve survival, reduce length of stay, decrease antimicrobial resistance, and overall cost of care. We have already decreased our piperacillin/tazobactam usage in the ED by 47%. With perseverance and a more prospective review of patient information, we hope to increase our antibiotic selection to 99%. Although the results presented do not encompass a years worth of data, we project that the data will continue to trend in a positive direction.

3-090

Category: Emergency Medicine / Emergency Room

Title: Impact of a pharmacist on the medication reconciliation process in the emergency department

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Purpose: The impact of a pharmacist on the medication reconciliation process in the emergency department (ED) has not been evaluated at our institution. The primary objective was to describe the role of a pharmacist in improving the accuracy and completeness of the medication reconciliation orders in the ED. The secondary objective was to describe other activities performed by the pharmacist in the ED.

Methods: This study was approved by the institutional review board. The pharmacist was available in the ED on weekdays from 8:00 AM to 4:00 PM. On daily basis, the pharmacist verified the completeness and accuracy of the physicians orders along with additional patient information on each medication reconciliation form. The pharmacist was also equipped with a pharmacy wireless laptop to profile the medication orders on the reconciliation form, or any new medication orders for the patients in the ED. When not profiling, the pharmacist conducted other activities pertaining to the care of patients in the ED. These activities included investigating medication-related issues, responding to medication requests from the medical team, providing drug information, counseling patients, performing clinical interventions, and others. Data analysis was done using descriptive statistics.

Results: From December 13, 2010 to January 31, 2011 the pharmacist spent 26 days in the ED. A total of 134 MRFs were reviewed. Each form had a mean of 6.79 orders (standard deviation (SD) equals 4.08). The mean daily time spent to complete and verify the MRF information was 141.6 minutes (SD equals 58.85). The pharmacist corrected incomplete medication information on 55 forms and clarified 36 physicians orders. The pharmacist spent 92.61 minutes (SD equals 41.80) profiling medications, on average 16 orders, daily. The pharmacist performed 174 interventions consisting of automatic substitutions (n equals 51), drug order changes (n equals 50), clarification of non-formulary drugs (n equals 30), and others (n equals 43). Daily, the pharmacist spent 65.83 minutes (SD equals 22.50) resolving medication-related problems, 117.69 minutes (SD equals 68.69) counseling patients, and 27.2 minutes (SD equals 14.16) providing education. Other activities included rounding, attending conferences, performing literature searches, and reporting adverse drug reactions.

Conclusion: The pharmacist in the ED improves the accuracy and completeness of the medication reconciliation process. The pharmacist also provides additional pharmacy-related services that enhance patient care.

3-091

Category: Emergency Medicine / Emergency Room

Title: Off to the right start: antibiotics in the emergency department

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Purpose: Through the Antibiotic Stewardship Committee, Empiric Antimicrobial Guidelines and Antibiogram Susceptibility Reports have been developed into a pocket guide for inpatient use at Hunterdon Medical Center. Since the selection of appropriate antibiotics prior to the speciation of culture results is critical to prevent antimicrobial resistance, the pocket guide provides a valuable tool for Emergency Department (ED) prescribers when admitting patients. The purpose of this study is to assess appropriateness of prescribing after the implementation of Inpatient Empiric Antimicrobial Guidelines.

Methods: Phase one of the study was a retrospective chart review from January 2010 to April 2010. PICIS, the ED documentation system, was utilized to perform chart reviews. Phase two of the study involved distribution of the pocket card and education to ED prescribers. Phase three of the study entailed a prospective analysis from January 2011 to April 2011. Patients who were 18 years of age and older, admitted as an inpatient through the ED, and had received antibiotics in the ED were included in the analysis. Antibiotics utilized in these patients were then reviewed and compared to the previously distributed pocket guide to assess for appropriate selection. Results from phase one and phase three were compared to determine the primary outcome.

Results: A total of 100 charts were reviewed, 50 in each group, prospective and retrospective. There was an improvement noted in appropriate antibiotic selection from 46 percent in the retrospective group to 62 percent in the prospective group. Although statistical significance was not attained, this was likely due to the small sample size. There were three reasons for inappropriate selection: appropriate agent(s) missing, inappropriate agent utilized and inappropriate dose used. Of the antibiotics deemed inappropriate, there was no overwhelming trend towards specific agents.

Conclusion: Improvement in appropriate selection of empiric antibiotics in the ED has been observed after implementation of the pocket guide.

3-092

Category: Emergency Medicine / Emergency Room

Title: Impact of door to alteplase (tPA) time with around the clock pharmacist response to Code Gray

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Purpose: The primary objective of this study was to determine the impact of around the clock pharmacist response to Code Gray alerts on the door to drug time goal of sixty minutes for patients receiving antithrombolytic therapy with alteplase. Total number of codes, codes receiving tPA and pharmacist time required were also assessed as secondary objectives.

Methods: Clinical Pharmacists worked with the Stroke Coordinator to develop an algorithm which enabled around the clock pharmacist response to Code Gray alerts at an accredited primary stroke center. Prior to implementation a clinical competency on stroke and Code Gray was developed for the hospital pharmacists. Individualized training on preparation of tPA and programming of the BBraun Smart Pumps were also provided to all full-time and part-time pharmacists. An in-service on the algorithm was provided for nurses and unit representatives throughout the hospital including the emergency department. Baseline data was collected starting three months prior to initiation of the Code Gray algorithm from June 2010 through August 2010. Post-algorithm initiation data was collected from September 2010 through December 2010. Door to drug time was obtained from the Stroke Coordinator via metrics on The Joint Commissions quality indicators. Total number of Code Gray pages received and total number of patients administered tPA were recorded by the covering Code Pharmacist. Time requirement of pharmacists responding to codes was assessed to determine impact on workload

Results: From June through August 2010, 55% of patients receiving tPA met the door to drug goal time of less than sixty minutes. However two of those codes occurred during the Monday through Friday day hours in which a clinical pharmacist responded to the code. Therefore, 43% of patients receiving tPA without a pharmacist involved met the door to drug goal pre-algorithm implementation. The range of time to tPA administration prior to the 24/7 pharmacist coverage was 39 minutes up to 130 minutes. The average time of door to drug was 63 minutes. Post-implementation, 86% of patients receiving tPA met the door to drug goal time of less than sixty minutes. The range of time to tPA was 28 minutes up to 71 minutes. The average time of door to drug when the Code Gray algorithm was followed was 44 minutes. During the three month post implementation phase 86 Code Gray activations were recorded, out of which seven required drug. Pharmacist time required for preparation, delivery and quality check was assessed to be approximately 23 minutes on average for patients receiving drug.

Conclusion: Pharmacist involvement in Code Gray coverage can have a significant impact on door to drug time and help the institution to meet their quality goals. Following an algorithm which maximizes the efficiency of pharmacist time involved in the Code Gray process allows for around the clock response of pharmacists without significantly impacting the pharmacists workload.

3-093

Category: Emergency Medicine / Emergency Room

Title: IV droperidol and olanzapine as adjuncts to midazolam for the acutely agitated patient: a multi-centre, randomised, double-blind, placebo-controlled, clinical trial

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Purpose: To determine if IV droperidol or olanzapine, as adjuncts to midazolam administration, improve sedation quality for the acutely agitated ED patient

Methods: We undertook a randomised, double-blind, placebo-controlled, double-dummy, clinical trial in three EDs (August 2009 to March 2011). Adult patients requiring IV drug sedation for acute agitation were enrolled. Each was randomized to receive an IV bolus of either saline (control), droperidol (5mg) or olanzapine (5mg). This bolus was immediately followed by an IV midazolam bolus (2.5-5mg) then additional boluses until sedation to a pre-determined endpoint was achieved. The primary outcome was time to sedation. Secondary outcomes were the need for rescue sedation and adverse events.

Results: Three hundred and thirty-six patients were enrolled. The baseline characteristics of the groups did not differ ($p>0.05$). However, the median (IQR) times to sedation (min) differed significantly ($p<0.001$): control group 10 (4-25), droperidol 6 (3-10), olanzapine 5 (3-10). At any time point, patients in the droperidol and olanzapine groups were ~1.6 times more likely to be sedated compared to controls: droperidol and olanzapine group hazard ratios (95%CI) were 1.58 (1.21-2.06) and 1.64 (1.25-2.15), respectively, ($p=0.001$). The droperidol and olanzapine groups required less rescue sedation and alternative drug use at any time after initial sedation had been achieved ($p<0.05$). The group adverse event profiles and lengths of stay did not differ ($p=0.21$ and 0.32, respectively).

Conclusion: Droperidol or olanzapine administration, as adjuncts to midazolam, is safe and significantly improves sedation quality. These findings will inform best-practice for sedation of the acutely agitated ED patient.

3-094

Category: Emergency Medicine / Emergency Room

Title: Effect of residency training on clinical activities in an emergency department

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Purpose: To describe the relationship between residency training and the clinical activities provided by pharmacists working in the emergency department (ED).

Methods: The clinical consultations documented by pharmacists in the ED at an academic, teaching hospital with a Level I trauma center over a 2 year period were retrospectively reviewed. The pharmacists provided coverage to the ED from 1-11pm, 7 days per week. Pharmacists were divided into four groups: those with no prior residency training, those with prior PGY1 residency training, those with prior PGY2 residency training, and those currently enrolled in a PGY1 or PGY2 residency program.

Results: During the study period, a total of 5,986 clinical consultations were documented by pharmacists providing clinical coverage in the ED. The most common consultations provided across all groups were dosing (48%) and therapeutic regimen recommendations (17%). Pharmacists with PGY2 residency training provided an average of 9.5 consultations per day compared with 8.3 for those currently in residency training, 7.3 for those with PGY1 residency training, and 6.5 for those with no residency training. Pharmacists with PGY2 residency training were also noted to have a higher average cost avoidance per day ($9,058) compared with other groups ($6,960, $3,271, and $2,642, respectively). In addition, pharmacists with PGY2 residency training were found to provide significantly more therapeutic recommendations when compared with the other three groups ($p<0.001$).

Conclusion: Clinical pharmacists from multiple backgrounds have the ability to make significant contributions to patient care in the ED. Those with PGY2 residency training tend to provide more clinical consultations and participate in more cost-avoidance activities than their counterparts. In addition, those with PGY2 residency training appeared to provide significantly more therapeutic recommendations than other groups. Residency training provides a quality learning experiencing for post-graduate pharmacists that can result in higher levels of patient care and potential financial benefits for institutions.

3-095

Category: Emergency Medicine / Emergency Room

Title: Efficacy of glucagon for the relief of acute esophageal food impaction

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Purpose: Acute esophageal food impaction is the most common foreign body obstruction that patients present to the emergency department with, accounting for nearly 75% of cases. Current guidelines suggest the administration of glucagon 1 mg intravenously in an attempt to relax the esophagus thus precipitating relief. The purpose of this study was to assess the efficacy of glucagon prescribed for relief of acute esophageal food impaction compared to patients who did not receive this therapy.

Methods: After obtaining investigational review board approval, data from patients who visited the University of Kentucky Chandler Medical Center between January 1, 2007 and December 31, 2009 with a diagnosis of esophageal obstruction/foreign body in the esophagus were retrospectively reviewed. Patients were included if they were >18 years of age and presented with an esophageal food impaction. The primary endpoint was to evaluate the efficacy of glucagon for the management of esophageal food impaction as measured by symptomatic relief of obstruction and avoidance of endoscopy within one hour of administration. Secondary endpoints included evaluation of the use of glucagon pharmacotherapy on length of stay and adverse effects.

Results: Of 319 patients who were initially identified, 89 patients met criteria for inclusion into the study. No significant differences were noted in baseline characteristics between the two groups. With regards to the primary endpoint, there was no significant difference between the incidence of symptom relief in the glucagon group compared to the control group (10.1% vs 10%, p=1.0, respectively). In addition, no significant difference was noted in the length of stay between the two groups (p=0.386). However, there was a significantly higher rate of nausea and vomiting following medication administration noted in the glucagon group (13.5% vs 0%, p=0.048, respectively).

Conclusion: Currently glucagon is recommended as the initial pharmacologic agent of choice by available guidelines for the relief of esophageal food impactions in the emergency department. Our analysis found no significant impact on symptomatic relief in those that received glucagon. In addition, we found no difference in the hospital length of stay and an increased incidence of adverse effects following therapy. These results need to be confirmed in a larger, prospective investigation.

3-096

Category: Emergency Medicine / Emergency Room

Title: Impact of a clinical pharmacist on antibiotic selection for treating urinary tract infections in the emergency department

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Purpose: The purpose of this study was to measure the change in prescribing pattern for the treatment of urinary tract infections (UTIs) in the emergency department (ED) after educating prescribers on recommendations that were developed by our infectious disease specialists and published in the hospital's antibiogram.

Methods: At our institution, the 2010 antibiogram detailed specific recommendations for the treatment of UTIs: cefazolin for uncomplicated UTIs and cefepime for complicated UTIs. In January 2010, the ED clinical pharmacist, in collaboration with the ED medical director, began educating ED prescribers on the use of the hospital's antibiogram to guide antibiotic selection when treating UTIs. Antibiotic selection in all patients who met UTI inclusion criteria was compared between 2009 and 2010 to measure prescribing pattern changes. The Chi Square test was used to measure significance.

Results: A total of 260 patients were admitted with a diagnosis of UTI and met inclusion criteria in 2009. In 2010, 236 patients were admitted with UTI and met inclusion criteria. Ceftriaxone was the most commonly used antibiotic to treat UTIs in 2009; it was used in 76 percent of the cases in this study. In 2010, after the educational efforts, ceftriaxone use declined to 21 percent (p less than 0.0001). Cefazolin was prescribed in 2 percent of the study cases in 2009 and increased to 30 percent (p less than 0.0001) in 2010. Cefepime was prescribed in 1 percent of study cases in 2009 and increased to 31 percent (p less than 0.0001) in 2010.

Conclusion: A clinical pharmacist can have a positive impact on antibiotic prescribing in the ED.

3-097

Category: Emergency Medicine / Emergency Room

Title: Time is Tissue: Emergency Medicine Pharmacists and Sepsis Management

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Purpose: To describe the role that an emergency medicine (EM) clinical pharmacist has on the management of patients presenting to the Emergency Department (ED) with sepsis, severe sepsis or septic shock.

Methods: The clinical consultations documented by the EM pharmacists at an academic, teaching hospital with a Level I trauma center over a 2 year period were retrospectively reviewed. The EM pharmacists provided coverage to the ED from 1-11pm, 7 days per week.

Results: During the study period, a total of 585 consultations were provided by the EM pharmacists to 130 patients who presented to the ED with a diagnosis of sepsis, severe sepsis or septic shock. The average age was 45.6 years and 53.8% of these patients were male. Dosing recommendations were the most frequent consultations provided (n=309, 53%), followed by the addition of appropriate empiric antibiotics (n=131, 22%) and medication preparation (n=108, 19%). Antibiotics (n=307, 83%) and vasopressors (n=31, 8%) were the pharmacologic agents that the EM pharmacists were regularly consulted on. Furthermore, vancomycin (n=90, 28%) and norepinephrine (n=15, 48%) were the most common agents involved in these consultations. The addition of other appropriate medications noted to be absent were added to initial pharmacotherapy regimens in 27% (n=156) of the consultations provided.

Conclusion: A clinical EM pharmacist has multiple roles in the early management of patients presenting with sepsis, severe sepsis or septic shock in the ED. Most commonly, they have a role in optimizing empiric antibiotic selection and dosing; thereby ensuring adequate antimicrobial coverage in this complex patient population.

3-098

Category: Emergency Medicine / Emergency Room

Title: Medication reconciliation improvement project at a community hospital

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Purpose: Reconciliation of medications across the continuum of care is a National Patient Safety Goal required by The Joint Commission. Implementation of medication reconciliation to promote prevention of adverse drug events is supported by the Institute for Healthcare Improvement as part of their 5 million lives campaign. It has been reported that 27% of all hospital prescribing errors can be directly related to incomplete admission medication lists. Patient safety is at risk when patients home medications are incorrectly documented in the medical record and reconciled by physicians to be continued upon admission and discharge. Incomplete or incorrect home medication lists also lead to pharmacist, physician, patient, and nursing dissatisfaction. The goal of this project is to improve the accuracy of home medication reconciliation lists prior to admission and at discharge to avoid medication errors.

Methods: A process was developed incorporating an Emergency Department (ED) Pharmacist/Pharmacy Technician Team in reviewing and clarifying home medication reconciliation lists 24 hours per day, 7 days per week in July 2010. In March 2011, a pharmacist/hospitalist team became involved with discharge medication reconciliation on an inpatient pilot to compliment the ED initiative and to complete the continuum of care.

Results: The ED Pharmacy Medication Reconciliation Team is able to review an average of 78% of patients 60 years and above and 67% of all adult patients. Approximately 2,900 interventions/corrections per month are made to patients home medications lists. The Pharmacist/Hospitalist team is able to review discharge medication lists and assist with discharge reconciliation and patient counseling on ~6 patients per day.

Conclusion: Pharmacy driven initiatives to improve medication reconciliation have a major impact on patient safety and cost avoidance.

3-099

Category: Emergency Medicine / Emergency Room

Title: Evaluation of animal bite treatment in a community hospital emergency department

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Purpose: Animal bites are a common reason that patients present to Emergency Departments for treatment. The Infectious Disease Society of America (IDSA) has specific recommendations for when antibiotic prophylaxis is indicated and what antibiotics should be used in the prophylaxis scenario. These antibiotics should be active against both the normal flora of the biting animals mouth and the normal skin flora in the bitten individual. Due to increasing prevalence of community-acquired methicillin-resistant Staph. aureus (CA-MRSA) and anecdotal treatment failures noted in patients prescribed appropriate therapy, there was concern among emergency medicine practitioners that empiric recommended therapies may not be adequate and may need to include agents active against CA-MRSA. The purpose of this study was to identify adequacy of current prescribing practices within the Emergency Department (ED) in patients with a chief complaint of a mammal bite, evaluate and quantify the treatment failures occurring in this population, and to determine if empiric therapy for animal bites in our area should include CA-MRSA coverage.

Methods: This study was a retrospective chart review. All mammalian bites presenting to the Emergency Department at a Midwestern, community, teaching hospital in a one year time period were reviewed using the electronic medical record. Demographic information, details about the bite incident and prescription data was gathered on each patient as well as information on return visits to the ED for treatment failures. Antibiotic therapy was classified as appropriate or inappropriate according to the 2005 IDSA Practice Guidelines for the Diagnosis and Management of Skin and Soft-Tissue Infections. Treatment failures were defined as patients returning to the ED with worsening infection, where a change or escalation of antibiotic therapy was prescribed by the ED physician. Returns for worsening infection in patients who admitted non-compliance to the prescribed antibiotics were not considered treatment failures.

Results: A total of 101 patient charts were reviewed. The animal bites involved included dog (n=55), human (n=29), cat (n=13), rat (n=2), raccoon (n=1) and unknown (n=1). Appropriate antibiotic selection occurred in 69% (n=70) of patients with amoxicillin/clavulanate being the most commonly prescribed agent. Inappropriate antibiotic therapy was prescribed in 31% (n=31) of patients; most of the inappropriate antibiotic selections were first-generation cephalosporins. Seven patients were prescribed antibiotic therapy when it was not indicated. There were a total of 3 treatment failures that returned to the ED; all of these patients had received antibiotic therapy that was considered appropriate and all had risk factors for complications (immunosuppression or age over 60 years). None of the 31 patient prescribed inappropriate antibiotics returned for treatment failure.

Conclusion: The results of this study indicate that empiric CA-MRSA antibiotic coverage is not needed in bite related complaints in this area of the country. It also demonstrates that inappropriate antibiotic selection is occurring frequently in this patient population; although none of these patients returned to the ED for failed therapy. Further education with prescribers is needed in this area. Overall, the treatment failure rate was very low but given that all three treatment failures had risk factors for complications, any patient with these risk factors merits close follow up after discharge from the Emergency Department.

3-100

Category: Emergency Medicine / Emergency Room

Title: Improving phytonadione prescribing practices through modifications to an emergency department computerized order entry system

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Purpose: Phytonadione is an important antidote for over-anticoagulation with warfarin. The American College of Chest Physicians (ACCP) has established guidelines for appropriate use of phytonadione in various clinical situations. The Emergency Department (ED) is an area where phytonadione is used frequently for the management of over-anticoagulation as well as emergent and life threatening bleeding. Emergency physicians in this community, teaching hospital were not always adherent to these guidelines, specifically in regards to the recommendation to avoid the use of the subcutaneous route of administration. After investigation by the emergency department pharmacist, it was identified that subcutaneous phytonadione was the first selection option in the computerized physician order entry (CPOE) system when Vitamin K or phytonadione were entered in the Orders function field. A change was made in the CPOE system so that only orders for oral or intravenous phytonadione were visible on the initial order screen when either of the two names was entered. The physician could still order subcutaneous phytonadione, but additional action was required to find the order. The purpose of this study was to evaluate the effect of this change on prescribing practices of ED physicians.

Methods: This was a single site, retrospective chart review study. All orders for phytonadione nine months before the change (the Before group) and nine months after the change were reviewed (the After group). Any patients not using warfarin were excluded; phytonadione orders from non-ED prescribers (i.e. admitting physicians) were also excluded because the changes to the CPOE system did not affect these prescribers. The data collected included demographics, co-morbidities, INR at presentation, presence of bleeding or invasive procedure planned, other medications that increase bleeding risk, hemoglobin and hematocrit on admission, use of fresh frozen plasma, and phytonadione dose and route. The dose and route of phytonadione were evaluated and determined to be either appropriate or inappropriate according to the ACCP guidelines. Comparison between the two groups was made using Fishers Exact test, with a p-value of < 0.05 considered significant.

Results: A total of 74 patients were included in the study during both time periods; 40 in the Before group and 34 in the After group. There were 13 orders (32%) in the Before group considered appropriate and 20 orders (59%) in the After group considered appropriate (p-value = 0.035). Subcutaneous phytonadione orders went from 20 orders in the Before group to 1 order in the After group. The average dose of phytonadione was 7.9 in the Before group and 7.0 in the After group. Despite the decrease in the number of subcutaneous orders in the After group, there were still a large

number of patients (41%) in whom the dose or route of phytonadione was considered inappropriate for the clinical situation.

Conclusion: In this study, the change made to the CPOE system dramatically decreased the orders for subcutaneous phytonadione. There was also a statistically significant overall improvement in the number of appropriate order for phytonadione. Further education or decision support may be needed for physicians to improve prescribing practices further. However, the significant limitation to this study is that the retrospective chart review process may not adequately capture the clinical situation or fairly evaluate whether a dose or route is truly inappropriate. Overall, this change to the CPOE system did have a significant impact on physician prescribing practices and similar, easy interventions such as these may be a way to promote better physician adherence to recommended therapies.

3-101

Category: Emergency Medicine / Emergency Room

Title: Documenting the value of pharmacist interventions in the emergency department

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Purpose: The presence of a pharmacist in the emergency department (ED) has become a common and growing practice in recent years. The trend to include a pharmacy presence in the emergency department has been endorsed by key organizations such as the Institute of Medicine and the Joint Commission. An analysis of pharmacist interventions in the emergency department was conducted to assess the value and impact a pharmacist would have on mediating medication safety in this area.

Methods: The study analyzed the quantity and type of interventions documented when a pharmacist was present in the ED compared to when not present. Pharmacists in the ED documented their interventions when on duty, and when off duty, the main pharmacy was in charge of this documentation. All interventions were recorded on a voluntary basis. Interventions pertaining to medications or patients admitted to the ED during the 24-hour period were included in the study. All other interventions that failed to meet these criteria were excluded. Interventions were recorded on an electronic clinical intervention database from December 23, 2010 to March 1, 2011. Interventions were categorized into the following types: ADE (adverse drug event), Alternative Drug Therapy, Allergy Screening, Anticoagulation, Order Clarification, Code Activity, Dosing Recommendation, Drug Interaction, Drug Information (i.e., review of evidence-based medicine as it pertains to specific patients and corresponding recommendations made to physicians), Drug Not Indicated, Duplicate Therapy, High Risk/BBW, Med Reconciliation, Patient Education, PK Consult, Request Labs/Monitoring, Renal/Hepatic Adjustment, Route, Therapeutic Substitution, Toxicology, Untreated Diagnosis, Pediatric Dosing, Pharmacotherapy consult, and Antibiotics. Interventions were then subsequently categorized for their potential to facilitate a medication related error based on the California Department of Public Healths 11 medication stages.

Results: During the study 1,039 interventions were documented. Exactly 1,000 interventions were recorded by the pharmacists on duty in the ED. The most documented interventions related to medication reconciliation (513/1,000), accounting for nearly half of the interventions recorded by the ED pharmacist. Other top intervention types included: drug information (115/1,000), drug therapy facilitation (61/1,000), and dosing recommendation (58/1,000). The most prevalent potential errors intercepted from the pharmacists interventions related to potential prescribing, administration, and prescription order communication errors.

Conclusion: The study determined that the ED pharmacist was instrumental at capturing a significant amount of interventions and that they played a key role at intercepting potential medication errors. .

3-102

Category: General Clinical Practice

Title: Evaluating the perceived value of PharmD candidates in delivery of medication therapy management (MTM) services

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Purpose: Medication therapy management (MTM) services have been utilized by the pharmacy profession to optimize therapeutic outcomes. The implementation of MTM provides opportunities for the pharmacy profession to move towards patient-centered care. Student pharmacists on APPE rotations are being exposed to MTM services in a variety of manners. By integrating students into MTM services, it will prepare them to deliver optimal patient care as they enter their pharmacy profession. A literature search revealed limited research on preparing students to deliver MTM services in a community setting. The objective of this study was to determine the self-perceived value of sixth year Pharm.D. candidates on clerkship rotation participating in MTM services at two community pharmacies through a self-administered survey.

Methods: Prior to data collection, the study was approved by the Institutional Review Board. An 8 question survey was initially administered to student pharmacists on a 6-week APPE rotation at two community-based pharmacies. Students were asked to answer survey questions to assess baseline demographics and their views regarding MTM. Students were then able to participate in the MTM process by preparing work-ups to assist in the delivery of a Complete Medication Review (CMR) for the remainder of the 5 weeks. Each student was assigned 3-4 patients each week. Students were provided with a patient profile consisting of patient initials, to allow for patient privacy, date of birth, and an active list of medications acquired from an online database. Students also received access to the patients medication history from the community pharmacy to assess drug compliance. All patient sensitive materials were concealed in order to maintain HIPAA standards. The patient CMR work-up was completed using a pre-designed form that addressed drug-drug interactions, late refills, inappropriate dosing, non-indicated medications, as well as device education. Common adverse reactions, important counseling points, and a comment section addressing any questions or concerns were also documented. Completed CMRs were then submitted to the preceptors for evaluation. Upon evaluation by the preceptor, the completed documents were then sent to the pharmacist to assist in a face-to-face CMR encounter with the patient. At the conclusion of the 6-week rotation, the student was given the same survey with an additional 9 questions to evaluate the perceived benefits of these MTM services.

Results: Baseline demographics were collected from the 23 completed surveys. Results indicate that 17 students worked in a chain community pharmacy. Of these 17 student pharmacists, only 7 indicated that

MTM services were being offered at their workplace, and all 7 students indicated that they plan on working for a community pharmacy after graduation. All questions were based on a 1 to 5 scale, 1 being strongly disagree and 5 being strongly agreed. Baseline perception of MTM services assisting in identifying medication errors prior to dispensing medications, on average was rated a 3.57, which indicated that the student did not agree or disagree with this statement. However, students agreed that MTM services were an important step in helping to move the profession of pharmacy forward. As a result of assisting in the delivery of MTM services, students agreed that the work they did helped them to identify key disease states, with a rating of 4.43. They also agreed that because of the assignment, they were able to identify medication interactions and duplication more effectively, with a rating of 4.52. Students also agreed, with a rating of 4.22, that they would seek employment opportunities where MTM training was available.

Conclusion: The participation of sixth year Pharm.D. candidates assisting in the delivery of MTM services through completion of CMR work-ups shows to have been a valuable assignment. Aspects that students found valuable pertain to identifying key disease states, identifying appropriate dosing and indications for drug therapies, selecting and using appropriate counseling and monitoring parameters, identifying drug interactions and recommending appropriate interventions to the provider, as well as being able to communicate effectively via written documents to positively impact patient care.

3-103

Category: General Clinical Practice

Title: Pharmacy resident in the intensive care unit: education and training

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Purpose: The education and training of the pharmacys resident are regulated by the Residents Program of Hospital Pharmacy from the Ministry of Health, Social Policy and Equality, as well as the Ministry of Education, although regional administrations are also involved. The 4 year specialist training program is carried out in 3 stages: Basic Training (short rotation on different areas of the pharmacy service to acquire basic knowledge, attitudes and skills); Specific Training (training in elective specialized areas under the supervision of the specialized pharmacist); Consolidation of clinical training (rotation in medical services where the resident develops their own clinical skills as an essential part of clinical proficiency and is integrated in the healthcare team). A standardized tool designed to provide an homogeneous pharmaceutical care practice, in line with the Pharmacy Service quality program, and to teach residents in the patient monitoring is described. The Neurocritical Care Unit has been selected as the presence of a pharmacist on rounds as a full member of the care team in an Intensive Care Unit (ICU) has been associated with a lower rate of adverse drug events.

Methods: A pharmacotherapeutic monitoring chart containing biodemographic and clinical data, analytical parameters and clinical problems of every patient was designed. A multidisciplinary team composed of staff physicians of the ICU and pharmacy residents tutors selected the main common clinical problems or key issues of the different type of patient attended in a neurocritical unit, as well as outstanding clinical problems of any specific pathology. Pharmacotherapeutic recommendations were based on clinical evidence or internal protocols. Specific efficacy and security indicators related to each clinical problem were defined.

Results: Three types of neurotrauma patient were selected: head trauma, acute spinal cord injury and polytrauma patient. The common key issues and some of the efficacy (E) and security (S) indicators were: nutritional support (E: weight, prealbumin; S: adequate nutrition via, electrolyte balance triglycerides, renal and hepatic function), thromboembolic prophylaxis (E: no thromboembolic events; S: initiation appropriateness, bleeding risk, thrombocytopenia), glycemic control (E: normoglycemia; S: hypoglycemic events), hemodynamic monitoring (E and S: arterial tension, cardiac frequency), pain management (E: pain scales; S: adverse drug reactions-ADR), infection management (E: infectious control, antibiotic therapy appropriateness; S: infectious complications, antibiotic resistances), sedative

and analgesic therapy in patients with mechanical ventilation (E: sedation scale; S: patient-ventilator asynchrony, ADR) and therapeutic drug monitoring (E and S: therapeutic range). The specific outstanding problems monitored in a particular type of patient were anticonvulsant prophylaxis (E: prophylaxis appropriateness, absence of convulsions; S: convulsion, ADR), intracranial pressure-ICP (E and S: ICP values, treatment adequacy), spinal cord protection with steroids (E: injury evolution; S: cord injury complications, ADR) and fluid resuscitation (E and S: hemodynamic control, blood products requirements). Moreover, all pharmacological treatments for every key issue were listed and those aspects recommended to be monitored by clinical literature were identified and followed.

Conclusion: The pharmacotherapeutic monitoring chart has allowed us to establish some standards in terms of pharmaceutical care in a neurocritical unit homogenizing performance among the entire care team and to optimize pharmacotherapy outcomes in patients. In the future, the evaluation of the tool and the impact on residents training benefit will be of interest. Moreover, it might be a reference model for other clinical rotations.

3-104

Category: General Clinical Practice

Title: Implementation and impact of standardized adult continuous renal replacement therapy

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Purpose: Moving away from customized continuous renal replacement therapy (CRRT) solutions toward standardized formulations was a process improvement initiative. The impact of such a move improves patient safety, utilization of pharmacy and nursing time, and compliance with regulatory and national standards. This project was designed to improve the process of ordering, preparing, and administering CRRT in the adult patient population.

Methods: All CRRT orders were collected over a two (2) month period and evaluated for prescribing patterns. Commercially available CRRT solutions were evaluated and compared to the prescribing patterns. A multidisciplinary team of pharmacists, nurses, and physicians provided input into solution selection and creation of an updated CRRT ordering form. The final recommendations and new CRRT ordering form were presented to the Pharmacy and Therapeutics Committee for approval.

Results: Based on the prescribing patterns identified and multidisciplinary team input, two solutions each of dialysate and replacement solution were selected. The new CRRT ordering form addressed the new solutions, standardized anticoagulation choices, and implemented a streamlined electrolyte replacement protocol. A communication and education plan was put into place to alert the over 30 physicians who prescribe CRRT at our institution, as well as all pharmacists and critical care nurses. Institutional policies were updated to reflect the new process. Anecdotally, the switch to the premade, standardized formulations has saved approximately eight hours of nursing time per day per patient. In general, the new formulations have reduced use of sodium bicarbonate infusions and the need for insulin in this patient population. A majority of CRRT solutions ordered are premixed and require little or no manipulation, further improving patient safety. Benefits of using the premade solutions for the Pharmacy Department include the centralization of compounding and inventory, and eliminating technician stocking of patient-specific CRRT carts. A majority of manipulations are now performed by the Sterile Products Preparation staff as compared to individual satellite pharmacies.

Conclusion: The implementation of standardized CRRT solutions and a new ordering form has improved patient safety, saved nursing time, improved regulatory compliance, and improved safety with anticoagulation. The higher cost of pre-mixed solutions is offset by the considerable labor and time

savings compared with compounding of custom replacement solutions. The next step in this project will be to reevaluate prescribing and utilization patterns to optimize the solution choices and to translate the CRRT form into the computerized prescriber order entry system.

3-105

Category: General Clinical Practice

Title: Impact of Extended Infusion of Piperacillin/Tazobactam On Utilization and Cost in a Tertiary Care Academic Heath System

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Purpose: Piperacillin/tazobactam (PT)is a commonly used broad spectrum antibiotic and clinical outcome is optimized when the free concentration remains above the minimum inhibitory concentration for approximately 50-60% of the times. The pharmacodynamic property allows it to be administered over four hours intravenously every eight hours, compared to the traditional infusion every six hours over 30 minutes. We describe the impact of successful implementation of an extended PT infusion program on cost savings and utilization in a 925-bed academic health care system.

Methods: A multidisciplinary team was formed to address the feasibility of implementing the extended infusion. After careful analysis of the scientific merits, the team primarily composed of pharmacists, nurses and infectious disease specialists developed the protocol. Automatic therapeutic conversion to extended infusion was approved by the medical staff committees. Intensive education programs were provided to physicians and nursing staff prior to implementation in selected pilot units. Health ststemwide implementation was followed after successful implementation in the pilot units.

Results: We achieved 100% compliance during the post implementation period . There was a twenty percent drop of the utilization during the 6-month post-implementation compared to the corresponding prior period. The number of PT doses per 1000 patient days significantly decreased and pharmacy expenditures decreased by eighteen percent. There were no changes in resistance trends against gram-negative pathogens during the post-implementation period.

Conclusion: Successful implementation of a healthsytem wide program for the administration of extended infusion PT program resulted in significant cost savings and reduced utilization of the agent. We believe that an interdisciplinary team led similar program can be successfully implemented in any other institution.

3-106

Category: General Clinical Practice

Title: Possible case of cyclobenzaprine-induced angioedema

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Purpose: Angioedema is a potentially life-threatening, abrupt swelling of the skin and/or mucous membranes that sometimes involves the upper respiratory and gastrointestinal tracts. While the differential diagnosis for angioedema is broad, a frequent precipitating factor is medications. Cyclobenzaprine is a centrally-acting skeletal muscle relaxant pharmacologically related to tricyclic antidepressants. Commonly used to relieve muscle spasm, pain and tenderness, the drug reduces tonic somatic motor activity by influencing both alpha and gamma motor neurons. To date, there have been no published case reports of cyclobenzaprine-induced angioedema. This report describes a case of severe angioedema temporally linked to the administration of cyclobenzaprine. A 44-year-old African American female with history of polysubstance abuse presented to the emergency department (ED) with progressive right-sided cheek and lip swelling. Approximately, 24-hours earlier, the patient admitted to smoking crack cocaine. At that time, she experienced some shoulder tightness, for which a friend gave her an unknown muscle relaxant pill, later identified to be cyclobenzaprine. Upon awakening the next morning, the patient noticed modest swelling of her lips and right cheek, which continued to progress throughout the day, prompting an ED visit. The patient reported no known drug allergies and no home medications. Likewise, she denied any personal or family history of angioedema. Notably, the patient smokes crack cocaine on a regular basis and has never before experienced this type of reaction. On physical examination, the patient's lips and perioral region were markedly enlarged and distorted. The swelling continued to progress while the patient was being triaged in the ED. Intravenous (IV) methylprednisolone 125 mg, IV diphenhydramine 50 mg, and subcutaneous (SQ) epinephrine 1:1000 0.3 mL were administered. Thereafter, the patient was admitted to the intensive care unit (ICU) for observation. Approximately 8 hours later, in the ICU, the patient received additional one-time doses of IV methylprednisolone 125 mg and IV diphenhydramine 50 mg. By hospital day 2, the angioedema appeared to be resolving and the patient was transferred to the telemetry/step-down unit. The next morning, she was discharged to home with instructions to complete a 4-day course of oral (PO) prednisone 40 mg once daily and PO famotidine 20 mg twice daily. Not immediately available at the time of hospitalization, serum complement factor 4 (C4) and C1 esterase inhibitor function were eventually found to be within normal limits, essentially ruling out hereditary angioedema [18 mg/dL (reference range, 9 to 36 mg/dL) and 116% (greater than or equal to 68%), respectively]. Use of the Naranjo probability scale indicated a possible relationship between cyclobenzaprine and development of angioedema in this patient. Although cyclobenzaprine was the most likely culprit, cocaine cannot be

eliminated as the cause of the patient's angioedema. When faced with a case of angioedema, clinicians should perform a comprehensive drug history and consider prescription, over-the-counter, and illicit drugs as a cause of this potentially life-threatening reaction. This case adds to the growing list of medications reported to cause angioedema.

Methods: N/A

Results: N/A

Conclusion: N/A

3-107

Category: General Clinical Practice

Title: Pharmacists and pharmacy students knowledge and skills in interacting with patients with disabilities in Qatar

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Purpose: People with disabilities, as defined by the Qatari Ministry of Family Affairs, encompass all individuals with varying degrees of mental, physical and psychological impairments. Community pharmacists in Qatar serve as primary care providers in this Arabian Gulf country where the majority of FDA regulated drugs are available without a prescription. Given the scope of practice of community pharmacists , knowledge regarding patients with a variety of needs is necessary as pharmacists may serve as the point of care providers for a large segment of the population. The purpose of this study was to assess community pharmacists and pharmacy students knowledge and attitudes toward patients with disabilities in Doha, Qatar.

Methods: The institutional review boards of the respective institutions granted approval for this cross-sectional survey which was conducted in Doha, Qatar between February and May 2011. The target samples were third and fourth year Qatar University pharmacy students and community pharmacists working in Doha. The survey was distributed using a mailing list developed by the college of pharmacy. This mixed-methods study consisted of a questionnaire designed and validated through external reviewers. Previously validated tools, which are the LEEDS Attitude Towards Concordance Scale (LATCon), Attitude Towards Patients with Disabilities Scale and the Social Distance Scale, were used to assess three pre-defined domains designated as Domain B - concordance with patient participation in the care process, Domain C - professional attitudes towards patients with disabilities and Domain C willingness to incorporate people with disabilities within one's social framework, respectively. The survey was adapted for Middle Eastern practitioners, with changes based upon cultural perspective and reviewed for face validity and comprehensibility. In addition to the professional domains, demographic characteristics, patient-centered activity questions and questions regarding accessibility of the practice site by patients with disabilities were also included. Two focus groups were conducted to further assess findings and extrapolate on reported results. Statistical analysis was conducted using SPSS version 18.0 (significant at $p < 0.05$). Descriptive statistical analyses and group comparisons were carried out using correlation statistics and linear regression analysis. Bivariate correlation was used to determine any association between dependent data and other independent variables identified a priori. Predictor factors were determined using linear regression and Anova test.

Results: A total of 107 (30%, N=362) participants responded to the survey, resulting in a confidence level of 95% and an 8% confidence interval. As this was the first survey of its type in this region, a reliability test with a Cronbach's Alpha score of 0.826 was obtained. The study included 82 community pharmacists (25%; n = 332) and 25 pharmacy students (83%; n = 30) from Qatar University. Male and female respondents were equal in number. The highest degree to practice of the majority of the pharmacists was a Baccalaureate degree. Respondents were working in chain pharmacies (36%; n = 29), primary health care clinics (29%; n = 24), or in independent community pharmacies (18%; n = 15). The majority (35%; n = 35) had more than 10 years experience in professional practice. Most of the respondent (75.2%; n = 79) spend about 1-10 minutes on average with patients per interaction and (32%; n = 33) interact with patients with disabilities on a monthly basis. There was no statistically significant difference between the community pharmacists and the pharmacy students across the three assessed domains. Community pharmacists and pharmacy students were found to have a high score (Likert score > 3.5) in regards to concordance and pharmacy practice. Conversely, the respondents had a relatively neutral (Likert score of 2.6-3.4) score of attitudes toward patients with disability (Domain C) and social distance (Domain D). Attitudes toward concordance, attitudes toward patients with disability, and social distance were significantly impacted by years of practice (P=0.010), education (P=0.05) and self reported experience with patients with disabilities (P=0.011), respectively. Focus group analysis revealed family participation and decision making on behalf of the disabled patient, sympathy and disabled patients receiving priority of care as repeated themes between the two groups. The community pharmacists identified additional professional development programs and students identified additions in the pharmacy curriculum as areas in which to incorporate increased education for this patient population.

Conclusion: Results suggest that pharmacy students and pharmacists have inconsistent attitudes toward patient care when discussing patients with disabilities versus patients without disabilities. Qualitative findings support the need for increased education and professional development regarding patients with disabilities. Increased education and professional exposure to patients with disabilities may be areas of opportunities for professional development programs and pharmacy school curriculum.

3-108

Category: General Clinical Practice

Title: Impact of a pharmacy concierge service in a community hospital setting

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Purpose: For patients being discharged from a hospital, filling home going prescriptions is rarely a convenient experience. After physically leaving the hospital, it is often challenging to go to a community retail pharmacy to fill newly written prescriptions. There are often long wait times, unavailable products, and transportation barriers. As a physician-owned community hospital, any initiative to relieve the patient of this inconvenience was identified as a high priority. A pharmacy concierge service was designed to improve patient satisfaction, enhance the patient experience on discharge, and increase compliance with home-going medications.

Methods: When home-going inpatients were given discharge orders the outpatient pharmacy was notified. A certified pharmacy technician promptly went to the patient's room to explain the concierge service and offered the patient the option to participate. If the patient agreed to take advantage of this service, the technician gathered the home going prescriptions located in the patient's chart, communicated to the nurse that the patient was participating, and took the prescriptions to the on-site retail pharmacy to be filled. All pertinent patient information including current medication orders, allergies, diagnoses, laboratory values, and insurance information was accessible to the pharmacists. The prescriptions, once filled, were returned to the patient's bedside where the pharmacist counseled the discharged patient, answered any of their questions, and collected any potential copayments.

Results: After five months, 321 of 396 patients discharged to home participated in the pharmacy concierge service. In total, 765 prescriptions were dispensed from this program. The two main reasons patients chose not to participate were not having any money on hand and wanting to go to their own community retail pharmacy. When asked, most patients truly appreciated this service and felt it was very accommodating. The pharmacy staff reported an increase in job satisfaction, while the nursing staff reported they appreciated the expertise the pharmacist provided regarding discharge medication counseling.

Conclusion: The pharmacy concierge service succeeded in improving the patient experience on hospital discharge. This program also improved interdisciplinary relationships between hospital staff as well as increasing employee satisfaction. Due to these successes, the pharmacy concierge service will be continued as a convenient option to the home-going patient.

3-109

Category: General Clinical Practice

Title: Evaluation of a benzodiazepine fixed-dosing guideline in the treatment of alcohol withdrawal syndrome within a Veteran inpatient population

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Purpose: Alcohol-dependent patients who abruptly discontinue their intake commonly experience symptoms known as alcohol withdrawal syndrome (AWS). Standardizing management of withdrawal by use of an evidence-based treatment guideline will improve patient outcomes and minimize complications. The purpose of this study was to examine the current fixed-dosing benzodiazepine protocol at the James H. Quillen VA Medical Center.

Methods: The institutional review board approved this retrospective chart review of patients admitted between July 1, 2009 and November 30, 2009 with an alcohol-related diagnosis. Patients included were those with the following ICD-9 diagnosis codes during study admission: (303.0) acute alcoholic intoxication, (291.81) alcohol withdrawal psychosis, (291.3) alcohol withdrawal hallucinosis, and (291.0) alcohol withdrawal delirium. Each patient chart was reviewed and the following information collected: demographic data, benzodiazepine(s) administered, total cumulative quantity of benzodiazepine administered, duration of benzodiazepine treatment, inpatient length of stay, presence of seizures, benzodiazepine reversal by flumazenil administration, and admission to the intensive care unit (ICU). Only descriptive statistics were used to analyze the data collected. The primary outcome was to assess the total amount and duration of benzodiazepine treatment in a fixed-dosing practice for patients with AWS. The secondary outcome was to assess the prevalence of complications and adverse events associated with treatment of patients experiencing alcohol withdrawal symptoms.

Results: A total of 313 patient charts were identified and reviewed. Lorazepam (n=95, 45%) and diazepam (n=67, 32%) were the benzodiazepines administered most often. The average total oral and intravenous doses of lorazepam were 21mg and 6.8mg, respectively. For diazepam, the average total oral dose administered was 130mg. The average length of benzodiazepine therapy was 6 days, while the average length of hospital stay was 8.25 days. Patients receiving lorazepam stayed in the hospital an average of 9.34 days, while patients that received diazepam stayed for 8.54 days. Alcohol-related seizures were documented in 1 patient during admission. No patients were given flumazenil during study admission.

Conclusion: This study established baseline data for benzodiazepine administration in AWS treatment of this study population. These data provide important information to help providers understand current treatment and usage patterns in the treatment of AWS. The findings of this study will be used in the development of future AWS treatment algorithms for this patient population.

3-110

Category: General Clinical Practice

Title: Evaluation of appropriate serological testing for suspected heparin-induced thrombocytopenia in hospitalized patients

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Purpose: Heparin-induced thrombocytopenia (HIT) is an immune-mediated adverse response to heparin treatment that results in an increased risk for thrombosis. The 4T test is a scoring system that can be performed before serological testing for suspected HIT. Literature suggests that this scoring system has as high as a 100% negative predictive value in ruling out HIT. The purpose of this study was to assess the predictive value for HIT of the 4T scoring system compared to the serological test results. Additionally, appropriate management of suspected HIT was evaluated.

Methods: This study was conducted as an IRB-approved retrospective chart review. Patients were eligible if they had HIT-antibody tests performed between June 2008 and June 2010. Sample size was based on prior studies. The 4T scoring test was retrospectively applied to each patient by 3 blinded pharmacists. Patients were then stratified by the probability of having HIT based on the 4T score: low (score 0 to 3), intermediate (4 to 5), and high (6 to 8) probabilities of having HIT. The final classification of each patient required at least two pharmacists be in agreement. Fifteen percent of all data was validated by a primary reviewer. Serologic test results were reviewed to determine the percentage of patients in each risk group who had positive and negative results. Statistical tests were performed to detect any difference at baseline between positive and negative serologic tests. A Cohen kappa statistic was calculated to assess inter-rater variability. Appropriate management of patients with suspected HIT was also evaluated as a secondary endpoint by assessing renal function, hepatic function, and documentation of patient allergy information.

Results: There were 450 patients screened. After randomization, the first 70 patients were included. The numbers of patients classified as low, intermediate, and high risk were 52, 17, and 1, respectively. The only baseline characteristic significantly different was age. The low risk group consisted of 52 patients with 37 ELISA-negative and 15 ELISA-positive. This translates to a negative predictive value of 71.2%. Eight of the 15 ELISA-positive patients had previously positive ELISA-tests. If these 8 patients were excluded, the negative predictive value would increase to 77%. In the low-risk group, heparin products were discontinued in 47 patients (94%). In the low-risk group, 11 patients received alternative

anticoagulation therapy. Information was updated in the patients medical record for 16 patients (67%) to reflect the heparin allergy.

Conclusion: Diagnosis of HIT remains a clinico-pathologic process. The 4T test is a validated clinical assessment tool that aids diagnosis by looking at the patients clinical picture in regards to thrombocytopenia, timing of thrombocytopenia, presence of thrombosis, and the ruling out of other causes. With an adjusted 77% negative predictive value, if a patient scores low-risk less than 8 times out of 10 that patient will have a negative ELISA test. Upon clinical suspicion of HIT, all forms of heparin, including low molecular weight heparins and heparin flushes, should be discontinued. Alternative therapies of argatroban, fondaparinux, and/or sequential compression devices should be initiated based on a patients pharmacokinetic parameters. Finally, allergy information should be updated based on serologic results to ensure appropriate therapy in the future.

3-111

Category: General Clinical Practice

Title: Prevention of contrast-induced nephropathy with N-acetylcysteine and sodium bicarbonate versus to N-acetylcysteine and saline hydration

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Purpose: Contrast-induced nephropathy (CIN) is the third leading cause of acute renal failure accounting for approximately 11% of all hospital-acquired renal failure. Contrast-induced nephropathy is defined as a 0.5 mg/dL or 25% increase in serum creatinine (SCr) within 48 to 72 hours after the administration of contrast media. Development of acute kidney failure is associated with longer hospitalizations and higher in-hospital mortality. Current prevention strategies include the use of low/iso-osmolar contrast media, saline hydration, N-acetylcysteine (NAC) and sodium bicarbonate. The purpose of the study is to determine if there is a significant difference between sodium bicarbonate in conjunction with NAC compared to saline hydration with NAC for the prevention of CIN in patients with renal insufficiency.

Methods: This study is an IRB-approved, observational, retrospective review of admitted patients greater than or equal to 18 years of age with renal insufficiency (SCr >1.2 mg/dL) who have undergone an intravenous, iodinated contrast procedure and received NAC 600 mg orally with either sodium bicarbonate infusion (arm 1) or saline infusion (arm 2). The primary objective was the number of patients that experience CIN by assessing serum creatinine 48 hours post-contrast. Secondary objectives evaluated the incidence of dialysis, death, effect of concomitant nephrotoxic medications, and incidence of CIN according to risk stratification.

Results: Baseline characteristics were shown to be similar except for the higher ratio of males:females, and also in the higher use of iso-osmolar contrast in arm 1 vs. arm 2. Differences in incidence per risk category between the two study arms were not found to be significantly different. The incidence of CIN was not significantly different between the study arms. The incidence of CIN in arm 1 versus arm 2 occurred in 8 vs. 5 patients (21.6% vs. 12.8%; p = 0.4344), respectively. Results for the secondary objectives including incidence of dialysis, death, effect of nephrotoxic medications and incidence of CIN according to risk stratification were not found to be significantly different.

Conclusion: Statistically significant differences in efficacy were not shown between the two study arms for the prevention of CIN. Neither regimen can be definitively recommended for a specific established risk category due to a lack of clear benefit. Based on these findings, a protocol with recommended standardized fluid and medication regimens would be beneficial. Further studies are necessary to

establish the comparative efficacy of regimens including sodium bicarbonate versus saline hydration in patients with chronic kidney disease.

3-112

Category: General Clinical Practice

Title: Analysis of a conversion from darbepoetin alpha to epoetin alpha in a large community hospital based dialysis unit

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Purpose: Darbepoetin alpha and epoetin alpha are two erythropoietin stimulating agents (ESAs) available for use in the treatment of anemia in hemodialysis patients. In April 2010, our institution converted from darbepoetin alpha to epoetin alpha. Several clinical trials and the darbepoetin alpha package insert suggest that 400 units of epoetin alpha is equivalent to 1 mcg of darbepoetin alpha (400:1 ratio). However, there is a paucity of data to suggest whether this conversion is appropriate in the opposite direction. Based on the average doses of darbepoetin in our dialysis unit, published case reports, and anecdotal evidence from other hospitals, it was theorized that this conversion could be done with less than a 400:1 ratio. The purpose of this study was to determine the actual conversion ratio in our population of dialysis patients. In addition, clinical trials have shown a hemoglobin greater than 12 mg/dL is associated with a higher risk of stroke in patients with renal disease. This analysis will evaluate hemoglobin values in each group to determine if there is any difference in maintaining a target range of 10-12 mg/dL. Lastly, a cost analysis was completed to determine if there was any savings achieved through the conversion.

Methods: The retrospective electronic chart review was approved by the hospital's investigational review board. Data was collected for all patients who were seen in the hospitals dialysis unit from July 2009 to March 2010 (darbepoetin data) and August 2010 to April 20011 (epoetin data). All Darbepoetin alpha doses were administered once weekly while all epoetin alpha doses were administered three times weekly. April 2010 through July 2010 data was excluded for all patients to allow for the transition. Data collection included patient demographics, hemoglobin levels, darbepoetin alpha doses and epoetin alpha doses for each month. A conversion ratio was calculated using both an intention to treat analysis and by including only patients who received at least four months of both drugs. In addition, the percentage of patients in both drug groups were recorded for three categories; hemoglobin less than 10 mg/dL, hemoglobin 10-12 mg/dL, and hemoglobin greater than 12 mg/dL. This data will determine if there was any difference in maintaining appropriate levels between the two groups. Purchase data was analyzed for the appropriate time period to calculate drug costs associated with the utilization of darbepoetin alpha and epoetin alpha.

Results: A total of 146 patients were included in the intent to treat analysis. Forty-six patients received both drugs for at least 4 months. The average age of all patients was 63 years (22-98). The conversion ratio for the intent to treat analysis was 226:1. The conversion ratio for the patients who received both drugs for at least 4 months was 225:1. (range 64:1 to 400:1) Higher doses of ESAs generally resulted in higher conversion ratios. The average treatment dose of darbepoetin was 114 mcg/week while the average dose of epoetin alpha was 8600 units three times weekly. There was a 14.4 percent increase in patients who maintained a target hemoglobin level of 10-12 mg/dL in the epoetin alpha group. In addition, there was a 16.2 percent reduction in the number of hemoglobins greater than 12 mg/dL in the epoetin alpha group. Approximately 275,000 dollars in drug cost savings was achieved within the first year of the conversion.

Conclusion: This study revealed that a successful conversion from darbepoetin alpha to epoetin alpha can occur effectively using a lower ratio than is suggested in the darbepoetin package insert. Due to the lack of published clinical data converting from darbepoetin alpha to epoetin alpha, this evaluation was able establish an appropriate conversion ratio in a large hospital dialysis unit. There are significant safety concerns with the administration of ESAs that should be considered when prescribing these agents. Administering epoetin alpha three times weekly in our institution reduced the number of elevated hemoglobins that put patients most at risk for stroke. In addition, an increase in the number of target hemoglobins in the range of 10-12 mg/dL shows that the drug is able to maintain equivalent efficacy at a reduced cost.

3-113

Category: General Clinical Practice

Title: Impact of a pharmacy-driven venous thromboembolism prophylaxis in hospitalized medical patients

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Purpose: A venous thromboembolism (VTE) prophylaxis assessment and order form was developed at our institution in January of 2009. However, from January 2009 to June 2010, chart audits revealed low compliance with the utilization of this form. The primary objective of this study was to evaluate the impact of a pharmacy-driven VTE prophylaxis in hospitalized medical patients. The secondary objectives were to describe the pharmacists interventions and to calculate the associated cost savings.

Methods: The study was approved by the institutional review board and the need for informed consent was waived. A retrospective medical chart review was conducted on two cohorts of patients: Group 1 (G1) consisted of patients receiving VTE prophylaxis prior to the pharmacists involvement, and Group 2 (G2) consisted of patients receiving VTE prophylaxis post pharmacist involvement. Adult patients (18 years of age or older) receiving subcutaneous low-molecular weight heparin (LMWH) or unfractionated heparin (UFH) on the general medical units were eligible for the study. Patients were identified for enrollment through a pharmacy-generated electronic report. Patients were evaluated for appropriateness of VTE prophylaxis and monitoring on a daily basis as specified on the institutional order form. Demographics, VTE risk factors, and other pertinent patient information were collected. Recommendations to adjust or maintain anticoagulation therapy were then made by the pharmacist in Group 2. Data analysis was performed using descriptive statistics and the Chi-Square test.

Results: Group 1 consisted of 50 patients (27 males, mean age equals 67.6 years and standard deviation equals 15.6 years) evaluated between 7/1/2010 and 10/31/2010. Group 2 consisted of 50 patients (22 males, mean age equals 66.7 years and standard deviation equals 18.6 years) evaluated between 11/1/2010 and 2/28/2011. Risk factor categories for VTE were similar in G1 and G2, respectively: 16 versus 15 high risk, 25 versus 27 moderate risk, and 9 versus 8 low risk. In G1 and G2, VTE prophylaxis was appropriate in 28 versus 38 patients, respectively (p equals 0.0174). Appropriate monitoring of VTE prophylaxis was performed in 38 patients in G1 compared to 48 patients in G2 (p equals 0.002). Patients in both groups had no contraindications to therapy and no adverse drug reactions were reported. In G2, the pharmacist performed 12 interventions pertaining to VTE prophylaxis which consisted of the automatic substitution of LMWH with UFH in patients with renal impairment (creatinine clearance less than 30 milliliters per minute). The associated cost savings for the 50 patients in G2 over a 3 month period was $885.00, calculated based on raw drug costs for the average length of stay of 5 days. With

200 beds on the general medical units at our institution, the estimated cost savings for the year totaled $14,160.00.

Conclusion: This study demonstrates the positive impact of a pharmacy-driven VTE prophylaxis on the prescribing and monitoring of therapy in hospitalized medical patients. The pharmacists interventions also allowed for cost-savings through the automatic substitution of LMWH with UFH in patients with renal impairment.

3-114

Category: General Clinical Practice

Title: Innovative Pharmacist Competency Program at Community Hospitals

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Purpose: The pharmacy profession continues to evolve and shape itself with increasing complexity. With this escalating complexity, pharmacist clinical competence needs to be addressed within each healthcare practice setting. Information on pharmacist competency programs (PCP) are limited currently. The objectives of this study were to describe our unique PCP and evaluate its satisfaction at two community hospitals.

Methods: Long Beach Memorial and Miller Childrens Hospital (LBM-MCH) are tertiary community hospitals with combined 770-licensed beds. Our unique and intensive PCP has been established for over 20 years. We conducted a literature review of PCP to determine the availability of current programs. To ascertain satisfaction and identify areas of educational need, we used Survey Monkey and paper copies in March 2011 to assess pharmacists at our institutions. All analyses were performed using SPSS PASW 19 (SPSS Inc., Chicago, IL).

Results: The PCP at LBM-MCH has a unique structure that focuses on pharmacy-regulated therapies (PRT), which are guidelines for therapeutic monitoring of vancomycin, aminoglycosides, anticoagulation, total parenteral nutrition, and other drugs with narrow therapeutic indices or therapies that warrant close monitoring. There are 15 PRT, and the practice of PRT requires demonstration of aptitude that consist of 80% passing on exams and presentation of 20 patients for each regulated therapies. Other aspects of the PCP encompass modules that are age-related, unit-specific, and hospital-wide. In addition, a newly-implemented Pharmacy Skills Day provides updates on PRT and other practice-related issues, including the medication use process. Among 61 pharmacists, 42 (69%) responded to the survey. Mean age of pharmacists was 3911 (range 27 to 71) years, with 36% male, 86% with residency training, and 12% with board-certified pharmacotherapy specialists. Over 80% of our pharmacists agreed or strongly agreed that our PCP was informative, and helpful in supporting daily responsibilities and activities. When prompted to identify areas for additional education, 79% of pharmacists indicated a need for more continuing education opportunities or modules to develop competency, and 21% indicated that the content should be succinct to optimize competency training.

Conclusion: Pharmacists were receptive of our unique and intense PCP to maintain clinical competency. With demonstration of success, the simulation of our program may be beneficial for other community-based hospitals to enhance and meet the growing demands for current pharmacy practice.

3-115

Category: General Clinical Practice

Title: Analysis of inpatient dispensing near miss events in a municipal hospital in Taiwan

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Purpose: The issue of medication safety has been valued recent years. The purpose of this study was to examine the type of dispensing errors reported by nurses at a municipal Hospital from 2009 to 2010 and to analyze overall medication-related errors.

Methods: Dispensing error reports from the station/ICU nurses in the medication error system were obtained for January 2009 to December 2010. Dispensing errors were tabulated according to the types of errors and severity of error.

Results: During the study period there are 2,387,787 inpatient prescriptions and 132 dispensing errors were reported. Of the 132 cases of medication errors, 123 cases are near miss. Errors included 78 wrong drugs(59.1%), 21 wrong numbers(15.9%), 20 wrong formulations(15.2%), 7 wrong dosages(5.3%), 2 wrong patients(1.5%) and 4 'other' errors. Analysis of the main reasons for wrong drugs, 25 similar name (32.1%), 24 similar appearance (33.3%), 11 similar pharmacological effects(14.1%) and 16 other reasons (20.5%). According to NCC MERP Index for categorizing medication errors, there are 123 case of category B(93.2%), 8 cases of category C (6.1%), and 1 case of category E(0.8%).

Conclusion: These data is published to increase awareness of medication safety, to share learning from these incidents and near misses and to encourage a more open patient safety culture.

3-116

Category: General Clinical Practice

Title: Improving hyperglycemia management of inpatients using a guideline directed order set in a community hospital

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Purpose: Hyperglycemia in hospitalized patients, with or without diabetes, has been linked to poor outcomes. Additionally, several studies have suggested that improving glycemic control of inpatients can lead to improved hospital outcomes. This study was designed to evaluate patients who received insulin via the Hyperglycemia Order Set, to determine if the patients achieved improved blood glucose values and to determine the impact of process improvement initiatives and education for the hospital staff.

Methods: The study was presented to the Institutional Review Board and was approved as an exempt study. A retrospective chart review was conducted during May and June, 2010 of adult patients admitted to the hospital that had been prescribed sliding scale insulin therapy. Subjects were excluded if they were less than 18 years of age. A revised Hyperglycemia Order Set was implemented in January 2011, and several education initiatives followed from January April, 2011. Prospective chart review was completed during January-April, 2011. Patients were identified using the hospital computer system to select for any patient with an order for correction scale insulin during the pre-identified time period. Study subjects were then randomly selected from this list. Data collected included patient demographics, glucose values, and information from the medication administration record.

Results: Eighty-one charts were reviewed during the retrospective review period. The mean age was 68 years (40-91years) and 72% were female. The average hemoglobin A1C for the patients was 7.7% (n=33). Patients received one of four regimens: correction insulin, basal insulin and bolus insulin (CO+BA+BO); correction insulin and basal insulin (CO+BA), correction insulin and 70/30 or 75/25 (CO+70/30), or correction insulin alone (CO). There were a total of 1407 blood glucose (BG) readings with 27 (1.9%) less than 60mg/dL, 773 (55%) with BG 140-180mg/dL, and 487 (35 %) with BG greater than or equal to 180mg/dL. Patients who were ordered the CO+BA+BO regimen had 2.6% of BG readings less than 60mg/dL, and 72.3% were greater than or equal to 140mg/dL. One insulin regimen was adjusted as a result. Patients who were ordered the CO+BA regimen had 1.6% of BG readings less than 60mg/dL and 52.3% were greater than 140mg/dL. Two insulin regimens were adjusted as a result. Of patients who were ordered the CO regimen, 1.5% of the BG readings were less than 60mg/dL, and 48.4% were greater than 140mg/dL. One insulin regimen was adjusted as a result. Amongst all the BG readings that were greater than 140mg/dL, 33.6% of the readings were between 140 180mg/dL and 70.5% were greater than 180mg/dL. Thirty-four charts were reviewed during the prospective period.

The mean age was 65 years (19-94 years) and 56% were female. The average A1C for the patients was 7.1% (n=6). There were a total of 628 blood glucose (BG) readings with five (0.80%) less than 60mg/dL, 227 (36%) with BG 140-180mg/dL, and 318 (51.0%) greater than 180mg/dL. For patients who were ordered CO+70/30 regimen, 0.16% of BG readings were less than 60mg/dL and 1.1 % were greater than or equal to 140mg/dL. Two insulin regimens were adjusted as a result. For patients who were ordered the CO regimen, 0.64% of the BG readings were less than 60mg/dL, and 34% were greater than 140mg/dL. One insulin regimen was adjusted as a result. Amongst all the BG readings that were greater than 140mg/dL, 36% of the readings were between 140 180mg/dL and 51% were greater than 180mg/dL.

Conclusion: Management of hyperglycemia amongst inpatients at a community hospital revealed deficiencies in process and outcome. A revised order set has been implemented. Education for the physicians, nurses, and pharmacists on the importance of rapid acting insulin with meals, basal insulin, correction insulin, and daily insulin adjustments in response to hyperglycemia has been conducted and is ongoing.

3-117

Category: General Clinical Practice

Title: Retrospective review of pharmacologic treatment for alcoholic hepatitis and adherence to the American Association for the Study of Liver Diseases (AASLD) guidelines for alcoholic liver disease

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Purpose: Nonpharmacological interventions for the treatment of acute alcoholic hepatitis (AH), including abstinence and nutrition therapy, are well established therapies. Pharmacological methods of treatment have been controversial and are reserved for patients with poorer prognosis [i.e., Maddrey discriminant function (MDF) score greater than or equal to 32 with or without hepatic encephalopathy; or Model for end stage liver disease (MELD) score greater than or equal to 18]. Historically, corticosteroids have been the standard therapy for AH, but clinicians are often hesitant to use corticosteroids in patients with commonly seen comorbidities such as active infection, renal insufficiency, or gastrointestinal bleeding. In the last decade, pentoxifylline (PTX) has gained popularity for treating AH. Although both therapies are effective, PTX has added benefit in preventing the development of hepatorenal syndrome (HRS), a complication associated with mortality in patients with AH. Despite the potential benefits, current guidelines recommend PTX only for patients with early renal failure or contraindications to corticosteroids. The purpose of this study is to describe the prescribing patterns for treatment of AH within a large healthcare network.

Methods: The institutional review board and the clinical research steering committee approved this retrospective study. This study is a retrospective medical chart review of adult patients aged 18 to 89 years treated for AH with corticosteroids or PTX at the Seton Family of Hospitals between January 1, 2006 and December 31, 2010. The research population was identified by a computer generated report documenting dispensed orders for corticosteroids or PTX for the treatment of AH. The following data was extracted from the electronic medical chart: demographic information, diagnostic criteria for AH, baseline and routine clinical laboratory values, pharmacologic treatment and dose, adverse events, and clinical status and/or death. The primary outcome measures were incidence of prescribing corticosteroids or PTX for AH and the baseline characteristics of patients at the time of prescribing. Secondary outcomes were to evaluate the appropriateness of therapy and adherence to 2010 AASLD guidelines for alcoholic liver disease. Descriptive statistics were used to analyze baseline characteristics and study data.

Results: Over the five-year study period, 145 patients were treated for AH. Eighty-eight patients (61 percent) were treated with PTX, 41 patients (28 percent) were treated with corticosteroids, and 16 patients (11 percent) were prescribed both PTX and corticosteroids. The corticosteroids prescribed were

prednisolone, prednisone, and methylprednisolone. The mean MDF score of all patients treated was 47.2 (range, -4.12 to 117.9) and the mean MELD score of all patients treated was 24.8 (range, 7.1 to 49.3). The mean MDF score was 47.4, 45.6, and 50.2 for the PTX, corticosteroids, and combination treatment groups, respectively. The combination group had the highest mean MDF, MELD, serum creatinine, and bilirubin. Therapy was defined as inappropriate when patients did not meet MELD or MDF criteria for pharmacotherapy (n equals 16); patients had no indication for PTX and should have received prednisolone (n equals 20); patients received corticosteroids and should have received PTX because of renal insufficiency (n equals 5); patients received the wrong corticosteroid (n equals 14); patients received the wrong dose of either corticosteroids or PTX (n equals 13); patients received combination therapy (n equals 16); and patients had concomitant cirrhosis (n equals 119). The average length of stay was 6.2 days (range, 1 to 30 days). In-hospital mortality was 13 percent with PTX having the lowest percentage of death (10 percent). Sixty-three percent of total deaths were attributed to HRS, with PTX having a lower percentage of deaths related to HRS (44 percent) compared to corticosteroids (83 percent).

Conclusion: Before PTX was incorporated into the 2010 AASLD guidelines, patients at the Seton Family of Hospitals were prescribed PTX more frequently than corticosteroids for AH. Most patients (89 percent) met MELD or MDF criteria for initiating pharmacotherapy and the most common reason for inappropriate therapy was concomitant cirrhosis. Patients with AH and underlying cirrhosis have been excluded from most clinical trials, but 82 percent of our study population had documented cirrhosis and received pharmacotherapy. This subpopulation requires additional research. Accurate assessment of efficacy and mortality in individual treatment groups is limited by the inability to follow all patients through completion of a 28-day course of treatment. There is a need to educate clinicians on the appropriate use of pharmacologic treatment for AH based on clinical trials and AASLD recommendations.

3-118

Category: Geriatrics

Title: Impact of vitamin d supplementation on community living center fall rates in a rural veteran's affairs hospital: a retrospective chart review

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Purpose: To evaluate fall rates in patients receiving vitamin D supplementation (at any dose) versus those who are not. The study will also assess the use of other Medications Associated with Falls (MAF). The primary endpoint will be to determine if vitamin D supplementation reduced fall rates in Community Living Center (CLC) patients. Secondarily, MAF will be assessed to evaluate their contribution toward fall rates.

Methods: A retrospective chart review was performed to evaluate the use of vitamin D supplementation to reduce falls over a one year time period (07/1/2009-07/1/2010) CLC in patients. The assessment of MAF over the same time period was also reviewed. Classes of MAF to be assessed include: antidepressants (selective serotonin re-uptake inhibitors (SSRIs) and tricyclic antidepressants (TCAs)), psychotropics, sedatives, hypnotics, benzodiazepines, neuroleptics, anticonvulsants, class IA antiarrhythmics, antihypertensives, non-steroidal anti-inflammatory drugs (NSAID), diuretics, and narcotics. Charts reviewed were those of patients residing in the VA BHHCS CLC for at least 90 days during the time period stated above.

Results: Fifty patients met inclusion criteria with a total of 63 falls occurring during the study period. Fifteen out of fifty patients were on vitamin D at some time during the study period. Five patients on vitamin D did not have a fall, one patient did fall. The other nine patients were placed on vitamin D after they had experienced a fall. Sixty-seven percent of patients who were not on vitamin D supplementation at any time during the study period had a fall. The difference between the two groups was not found to be statistically significant. One patient was not on any MAF and did not experience a fall. Twenty-four (48%) patients on a MAF experienced a fall during the study period. A very small correlation was found between vitamin D supplementation and falls. The very small negative Phi correlation (-0.171) found between vitamin D supplementation and falls showed an inverse relationship. Therefore, the more vitamin D supplementation a person had the less likely they were to fall however; this correlation is not powerful enough to base any recommendations upon.

Conclusion: There is no true association with vitamin D supplementation and a decreased fall risk which can be made from these results. There was however a slight negative correlation between the two variables. A larger study population is needed to assess any true relationship.

3-119

Category: Geriatrics

Title: Evaluation of the management of persistent pain in older adults admitted to a tertiary care teaching hospital before and after prescriber education on the American Geriatric Society (AGS) 2009 recommendation

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Purpose: The American Geriatric society (AGS) has published guidelines regarding the pharmacological management of persistent pain in older persons. A major change from the previously published guideline, this updated guideline encourages prescribers to consider opioid therapy in all patients experiencing moderate to severe pain and advises the use of non-steroidal anti-inflammatory agents (NSAIDs) and cyclooxygenase-2 (COX-2) selective inhibitors only in rare instances. The purpose of this study is to evaluate the pharmacological management of persistent pain in older adults admitted to a tertiary care teaching hospital before and after healthcare provider education on the newest AGS 2009 recommendation.

Methods: This study was approved by the institutional review board. The study consisted of two phases of retrospective review and an educational phase. A total of 50 patients over age 65 were reviewed in each phase. Patients were included if treated for conditions known to be associated with persistent pain (e.g. arthritis, diabetic neuropathy, skin ulcers). Patients with a diagnosis of cancer, or those who experienced a recent trauma or surgical procedure within 3 months prior to admission were excluded. During the educational phase, healthcare providers learned of the new AGS guidelines via seminars and in-services as well as the distribution of educational material. Educational seminars and material were focused on addressing specific shortfalls in our practice identified during phase I of this study. A main database was created to record information regarding patient demographics, pain assessment, specific analgesics used, presence of prophylactic regimens to prevent NSAID induced ulcers or opioid-induced constipation, as well as the presence of opioid-induced adverse effects, specifically constipation and respiratory depression. All data was recorded and analyzed anonymously.

Results: The demographic profile was comparable in the two groups. The most common types of pain treated were musculoskeletal disorders and skin ulcer. Following the educational phase, there was a 71% (P less than 0.001) improvement in the appropriate use of pain assessment tools in cognitively impaired older adults. There was a trend towards improvement in the appropriate use of NSAIDs and COX-2 selective inhibitors, specifically in patients with gastrointestinal disorders. There was no change in

practice in the frequency of opioid use, combining long acting and short acting opioid preparations, or preventing opioid-induced constipation.

Conclusion: Although findings from this study have aided in recognizing specific areas needing improvement in the management of persistent pain in older adults; further education is still warranted to ensure the safe and effective management of persistent pain in the older adult population.

3-120

Category: Geriatrics

Title: Effectiveness of A Medication Use Safety Training Program for Seniors in Community from 2010 to 2011

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Purpose: The twenty-first century is the century of the aged. According to statistics compiled by the Ministry of the Interior in Taiwan, there were 7 percent of Taiwan's total population are elderly people. In response to the growing number of elderly people, the Medication Use Safety Training (MUST) program for seniors is designed to promote awareness of medication safety in elderly.

Methods: Pharmacists from municipal hospitals cooperate with community pharmacists in Taipei to conduct the campaign. The educational campaign talk about safe and appropriate medicine use, how to avoid medication misuse, the way to recognize and manage common side effects, and improve medicine use knowledge, attitudes, and skills to avoid medication errors in seniors. Participants were requested to fill in a questionnaire and the same quiz before and after the campaign. Improvement of medication use safety awareness is defined by the increase in scores from the quiz.

Results: There were 58 awareness campaigns for community held during the period from 2010 January to 2011 June, and 1,396 citizens participated. Among the 1,396 participants, 831 valid questionnaires were collected. The respondents mean age was 63.3 years and 67.9% were female. The majority of education level were high school degree or above (54.2%).Most of them are retired (31.6%). Compare the scores from the quiz before and after the awareness campaign, the average scores has increased from 86.8 to 95.6 points.

Conclusion: The MUST program had a positive impact on the awareness of medication safety in seniors. It is suggested to have more campaigns to publicize how to improve medicine use knowledge, attitudes, and skills to avoid medication errors for the seniors in community.

3-121

Category: Geriatrics

Title: Occurrence of duodenal ulcer associated with formulary interchange of donepezil to galantamine: a case report

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Purpose: 78-year old male patient presented to the emergency department reporting mild epigastric pain and two episodes of melenic stools four months after he was converted from donepzil to galantamine. Gastrointestinal hemorrhage is a known risk of cholinesterase inhibitor use, however, previous post-marketing surveillance and case reports only implicate the cholinesterase inhibitors donepezil and rivastigmine. This is the first case report, to our knowledge, that possibly implicates galantamine and highlights the risk of formulary interchange with these agents. The patient's medical history was significant only for Alzheimer's disease. Significant medications included aspirin enteric coated 81mg daily and galantamine SA 16mg daily. Recent changes in medical status were significant only for upper respiratory tract infection two weeks prior to presentation. The patient had been initiated on donepezil for Alzheimer's disease eleven months earlier and had been maintained on donepezil 10mg daily for six months. Four months prior to the event, donepezil was switched to galantamine SA 16mg daily per formulary interchange. The patient's wife administered the galantamine once daily in the morning for one month before reporting that the patient was 'lethargic', that 'self initiation' had decreased, and the patient had suffered a fall. As a result, the medication was switched to evening dosing and report one month later was improved. One month later, the patient was admitted to the inpatient medicine ward with an upper respiratory tract infection, treated empirically with azithromycin and cefpodoxime then discharged home on hospital day two. Discharge medications included a total five day course of azithromycin and ten day course of cefpodoxime. Ten days later, the patient reported 'jet black, tarry stools' to his primary care physician via telephone and was instructed to report to the emergency department with a stool sample. On admission, the patient was orthostatic, anemic, and stool samples were guaiac positive. The patient's hematocrit had decreased from 39.6 percent ten days prior to a nadir of 29 percent. Galantamine was discontinued; the patient was given fluids and an intravenous proton pump inhibitor. Hematocrit stabilized and no further episodes of melena were reported. Esophagogastroduodenoscopy revealed a non-bleeding, duodenal bulb ulcer of 6-7mm without bleeding stigmata. Biopsy revealed severe chronic gastritis with minimal activity and intestinal metaplasia. A Giemsa stain was positive for H.pylori and the patient was started on antibiotic and proton pump inhibitor therapy. The patient was discharged on hospital day three. Seven weeks later, the patient's hematocrit improved to 38.1 percent. As the patient's wife reported significant decline in memory with discontinuation of cholinesterase inhibitor, the primary care physician restarted the previously tolerated donepezil at 10mg daily. At time of report, there have been no further episodes. With a Narajno score of 4, this case report possibly implicates galantamine as a causative factor in gastrointestinal hemorrhage, based on previous reports implicating donepezil or rivastigmine.

Clinicians should not only be aware of risks for gastrointestinal adverse effects of cholinesterase inhibitors, but also continue to monitor for these risks in the event of within-class substitutions.

Methods: N/A

Results: N/A

Conclusion: N/A

3-122

Category: Herbals / Alternative Medicines

Title: Adjuvant effect of traditional herbal diet for pain management in terminal cancer patients

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Purpose: In addition to modern medicinal therapy, many cancer patients in Taiwan are treated regularly with herbal medicines or prescribed a traditional herbal diet. This study was to evaluate the effect of a Taiwanese traditional herbal diet (TTHD) comprised on Shao-Yao-Gan-Cao-Tang (SYGCT) on pain management in terminal cancer patients.

Methods: 2,466 terminal cancer patients were included and randomly divided into three groups for the study. The treatment group were given the traditional herbal diet which consisted of SYGCT and a Taiwanese tonic vegetable soup. The remaining patients were divided into a reference group (given the regular hospital diet) and a control group (given the Taiwanese tonic vegetable soup without analgesic herbs). All patients maintained their assigned diets for one week. Administration of their regular medications was unaltered. A verbal numerical questionnaire was used to assess pain.

Results: The reference group patients reported a reductions in pain scale from 54.60.72 on day 3 to 52.50.75 on day 10 ($p < 0.05$). Patients in the control group reported an improvement in pain levels from 54.70.99 on day 3 to 52.00.88 on day 10 ($p < 0.05$). The TTHD group reported initial pain levels of 53.00.65 on day 3 which decreased to 50.00.54 on day 10 ($p < 0.001$). Patients in the reference group experienced pain amelioration of 2.1. Patients in the control group reported an improvement in pain scale of 2.7. Patients in the TTHD group reported a significant improvement in pain scale of 3.0 which was significantly different than the reference and control groups ($p < 0.05$).

Conclusion: TTHD could alleviate the pain among terminal cancer patients thereby supporting the supposition that Eastern and Western medicines can be effectively co-administered to enhance terminal patients quality of life. Further research is warranted.

3-123

Category: Home Care

Title: Applying lean sigma methodology to improve efficiency and medication safety

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Purpose: The demand for infusion drug preparation in our production pharmacy is growing, leading to increased pressure and stress on staff, longer work hours, and the potential for medication errors. In order to improve staff satisfaction and medication safety with increasing workload, we applied the Lean Sigma Methodology to evaluate efficiency and related safety in our production pharmacy.

Methods: We employed the lean methodology to remove process waste and establish improved flow for increased efficiency. An outside facilitator led a cross-functional team comprised of various front-line and management pharmacy staff to learn and apply the concepts. We divided the project into two phases with Phase I focusing on the clinical teams (the front-end) and Phase IIA and B on the production team (the back-end). Our project goal is to decrease lead time by 25% for both compounded and non-compounded drugs. The projected benefits are to improve patient and staff satisfaction, to enhance medication safety by reducing potential for error, and to increase staffs ability to handle increased volume. After establishment of a project charter, a process map, value stream map and spaghetti diagram were created to capture baseline data.

Results: Phase I revealed that the layout of the area for the clinical teams was suboptimal for efficient flow and communication with the production staff. This resulted in delays to begin drug compounding. A new layout with communication tools resulted in a 55% reduction in distance traveled and a 29% and 38% reduction in lead time for compounded and non-compounded drugs respectively. Phase IIA revealed that Key process barriers included insufficient space for drug storage, a lack of visual management, and an inefficient layout. The team redesigned the production area which, within the footprint of the existing space, increased storage capacity by 110% and reduced distance traveled by 49%. Visual management tools were established to remove the guesswork out of the process as to what needed to be done at a point in time. Phase IIB focused on process improvement of workflow. Additional interventions were implemented to complete the process and paced production to create a pull system. These interventions included kanban, hijunka bin, line of sight, intercom system, additional clean room pass-thru windows, production counters modification, and delivery ticket window relocation. With the completion of phase II interventions, the lead time will be re-measured in thirty days and we are confident that the project will meet goal and deliver sustained results.

Conclusion: The lean sigma methodology is a useful tool to evaluate and identify current pharmacy workflow inefficiency, to remove process waste, to reduce lead time, and to improve medication safety.

3-124

Category: I.V. Therapy / Infusion Devices

Title: Simple method to sustain improvements: kamishibai IV process card audit

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Purpose: As difficult as it is to make improvements no matter what method is used, sustaining those improvements often represent a bigger challenge. Our department began a lean transformation journey in 2007 and quickly realized this challenge. Many methods can be used to ensure sustainment but can often be cumbersome and difficult to maintain.

Methods: Kamishibai (telling a story with pictures) is one tool that can be used to help with sustainment. It is a simple and standard check tool that ensures required checks are prompted and completed in a timely manner. It makes checks and status visual. They can be used to focus on adherence to standardized work, maintenance of accurate documentation, and other processes. Each process will have set of audit cards detailing the standard work checks that must be made. The cards are double sided and color coded green on one side and red on the other. Each card clearly outlines what process is being audited. The auditor picks out a card at random and completes the checks. If all checks meet criteria the card is placed with green side showing. If one check does not meet the criteria the card is placed with red side showing and the concern is logged onto the sign off sheet. We used this process to ensure improvements for our IV processes. The cards are displayed on a magnetic board in the main IV work area. The kamishibai process cards are used to ensure sustainment with our IV processes focusing on garbing, hand hygiene, batch documentation, and cleaning. The IV room and the supervisor completed one audit card daily. The area manager reviewed periodically.

Results: Our initial kamishibai IV process card audit revealed no issues with proper garbing or hand hygiene but issues with sustaining proper cleaning and batch documentation. After implementing this audit we were able to show 100% sustainment in all of these areas within one month. This system works because it makes the process status immediately visible, allowing all to see the results.

Conclusion: Using kamishibai process card audit is easy to start and requires minimal training. The system prompts checks to ensure 100% completion. The results are visual and displayed in real time. It can be applied to any area and any level within an organization. Like any system it requires discipline to be effective. This process has demonstrated an easy visual method to ensure sustainment for IV process improvements.

3-125

Category: I.V. Therapy / Infusion Devices

Title: Safety and tolerability of immune globulin intravenous (human), 10% liquid at high infusion rate in patients with secondary immunodeficiency

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Purpose: The object of this study was to assess the safety and tolerability of Privigen (immune globulin intravenous (human), 10% liquid), when administered at a high infusion rate of 7.2 ml/kgBW/h in patients with secondary immunodeficiency.

Methods: The protocol for this single center study was approved by the institutional review board and all patients signed informed consent forms. Patients with secondary immunodeficiency due to hematological neoplasia were administered Privigen (0.2 g/kg body weight) every 4 weeks at a rate of 0.3 ml/kg/h for the first 30 min and 0.6 ml/kg/h for the following 30 min if well tolerated. After this initial 60 minute period, the rate was then increased to 2.4 ml/kg/h for the first infusion, 4.8 ml/kg/h for the second, and 7.2 ml/kg/h for the third and all following infusions. No premedication was given. The main endpoint was the incidence of temporally-associated adverse events occurring during or within several hours after the end of infusion, including all grades of toxicity, graduated according to CTCAE criteria. Serum immunoglobulin (Ig) and creatinine levels were measured. P-values of medians were calculated using the Mann-Whitney-Wilcoxon U-Test.

Results: A total of 80 infusions at the highest rate were given in 14 patients at 0.2 g/kgBW every 4 weeks. Median IgG levels increased from 1.0 g/L at the start of the first infusion to 4.6 g/L, 7.4 g/L, and 6.2 g/L at the start of the third, 6th and 9th infusion, respectively. There was no change of the median serum creatinine level during therapy. There was only one patient with mild chills, fever and hypertension, all grade I according to CTCAE criteria, occurring during the 6th cycle. All other applications at the highest infusion rate were well tolerated without any premedication.

Conclusion: 4-weekly administration of Privigen at 0.2 g/kg BW at an infusion rate of 7.2 ml/kgBW/h is safe and well tolerated.

3-126

Category: I.V. Therapy / Infusion Devices

Title: Compatibility study of intravenous immunoglobulin in plastic container bags

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Purpose: To adjust intravenous immunoglobulin (IVIG) dosage to the therapeutic requirements of each patient, transferring the content of several flasks of product into a single container could be needed. In this work we evaluated whether any biochemical, chemical or biological alteration occur after transferring 10 percent IVIG from their original containers into plastic container bags. Similarly, the stability of these new preparations was also studied at different temperatures to cover the required interval between preparation and administration to the patient

Methods: Two lots of 10 percent IVIG (a liquid preparation) were analyzed, which were transferred into polypropylene bags at a rate of 40 ml of immunoglobulin solution per 100 ml bag, in order to simulate the worst case condition with regard to contact surface area/volume ratio. The samples were subjected to a temperature of 5, 30 centigrade degrees /65 percent relative humidity (RH) or 40 centigrade degrees/25 percent RH for a period of 15 days evaluating, among others, the appearance of solution, turbidity, pH, osmolality, total protein (Bradford), molecular distribution (HPLC), anticomplementary activity (ACA, hemolytic test), prekallikrein activator (PKA, chromogenic assay), anti-hepatitis B activity (ELISA), anti-polyovirus type I titre (neutralisation), Irganox and BHT (HPLC), safety (intraperitoneal injection to guinea pigs and mice) and pyrogens (injection to rabbits).

Results: The tested parameters, before and after transferring the IVIG solution into plastic bags, did not show relevant variations. The HPLC profile of the product was similar and no variations occured in ACA results, besides, no PKA was detected (lower than 2 IU/ml). No loss of activity against Hepatitis B virus and poliovirus type I occured either. The results obtained after 15 days of storage at 5 and 30 centigrade degree did not show alterations for any parameter. The plastic bag additives content (Irganox and BHT) were not detected in any case before and after plastic contact (lower than 2.5 mcg/ml). The weight of the product-plastic container system slightly decreased at 30 centigrade degree over time (loss of 0.4 percent after 15 days). After 15 days at 40 centigrade degree, only the loss of weight was slightly higher (1.5 percent) while the rest of the product characteristics remain unchanged.

Conclusion: Taking into account that the product should be sterile when dosed with an appropriate system, 10 percent IGIV filled in polypropylene bags does not show any sign of alteration in the parameters studied after 15 days at 5 and 30 centigrade degree.

3-127

Category: I.V. Therapy / Infusion Devices

Title: Clean room floor cleaning

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Purpose: Following implementation of a USP <797> compliant clean room in October 2007, pharmacy clean room personnel assumed most required cleaning activities. However, hospital environmental services personnel were responsible for daily floor cleaning on third shift. Since the personnel completing this task did not report to pharmacy, we had little ability to train or manage their performance and no control over who was assigned to the task. We were also unable to control the materials and cleaning agents used. To address these cleaning deficiencies and to get clean floors we implemented an alternative cleaning process managed by pharmacy personnel.

Methods: Workflow was evaluated to determine the best time of day for floor cleaning on first or second shift. Technical staff were selected to pilot and run the program. Position duties were evaluated to determine who on each shift would be responsible for floor cleaning. We evaluated traditional wet mopping methods and equipment and several commercially available steam mops for ease of use and effectiveness at cleaning our floors.

Results: Initially we determined that most of the floor cleaning would be done by second shift technicians because workflow on second shift allowed a long enough period to complete the task while compounding was not being done. Following a change in scheduled patient-specific batches, cleaning was moved to first shift. Sections to be cleaned are delegated by the lead technician on a daily basis. Traditional wet mopping presents several challenges especially for a large clean room. Water-based methods are difficult to manage because of the weight of the water and large mop buckets and accessibility of appropriate facilities to empty, clean, and refill buckets without having to lift a heavy water-filled bucket. Cleaning and drying time can be prolonged which presents interruptions in compounding ability and potential safety risks due to wet floors. Water-based methods require personnel to mix the correct cleaning agents appropriately. Some cleaning agents require additional personnel protective equipment. It is also necessary to maintain a supply of clean non-shedding mop heads. Direct application cleaners in combination with a dry flat mop head are easier to use but leave residue on the floors. Steam mops use plain water to produce high temperature steam that is applied to the surface being cleaned by a microfiber mop cover. The steam mops evaluated were effective at removing visible dirt including adhesives from the floors. The microfiber material seems effective at holding on to the dirt picked up. No film remains on the floor and the thin layer of water dries quickly. Other factors evaluated were cost per unit, cost of disposables, weight, ease of use, and electrical cord

length. For general floor cleaning we purchased several units of a commonly available steam mop. We elected to use sterile water for irrigation that is changed daily. These units are light weight and easy to operate. The electrical cord is long enough to allow a cleaning range of approximately 700 square feet without changing outlets. We also purchased a more specialized unit that we use for harder to clean areas such as corners and tight spaces. This unit is versatile, but heavier and has a shorter electrical cord.

Conclusion: Clean room floor cleaning is better done by pharmacy personnel who understand the requirements and are motivated to maintain their clean room. Use of commercially available steam mops is an environmentally friendly, effective, easy, and fun method for daily cleaning of clean room floors. The floors are visibly cleaner and the technical staff take pride and ownership for the maintenance of their work area.

3-128

Category: I.V. Therapy / Infusion Devices

Title: Quantitative evaluation of syringe accuracy

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Purpose: The International Organization for Standardization (ISO) defines standards for the maximum allowable error according to the capacity of the syringe and the volume aspirated. For most standard syringe sizes and aspirated volumes above 0.2 ml, syringes are required to be volumetrically accurate to plus or minus 5 percent. Volumes below 0.2 ml measured in 1 ml or smaller syringes may be less accurate. The purpose of this pilot study was to evaluate the accuracy of volumetric measurement in the Becton-Dickinson syringes typically used at our institution.

Methods: Volume was measured by weighing an empty syringe, drawing the specified volume of water into the syringe using a dispensing pin, then weighing the same syringe. A Mettler-Toledo precision electronic balance was used to measure all weights. Ten unique syringes were evaluated for each condition. Two conditions were assessed for each syringe size: first with a fill volume half or less of the nominal volume and second with a fill volume of more than half the nominal volume. Following the initial analysis, we evaluated delivered volume for 1 and 3 ml syringes by drawing the specified volume of water into the syringe using a needle, and then expelling the fluid through the needle into an empty container using the tare function on the balance. For each sample the weight of the water was calculated. The percent variation from the expected weight of the water was calculated assuming a specific gravity of 1 gm/ml. The mean and standard deviation of variance for each series were calculated.

Results: The original methodology for 1 and 3 ml syringes resulted in mean variances greater than 5 percent for two conditions (0.5 ml fill in a 1 ml syringe and 1 ml fill in a 3 ml syringe). Consequently, all conditions with 1 and 3 ml syringes were repeated using the delivered volume methodology. The delivered volume measurements resulted in mean variances below 2 percent with the range for each series within plus or minus 3 percent. The 2 ml fill in a 5 ml syringe had the highest mean variance at 3.3 percent with one sample exceeding the specification at +6.5 percent. All other conditions with 5, 10, 20, and 60 ml syringes demonstrated ranges within plus or minus 3 percent. Most of the conditions had a negative mean variance. A 10 ml volume was measured in 10, 20, and 60 ml syringes. Of these conditions, the 20 ml syringe had the lowest percent variance at -0.951 percent.

Conclusion: Based on this pilot study, volumetric accuracy of syringes used in our institution was better than the plus or minus 5 percent specification.

3-129

Category: I.V. Therapy / Infusion Devices

Title: Compounded sterile preparation competency assessment program

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Purpose: Compounding sterile products is a critical function. Due to patient safety and regulatory concerns it is important that all staff demonstrate competency prior to compounding any sterile products for patient use. It is necessary to demonstrate competency on an annual basis. It is also critical to ensure the documentation for compounded sterile preparation (CSP) competency is complete, concise, and readily retrievable.

Methods: Initial CSP staff training consists of a formal didactic training program that includes commercially available training products, one-on-one experiential training with IV area supervisor, policy and procedure review, skills assessment checklists, and written exams. After successful completion of the didactic program the competency assessment program begins. The IV area supervisor assesses each employee using observation checklists for hand hygiene/garbing and aseptic technique, fingertip samples, and a media fill process. The supervisor observes the employee for hand hygiene/garbing and conducts fingertip sampling using microbial growth media at defined points in the process as outlined in the observation checklist. The assessment then moves to the compounding room using an aseptic technique observation checklist. The employee follows details instructions a preparing a media fill using tryptic soy broth. Additional fingertip samples are taken at the end of the media fill process. Results are documented on the checklists. The samples are incubated per standard procedures. The results of the fingertip samples and media fill are recorded and noted on the bottom of the observational checklists. The annual CSP competency assessment is done in conjunction with the pharmacy departments annual skills day. Each pharmacy employee that compounds sterile preparations completes an on-line CSP exam and repeats the assessment steps noted above for initial training (observation checklists for hand hygiene/garbing and aseptic technique, fingertip samples, and a media fill process) with a selected group of staff trained to conduct the assessment. Results are documented as noted above for initial assessment. If any staff fails the assessment they are removed from CSP assignments and receive additional training. No employee prepares CSP until successful completion of the CSP assessment.

Results: Initial assessments are conducted with employees new to CSP assignments throughout the year by the IV supervisor. The annual CSP competency assessment for 2010 was completed in November for 115 pharmacy employees. The IV supervisor trained a group of 5 supervisors to assist with the annual

competency assessments to ensure timely completion. A summary page was completed for each employee and placed in their employee file noting all assessment steps.

Conclusion: By implementing a standardized process the pharmacy department has successfully documented initial and annual CSP assessment for pharmacy staff. Documentation was streamlined by using the observation checklists to record fingertip and media fill sample results. The summary sheet and observation checklists are placed in each CSP employee file ensuring the CSP competency documentation is complete, concise, and readily retrievable.

3-130

Category: Infectious Diseases

Title: Antiretroviral therapy medication reconciliation for hospital admissions of clinic patients

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Purpose: Medication reconciliation continues to be an area of focus as highlighted by the Joint Commission National Patient Safety Goal. This issue is especially challenging in patients with human immunodeficiency virus (HIV) on antiretroviral therapy (ART) due to the complexity of regimens. Currently at Jersey City Medical Center, medication reconciliation is routinely performed by the admitting nurse. However, pharmacists have a unique role in identifying medication related errors and providing timely interventions. This project aimed to implement a service to enhance the medication reconciliation process for antiretroviral therapy medications for hospitalized patients routinely followed by the outpatient HIV clinic.

Methods: A need for improvement in ART medication reconciliation for HIV patients was identified previously by Pharmacy and infectious disease physicians. Beginning February 2010, a specific process was implemented between the hospital outpatient HIV clinic and pharmacy to ensure the appropriate continuation of ART in these patients upon admission. The designated clinical pharmacist was notified by the clinic whenever a HIV clinic patient was admitted to the hospital. The clinic medication records were communicated to the pharmacist to perform ART medication reconciliation. Prescribers were notified of any ART drug omissions, dosing or frequency errors, and drug drug interactions. Medication issues that could not be resolved based on available information were deferred to infectious disease attending or clinic personnel, and appropriate recommendations were subsequently made. All medication reconciliations and clinical interventions were documented by the clinical pharmacists. All relevant data were collected and periodically reported to hospital Pharmacy and Therapeutics Committee.

Results: Medication reconciliation was performed for 195 admissions from February 2010 thru April 2011. Twenty one admissions were deemed as reasonable treatment interruptions (RTI) based on prescriber's clinical assessment and documentation. The remaining 174 admissions were broken down by the following categories: patient care unit, prescriber or admitting physician's area of practice, and number of drugs constituting a correct regimen. One hundred and four admissions had ART correctly prescribed (60%). ART drug omissions were found in 41 admissions, and incorrect dosing or frequency

errors were found in 38 admissions. Sixteen major drug drug interactions were noted. A total of 81 pharmacy interventions were documented, and 66 (81%) of those were accepted by prescribers.

Conclusion: Pharmacist collaboration with key stakeholders has improved medication reconciliation of ART medications. This project will continue to be an ongoing service provided to hospitalized patients routinely followed by the outpatient HIV clinic.

3-131

Category: Infectious Diseases

Title: Potential impact of PCR-based rapid identification of coagulase negative staphylococci on reducing vancomycin consumption

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Purpose: Since 1997, methicillin-resistant Staphylococcus aureus (MRSA) rates at UAB Hospital have increased from 28% to 58% of total S. aureus isolates. This shift coincides with an increase in vancomycin usage over the same time period from an average 120 days of therapy (DOT)/1,000 patient days to 170 DOT/1,000 patient days. With increasing rates of MRSA, stewardship initiatives aimed at reducing inappropriate usage of this agent are becoming increasingly important. A potential target for reducing vancomycin usage is in the setting of blood culture contamination. The purpose of this project is to assess the impact of polymerase chain reaction (PCR)-based rapid identification of gram positive blood cultures on vancomycin DOT.

Methods: The antimicrobial stewardship intervention occurred between December 17th, 2010 and March 10th, 2011. Patients evaluated include those with positive blood cultures identified through the GeneXpert System as not being S. aureus. Patients with concurrent active vancomycin orders were identified using MedMined reports. Patient cases warranting a high suspicion for blood culture contamination were presented to infectious disease faculty. Reductions in DOT were calculated for the 10 months before and the 10 months after Cepheid GeneXpert initiation.

Results: A decrease of 15 DOT/1,000 patient days was observed in the 10 months following Cepheid GeneXpert implementation. During the antimicrobial stewardship intervention, 173 patients with Cepheid results were identified. Eighteen patients with MRSA and 12 patients with S. aureus awaiting sensitivities were excluded from stewardship intervention. Of the 143 patients remaining, 101 patients did not qualify for evaluation; this was primarily due to being emergency department patients that were not admitted, those receiving one-time doses of vancomycin, or vancomycin never being ordered. The 42 evaluated patients had an average duration of therapy of 9 days. Ten patients had their vancomycin discontinued by their primary medical team in the 24 hours following Cepheid results. Infectious disease (ID) consult recommended continuing therapy for 8 patients and recommended discontinuing therapy for 3 patients. The primary medical teams accepted all ID consult recommendations. Antimicrobial stewardship recommended 10 patients continue vancomycin and 11 patients discontinue therapy. Seven of the recommendations to discontinue therapy were accepted and 4 were continued despite the high suspicion of blood culture contamination.

Conclusion: While it did result in a modest decrease of 15 DOT/1,000 patient days since its implementation, further reductions will likely involve additional education of housestaff and the implementation of automatic stop times for empiric vancomycin therapy.

3-132

Category: Infectious Diseases

Title: Retrospective analysis of community-onset versus health care-onset Clostridium difficile infection

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Purpose: Clostridium difficile infections (CDI) have increased in both frequency and severity over the past decade. Although these infections are most often associated with institutionalized patients recently exposed to antibiotics, several reports have noted an increased onset of symptoms in the community involving younger patients that lack traditional risk factors. The primary objectives of this study were to determine the incidence of community onset (CO)-CDI and assess patient demographics, risk factors, and clinical outcomes as compared to health-care onset (HCO)-CDI at our institution.

Methods: A single center, retrospective study was conducted at a 615-bed community teaching hospital in Oklahoma City, OK. The study protocol was approved by the hospital's institutional review board. Microbiology laboratory computer records were used to identify all adult patients with positive Clostridium difficile stool toxin assays from June 2010 through May 2011. Medical records were obtained and patients were categorized as having CO- or HCO-CDI. CO cases were defined as patients with a positive toxin assay within 48 hours of admission and no hospitalizations or stay at an extended care facility (nursing home, health-care facility, etc) within 30 days prior to detection. HCO cases were defined as patients with a positive toxin assay occurring >48 hours after admission or any patient that presented from an extended care facility. Pertinent data collected and compared between groups included patient demographics, comorbidities, previous antibiotic use, previous proton pump inhibitor (PPI) or histamine-2 (H2) receptor blocker use, immunosuppression, severity of infection, length of stay, and recurrence of infection.

Results: Of the 72 patients that tested positive for CDI during the study period, 14 (19.4%) had CO-CDI and 58 (80.6%) had HCO-CDI. The average patient age was similar between CO and HCO groups (66.1 years versus 65.3 years, P equals 0.85). CO cases were more commonly female, although this was not found to be statistically significant (64.3% versus 51.7%, P equals 0.069). HCO cases were significantly more likely to be Caucasian (84.5% versus 57.1%, P equals 0.024) and have recent antibiotic exposure (93.1% versus 71.4%, P equals 0.021) than patients with CO-CDI. All other patient demographics, comorbidities, and risk factors were similar between groups. Although the incidence of severe CDI cases was comparable in both groups, patients with HCO-CDI were significantly more likely to require admission to the intensive care unit (48.3% versus 14.3%, P equals 0.021) and prolonged hospitalization

(19.8 days versus 6 days, P equals 0.0025). Rates of CDI recurrence did not differ significantly between groups.

Conclusion: Clostridium difficile has traditionally been associated with nosocomial infections in older patients exposed to antibiotics. However, 1 in 5 patients with CDI admitted to our institution were classified as CO-CDI with only 70% citing previous antibiotic exposure. Our retrospective analysis was unique in that patients who had been recently hospitalized and/or transferred from extended care facilities were excluded from the CO-CDI group, giving us a better representation of true CO-CDI patients. The emergence of CDI in the outpatient setting poses serious challenges for all health care practitioners. Pharmacists should be aware of this growing trend in patients from the community presenting to their practice sites with symptoms consistent with CDI.

3-133

Category: Infectious Diseases

Title: Antimicrobial stewardship program: the pharmacist's impact

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Purpose: Antimicrobial stewardship programs (ASP) utilize a team of healthcare professionals to combat the direct and indirect costs of antimicrobials by advocating appropriate and cost-effective treatment plans. Munson Medical Center, a 401-bed community teaching hospital, implemented an ASP in 2001 and added a full-time pharmacist in 2010. This study aimed to quantify the impact of the addition of a pharmacist to the ASP on cost, local resistance patterns, and number of Clostridium difficile infections.

Methods: To evaluate the pharmacists impact on the appropriate and cost-effective use of antimicrobial agents, data was collected before integration of the pharmacist to the ASP team (April 1-June 30, 2010) and after integration of the pharmacist (December 1, 2010-February 28, 2011). Data collected included: local resistance patterns and the number of Clostridium difficile infections. Also, the recommendations made by the ASP team after integration of the pharmacist were analyzed. Analysis included: number of recommended changes accepted, changes in antimicrobial therapy leading to a decrease in cost and de-escalation of therapy, and overall cost savings.

Results: After pharmacist integration to the ASP from December 1, 2010- February 28, 2011, the ASP pharmacist made 124 recommendations regarding antimicrobial selection and 93 were accepted (75%). The average cost avoidance attributed to the antimicrobial recommendations was $234 per day. There were 1.56 Clostridium difficile cases per 1000 patient-days in the time period of April 1-June 30, 2010. In comparison, there were 0.96 Clostridium difficile cases per 1000 patient-days in the time period of December 1, 2010- February 28, 2011. Susceptibility patterns of select organisms varied little between the two time periods.

Conclusion: The pharmacist's presence in the ASP resulted in a decrease in both cost and number of Clostridium difficile infections. Pharmacists represent an integral part of the antimicrobial stewardship team in improving patient care within the community hospital setting.

3-134

Category: Infectious Diseases

Title: Analysis of clinical and cost benefits of conversion to extended infusion piperacillin/tazobactam in a community based teaching hospital

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Purpose: To determine if the magnitude of clinical and cost benefit resulting from a conversion to extended infusion piperacillin/tazobactam (P/T) from intermittent infusion P/T in a community based teaching hospital would warrant the necessary institutional changes.

Methods: The changes necessary to successfully implement extended infusion P/T were determined by the clinical pharmacist, the nurse educator, and pharmacy administration. The clinical benefit of a conversion to extended-infusion P/T (3.375 grams infused over 4 hours every 8 or 12 hours) was determined by the hospital epidemiologist and clinical pharmacist based on a review of the minimum inhibitory concentrations (MICs) of Pseudomonas aeruginosa isolates in 2010. The cost benefit of the conversion was determined based on acquisition cost savings. To determine acquisition cost savings, a daily cost difference for every potential dosage regimen was calculated. Then, using P/T usage reports generated from the clinical computer system, the clinical pharmacist reviewed each course of P/T to determine the cost difference associated with a switch. The cost savings was subtracted from total money spent on P/T for 2010, which was determined from purchasing records.

Results: The institutional changes that were identified included protocol development; nursing, pharmacy, and physician education; an additional compounding and labeling process; re-routing of P/T to the intravenous medication administration record; and increased volumetric pump usage. In 2010, 77.7 percent of all Pseudomonas aeruginosa isolates had an MIC greater than 4 mg/L, and 8 of these isolates were from critical care areas. The hospital spent $110,856.40 on 11,472 doses of brand and generic piperacillin/tazobactam in 2010. Based on this usage, the hospital anticipates saving at least $30,749.93 per year, a 27.7 percent decrease in expenditures.

Conclusion: The conversion to extended infusion P/T would improve bactericidal activity for the majority of patients at our institution, improve mortality in critical care areas, and decrease drug acquisition costs. It was determined that these improvements warranted the necessary policy changes and staff education to convert from an intermittent infusion of piperacillin/tazobactam to an extended infusion.

3-135

Category: Infectious Diseases

Title: Clinical Outcomes of Intermittent versus Extended Infusion Doripenem in the ICU: Experience at a Community, Teaching Hospital

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Purpose: Doripenem exhibits time-dependent bactericidal activity when the concentration of free drug exceeds the minimum inhibitory concentration (MIC) for at least 40% of the dosing interval. Extending the infusion over 4 hours allows for more time above the MIC, allowing for a longer duration of active antibiotic concentrations when contrasted to intermittent infusions over 30 minutes. This leads to more targeting of more virulent strains with higher MICs.

Methods: A baseline group prior of patients in the ICU of a 550 bed community teaching hospital who received intermittent doripenem infusions was collected for the first quarter of 2010. A post intervention group of patients in the ICU who received extended infusion doripenem was collected for the first quarter of 2011. Baseline characteristics, including case mix index were analyzed between both groups. Length of stay, 30-day readmission rates, and mortality were assessed via the University Health Consortium.

Results: A total of 35 patients were identified in the pre-intervention group, with 30 patients identified in the post-intervention group. Mortality trended downwards from 34% in 2010 to 23% in 2011. The mortality index decreased from 1.22 in 2010 to 0.93 in 2011. Length of stay was 25.17 days in 2010 compared to 24.87 in 2011. The length of stay index trended downward from 1.51 in 2010 to 1.28 in 2011. 30-day readmission rates were 17.39% in 2010 versus 5.77% in 2011.

Conclusion: In a time of increasing antimicrobial resistance, extended infusion antibiotics provide an effective option to improve patient outcomes. Extending the infusion of doripenem showed a trending decrease in mortality rates and 30-day readmission rates.

3-136

Category: Infectious Diseases

Title: Retrospective evaluation of clostridium difficile infections at a large community-based acute care hospital: causes, treatment and outcomes

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Purpose: With the widespread use of broad-spectrum antibiotics, Clostridium difficile (C. difficile) is becoming more common and difficult to treat. This infection is associated with significant morbidity and if undertreated, mortality. An understanding of antibiotic causes and effective treatment options is critical to prevent the infection and complications. The purpose of this study was to evaluate antibiotic-associated C. difficile infections. This included identifying the antibiotics most associated with C. difficile. We also evaluated the C. difficle treatment options, including medication, dose, and duration as well as readmission rates.

Methods: This retrospective electronic chart review was approved by the institutional review board. Patients were evaluated if positive C. difficile culture occurred more than 48 hours after admission during an 11 month time period. Antibiotic use was also evaluated so that rates of positive C. difficile could be calculated and allow associations of antibiotics with C. difficile to be compared equally. Data was collected on demographics, antibiotic use, C. difficile treatment options and readmission rates.

Results: A total of 94 patients met the inclusion criteria. The average age was 68.4 years and 57 percent of patients were female. Aztreonam was associated with the highest percentage of positive C.difficile culture at 12.5 percent. The other antibiotics associated with positive C. difficile cultures were imipenem/cilastatin (5.2 percent), cefepime (4 percent), linezolid (3.3 percent), ceftriaxone (2.8 percent), azithromycin (2.7 percent), ampicillin/sulbactam (2.6 percent), piperacillin/tazobactam (2.4 percent), cefazolin (2.2 percent), ciprofloxacin (1.9 percent) and moxifloxacin (1.5 percent). As a class, cephalosporins seemed to be most likely associated with C. difficile, accounting for 32.1 percent of all patients with positive C. difficile cultures. Quinolones were next at 20.7 percent, followed by penicillin derivatives (19.2 percent) and carbapenems (6.2 percent). Most patients were treated with metronidazole (31.9 percent), followed by vancomycin (27.7 percent), vancomycin and metronidazole together (20.2 percent), metronidazole followed by vancomycin (10.6 percent) and no treatment (9.6 percent). Readmission rates were lowest for patients receiving vancomycin alone. Of note, mortality at 6 months was 18.3 percent.

Conclusion: To effectively prevent C. difficile infections, many factors have to be considered. The authors believe the high association between C. difficle and aztreonam or imipenem/cilastatin is likely

due to the underlying patient situation (multiple antibiotics, critically ill, etc). Not surprisingly, about a third of patients with C. difficile were taking a cephalosporin. The authors expected quinolones to have a similar association; however the study revealed a lower incidence. Although current guidelines recommend metronidazole as initial therapy for C. difficile, this study showed that patients were almost equally as likely to receive vancomycin. One in three patients actually received both (combination or sequentially). Metronidazole failures were seen almost 25 percent of the time (either readmission or change to vancomycin). Principles of antibiotic stewardship, such as therapy de-escalation, minimizing duration of therapy and re-evaluating antibiotic need, will help reduce incidence of C. difficile. Metronidazole should still be considered for patients with C. difficile, however based on this study and other recent data, there should be a low threshold for initiating vancomycin. As more virulent strains of C. difficile continue to emerge, proper prevention and treatment is critical.

3-137

Category: Infectious Diseases

Title: Evaluation of the usage of voriconazole in a tertiary care medical center

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Purpose: St. Josephs Regional Medical Center is a 651-bed tertiary care non-transplant medical center and state designated trauma center with over 40,000 admissions each year. An Antimicrobial Stewardship Program (ASP) was developed in 2009 and implemented the restriction of 13 broad spectrum antimicrobials. Voriconazole became an agent restricted with ASP approval or for use by infectious disease and hematology/oncology physicians. Voriconazole is an antifungal agent with activity against many pathogentic fungi; however its use should be restricted to those patients with resistant organisms where other more cost effective agents are not appropriate. This study aims to evaluate the use of voriconazole at our institution after implementation of a restriction program.

Methods: We evaluated the appropriateness for use by conducting a retrospective chart review of all adult and pediatric patients on voriconazole during a 12 month period. Fifty charts were randomly selected and data were collected on indication, dosing, previous and concurrent antifungal/antibiotic treatment, duration of treatment, length of stay, and cultures and sensitivity. Patients were only included in the study if they have been on voriconazole for more than 5 days. Appropriate criteria for use included patients with any documented or suspected aspergilosis/aspergilloma, resistant candida species that has failed micafungin/fluconazole, patients with ANC<1000 with documented fever, and neutropenic patients with myelodysplastic syndromes, acute myeloid leukemia or acute lymphoblastic leukemia.

Results: Twenty patients were included in the final analysis. The appropriate indications for use included hematologic malignancy with neutropenia (65%) and aspergilosis/aspergilloma infection (15%). The mean duration of therapy for those patients in house was 20 days. Inappropriate use included Cellulitis of the skin with no identifiable organism (5%), esophageal candidiasis (5%), intra-abdominal abscess with no identifiable organism (5%) and candida glabrata fungemia susceptible to the echinocandins (5%). The mean duration for use in those patients in house was 11 days.

Conclusion: The implementation of an ASP program has promoted appropriate use of voriconazole. All patients who were prescribed voriconazole had ASP approval or infectious disease/hematology/oncology consults. The use of voriconazole as empiric therapy, where a fungal culture cannot be isolated is the most common underlying problem. Disseminating more information on cost effective alternatives to the medical staff can help improve the appropriate use of this agent. A

multidisciplinary model is being developed to communicate this information to the private infectious disease sector.

3-138

Category: Infectious Diseases

Title: Evaluating the correlation of serum procalcitonin with bacterial infections and its possible role in guiding antibiotic use

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Purpose: Inappropriate antibiotic use is associated with multidrug-resistant bacteria, adverse drug reactions, and increased medical costs. Therefore, judicious antibiotic usage is imperative. A biomarker that may assist in reducing antibiotic exposure for viral and noninfectious causes is procalcitonin (PCT). PCT is a precursor of the hormone calcitonin and is secreted by several types of cells and numerous organs in response to pro-inflammatory stimulation, particularly by bacterial products. PCT levels are elevated with bacterial infections but remain fairly low with viral infections or other inflammatory conditions. Consequently, this biomarker could serve as an antimicrobial stewardship tool to reduce inappropriate antibiotic use. The purpose of this study was to evaluate the predictive value of serum PCT levels in patients with all types of bacterial infections and to determine this biomarker's possible role in reducing unnecessary prescribing of antibiotics at our institution.

Methods: Adult patients (18 years and older) presenting to the emergency department and/or admitted to the community hospital system from January 1 through March 31, 2011, who had a PCT level drawn during their visit were retrospectively reviewed. Patients were identified from a computer laboratory report listing PCT levels obtained during the 3-month time period. A PCT concentration above 0.15 ng/mL was considered elevated (our laboratory's normal PCT value is less than or equal to 0.15 ng/mL). The PCT test was performed on-site at the hospital's central laboratory. For those patients with multiple PCT levels drawn during their stay, the first one was included in the data pool. Exclusion criteria included age under 18 years. Other data that were collected included patient demographics, admitting/discharge diagnoses, clinical presentation, laboratory values (white blood cell count, lactic acid level, serum creatinine, positive cultures), fever, imaging studies (X-ray reports/CT scans), and specialty of physician ordering PCT level. The study was approved by the university and hospital institutional review boards. Informed consent was not required for this study.

Results: One hundred five patients met eligibility criteria and were retrospectively reviewed. The mean patient age was 66 years, and 56 percent (n equals 59) were female. The majority of PCT levels were ordered by emergency department physicians (62 percent), followed by infectious disease physicians (17 percent) and intensivists (12 percent). The PCT level was most frequently drawn upon initial presentation to the hospital or emergency department (77 percent). The PCT levels correlated with the

presence or absence of bacterial infections in 85 patients (81 percent). Of these patients, 57 had elevated PCT levels consistent with the diagnosis of a bacterial infection, and 28 had normal values, indicating a viral infection or other inflammatory disease. The most common bacterial infections resulting in a higher PCT level included pneumonia (34), urinary tract infection (UTI)/urosepsis (22), and bacteremia/sepsis (10). Please note that patients may have had more than one type of bacterial infection. In the other 20 patients (19 percent) whose PCT levels did not accurately predict the presence or absence of bacterial infections, there were 16 false-negative results and 4 false-positive results. Of the 16 false-negatives, 6 patients were on antibiotics prior to the PCT level being drawn. The most common bacterial infections that did not correlate with an elevated PCT were pneumonia and UTIs. For the 4 patients with false-positive PCT results, 3 had an elevated serum creatinine (1.49 mg/dL or greater), which is noteworthy since PCT can increase in renal impairment in the absence of infection. Although a PCT concentration above 0.15 ng/mL was considered elevated for our study, further evaluation revealed 88 percent of patients (50/57) with bacterial infections had a PCT level 0.25 ng/mL and higher, which is consistent with cutoff values used in published studies suggesting the likelihood of bacterial infections and recommending antibiotic therapy. One notable limitation for this study is that only one PCT level was included per patient visit. This may cause false-negative results if samples are drawn too early in the course of infection.

Conclusion: PCT seems to be a promising biomarker for determining the need for antibiotic therapy. It accurately predicted the presence or absence of bacterial infections in most of our study patients. As an adjunct to clinical, laboratory, and radiographic findings, a PCT value of at least 0.25 ng/mL could serve as a tool for guiding initiation or continuation of antibiotics.

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Category: Infectious Diseases

Title: Successes of an antimicrobial management team (AMT) at a large community-teaching health system

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Purpose: Analyze the effectiveness of an antimicrobial management team (AMT) composed of three clinical pharmacists, five infectious diseases physicians with designations of AMT Medical Directors, an infection preventionalist, and a microbiology supervisor.

Methods: The AMT was initiated within Huntsville Hospital System. It involved a rotating team of pharmacists, physicians specializing in infectious diseases, along with an infection preventionalist and a microbiology supervisor. The AMT recommended and initiated patient-specific therapeutic interventions based upon patient electronic medical record review and Sentri7 lists specifically related to infectious diseases management and diagnoses. Data regarding acceptance rates, financial impact, total antibiotic days and costs as well as microbial culture and sensitivity data were analyzed to determine the beneficial impact of the AMT.

Results: The Huntsville Hospital System annual antibiogram proved that the ecology remained consistent when comparing the fiscal year 2010 and 2011 antibiotic susceptibility reports. A 72% rate of acceptance and implementation of AMT recommendations was achieved. The total drug expenditure for anti-infectives has decreased since the implementation of the AMT. There has been a decrease of 18% in the antibiotic costs per adjusted discharge which correlates to a greater than one million dollar decrease in antibiotic spend from the previous fiscal year.

Conclusion: Both financial and ecological data have proven a net benefit associated with the implementation of an AMT. Costs associated with pharmacy, infection control, and microbiology staff and resources as well as physician compensation out of the pharmacy budget associated with this program are offset by the substantial cost avoidance that it achieves. Moreover, the AMT has been successful in influencing prescribing practices and culture throughout the health system which serves to greatly expand the benefits associated with maintaining this team.

3-140

Category: Infectious Diseases

Title: Spectrum of miconazole activity against oral Candida species

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Purpose: Although C. albicans remains the most common pathogen in oropharyngeal candidiasis (OPC), the epidemiology of OPC is changing with non-albicans species becoming more frequently isolated. Miconazole 50 mg buccal tablet (MBT) is a recent addition to the antifungal armamentarium for treatment of OPC and is the only once-daily local treatment. In this era of fluconazole-resistant yeasts, the spectrum of miconazole activity against Candida isolates should be evaluated.

Methods: The appropriate institutional review boards and independent ethics committees approved this randomized, double-blind, double dummy, multicenter, non-inferiority trial conducted in United States, Canada, and South Africa. HIV-positive patients with OPC were randomized to 14 day treatment with MBT once-daily or clotrimazole troches (CT) 5 times daily. Patient informed consent was obtained prior to study enrollment. The primary endpoint was clinical cure (resolution of OPC lesions, burning, and soreness) at the test of cure (TOC) visit (days 17-22). Identification and susceptibility testing of yeast isolates were performed at a central laboratory. Susceptibility to antifungal agents, including miconazole, clotrimazole, fluconazole, and nystatin was determined for baseline isolates, and any isolates at the TOC visit.

Results: Of the 577 patients in the intent-to-treat (ITT) population, 565 patients had a positive culture at baseline and 88.7 percent of these patients were infected with C. albicans; 12.2 percent of patients were infected with C. non-albicans species. Overall clinical cure rates for all ITT patients were 61.1 percent MBT and 65.4 percent CT, demonstrating MBT was non-inferior to CT. Non-albicans species occurred more frequently among North American (31.3 percent) than South African isolates (6.7 percent), with C. parapsilosis being isolated from North American patients only. The second most frequently isolated organism was C. tropicalis (6.7 percent of baseline isolates). Among patients singly infected with this organism, clinical cure was achieved in 17 of 21 (81 percent) MBT and 8 of 15 (53.3 percent) CT patients. C. parapsilosis and C. dubliniensis occurred in 2.6 percent and 1.1 percent of baseline isolates, respectively. For patients infected with C. parapsilosis, 5 of 6 MBT and 8 of 9 CT patients had clinical cure. For the 5 C. dubliniensis patients, only 1 had cure in the MBT group. The minimum inhibitory concentration (MIC) range against all Candida species was 0.002 to 4 mcg per mL for miconazole; less than or equal to 0.001 to 0.5 mcg per mL for clotrimazole; 0.03 to 32 mcg per mL for fluconazole; and 0.5 to 8 mcg per mL for nystatin. Most organisms were susceptible to the antifungals. Five baseline

isolates (3 C. krusei, 2 C. albicans) were susceptible dose-dependent to fluconazole. Although each isolate responded to miconazole and clotrimazole at MIC less than or equal to 1 mcg per mL, the C. albicans patients were clinical failures at the TOC visit.

Conclusion: C. albicans remains the predominant causative agent of OPC, however, non-albicans species can also be present, particularly in North America. Both MBT and CT demonstrated similar clinical efficacy for treatment of OPC with MICs within the expected ranges for all Candida species tested. The MIC range was broadest for fluconazole, which is consistent with decreased susceptibility to this antifungal seen in other studies.

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Category: Infectious Diseases

Title: Daptomycin: A retrospective and prospective review at Baptist Hospital of Miami

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Purpose: To evaluate daptomycin prescribing patterns and optimize the use of daptomycin by ensuring compliance with the approved criteria for its use.

Methods: This study is IRB approved. A randomized, retrospective chart review of 75 patients prescribed daptomycin from July 2009 to June 2010 was conducted followed by a randomized, prospective review of the first 75 patients prescribed daptomycin. The primary endpoint is compliance with the prescribing criteria in the patients reviewed retrospectively versus those reviewed prospectively. The secondary endpoints are to assess the number of interventions made and accepted including: changes in therapy due to MEC criteria, changes in therapy due to adverse drug effects, changes in dose, recommendations for laboratory monitoring, and cost-savings.

Results: Of the 55 patients reviewed in the retrospective review, 22 were prescribed according to the criteria. In the prospective group, 11 of the 15 patients were prescribed according to the criteria. A Chi-square test for independence indicated no significant association between renal dose adjustments in the retrospective versus prospective group [2(1, n equals 20)less than 0.001, p value is 1, phi equals 0.034]. A Chi-square test for independence indicated a significant association between CPK monitoring in the retrospective versus prospective group [2 (1, n equals 70)equals 7.28, p value is 0.007, phi equals -0.36]. A Mann-Whitney U revealed a significant difference in the orders received during the months of the retrospective phase (Md equals 9.38, n was 12) versus the months of the prospective phase (Md equal 2.5, n was 3), U equals 1.5, z equals -2.39, p value is 0.017, r is 0.62.

Conclusion: The intent of prescribing criteria for daptomycin is to minimize the overuse and reserve the antibiotic only when needed. Educating physicians and pharmacists on appropriate use in addition to continuous monitoring is essential.

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Category: Infectious Diseases

Title: The impact of a proactive computerized physician order entry antimicrobial stewardship program (CPOE-ASP), in the presence of an infectious diseases physician, on linezolid use in a community hospital

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Purpose: To assess the impact of a proactive, CPOE-ASP on the use of linezolid in two community hospitals, one with and the other without the presence of an infectious disease (ID) physician.

Methods: A CPOE-ASP addressing the utilization of linezolid was implemented in two community hospitals serving two suburban centers of Maricopa County, AZ over a 16-month period before and after its implementation. The 214-bed facility (Hospital A) incorporated an ID physician to direct the ASP while the 165-bed facility (Hospital B) ASP operated in the absence of an ID physician. Linezolid prescribers are presented with a dialog window summarizing the current approved usages, as well as alternative antibiotics and hyperlinks to evidence-based articles. Utilization of this antibiotic was based on FDA-approved indications and limited to patients with: 1) treatment failure after at least 5 days of vancomycin treatment, 2) vancomycin-resistant enterococcus, or 3) history of allergic reaction to vancomycin. Linezolid use for bacteremia, endocarditis and osteomyelitis is considered inappropriate unless all other treatment options have been unsuccessful. Utilization was monitored using monthly hospital pharmacy purchasing data to obtain the defined daily dose (DDD) per 1000 patient-days. A medication utilization evaluation (MUE) was performed to assess the appropriateness of linezolid ordering. Mann-Whitney U and the Fisher Exact tests were used for statistical analysis when appropriate.

Results: Linezolid use in Hospital A decreased significantly from 44 to 28 DDD per 1000 patient-days ($p<0.03$) in the presence of an ID physician leading an existing program. The subsequent introduction of a CPOE-ASP significantly decreased linezolid usage to 7.5 DDD/1000 patient days ($p<0.001$). In contrast, linezolid use in Hospital B was lower from the onset when compared to Hospital A, and did not improve with the initiation of CPOE-ASP (from 0.78 to 1.03 DDD/1000 patient days). After initiating CPOE-ASP, Hospital A's total expenditures for linezolid decreased, resulting in cost savings well over $600,000 over the 16-month period. The MUE of Hospital A showed that the percentage of inappropriate linezolid orders dropped significantly from 77% to 11% ($p<0.0001$), with a modest decrease in inappropriate linezolid orders described with Hospital B (60% to 36%).

Conclusion: These results suggest that a proactive, computerized physician order entry (CPOE) system can be successfully initiated in the presence of an ID physician leading an ASP in the community hospital setting, impacting both the prescribing habits of hospital practitioners and can significantly decrease hospital expenditures of this medication.

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Category: Infectious Diseases

Title: Evaluation of Clinically Important Gram-negative and Gram-positive Isolates in Alabama: Electronically Captured 2007-2010 State-Wide Antibiogram

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Purpose: Regional differences in multi-drug resistant organisms (MDRO) have been noted in the literature. We report on trends in gram-positive and gram-negative MDROs from state-wide antibiogram data in the state of Alabama for admission and hospital-associated time period for urine and non-urine non-duplicate isolates.

Methods: Using electronically available microbiology results and census data from hospitals in Alabama for calendar years 2007-2010 (MedMined Services, CareFusion) we evaluated for trends in resistance (R) for non-duplicate urine and non-urine isolates during the admission [AD] and hospital-associated [HA] time period for: S. aureus (n=194,736)resistant to oxacillin (MRSA), E. faecium (n=7,053) R to vancomycin, K. pneumoniae (n=38,270) R to ceftriaxone, E. coli (n=160,775) R to quinolone, P. aeruginosa (n=39,922) R to carbapenem and pip/tazo. Non duplicate isolates were defined as first isolate for a species per patient per 30 days.

Results: MRSA was fairly stable and higher (2010) for urine HA (70%) than urine AD (55%) and similar for non-urine HA (63%) and non-urine AD (62%). For gram-negative pathogens, resistance was stable but higher (2010) for urine HA and non-urine HA vs. AD urine and non-urine isolates for K. pneumoniae R to ceftriaxone (12% and 15% vs. 5% and 7%), E. coli R to quinolone (45% and 44% vs. 26% and 33%), P. aeruginoa R to carbapenem (25% and 26% vs. 12% and 11%), P. aeruginosa R to pip/tazo (14% and 16% vs. 10% and 9%). Most notably, E. faecium R to vancomycin increased across all categories from 2007-2010; urine AD (49% to 63%), non-urine AD (52% to 62%), urine HA (74% to 81%) and non-urine HA (71% to 82%).

Conclusion: In the state of Alabama, differences in gram-negative and gram positive resistance is stable but higher for HA urine and non-urine non-duplicate isolates. Increases are seen in E. faecium R to vancomycin across HA and AD categories evaluated. Such state-wide antibiogram data may be helpful in managing local antimicrobial stewardship efforts.

3-144

Category: Infectious Diseases

Title: Evaluation of the incorporation of decentralized pharmacists and standardization of documentation of pharmacist interventions in an antimicrobial stewardship program

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Purpose: Infectious Disease Society of America and the Society of Healthcare for Epidemiology of America (IDSA/SHEA) guidelines state that one of the core members of a multidisciplinary antimicrobial stewardship team should be a clinical pharmacist with infectious disease training. A statement recently released by the American Society of Health-System Pharmacists (ASHP) emphasizes the important role and responsibilities of pharmacists in antimicrobial stewardship programs (ASP). In our academic community medical center, the infectious disease pharmacy specialist rounds with the infectious disease (ID) team to promote the optimal use of antimicrobial agents. Recently, a revision to our antimicrobial stewardship program was made to incorporate decentralized pharmacists and to standardize and improve the documentation of pharmacy clinical interventions. An evaluation of the program was undertaken to ensure appropriate antimicrobial monitoring.

Methods: To incorporate decentralized pharmacists into the ASP, all pharmacists were trained individually and required to sign a competency and assessment of their understanding of the procedure. This procedure targeted four monitoring criteria for all restricted antimicrobials and included : (1) infectious disease approval (documented ID approval or call for ID approval), (2) appropriate dosing (renal dosing, intravenous to oral, penicillin allergies, drug interactions or recommendation for dose adjustments according to trough level), (3) review of microbiology data (pseudomonas, MRSA. or ESBL positive culture) and (4) de-escalation therapy. Intervention were standardized and aligned with the four targeted monitoring criteria to improve documentation. Evaluation included reviewing the defined daily dose (DDD) of restricted antimicrobials per month using DDD from the WHO as well as documented clinical pharmacist interventions for a one year period prior to and three months after implementation of the revised program.

Results: During the year prior to implementation of the revised antimicrobial stewardship program the average monthly calculated DDD for restricted antibiotics was aztrenom (7), cefepime (68), ciprofloxacin (133), daptomycin (18), ertapenem (63), imipenem/cilastin (34) levofloxacin (234), linezold (8), piperacillin/tazobactam (119), vancomycin (306). The monthly average DDD during the three months after implementation remained similar for ertapenem (63), levofloxacin (237), and linezolid (10); increased for aztreonam (12), cefepime (80), daptomycin (30), and imipenem (40); and decreased for

piperacillin/tazobactom (110), ciprofloxacin (84), and vancomycin (289). An average of 54 (19-214) pharmacist clinical interventions per month were identified as antibiotic related during the year prior to implementation of the revised procedure. This increased to an average of 599 (282-772) clinical interventions per month during the three months after implementation. Documentation of ID approval in clinical interventions increased from an average of 40 (11-76) per month during the prior year to an average of 142 (100-173) per month after implementation. A total 4 documented clinical interventions were easily identifiable as de-escalation of antimicrobials during the prior year which increased to an average of 18 (6-28) clinical interventions per month documenting de-escalation after implementation

Conclusion: Pharmacist clinical interventions were not easily identifiable from our computer system during the year prior to implementation of the revision to the ASP, making it difficult to evaluate our program. After this revision, clinical interventions related to antimicrobials reflected increased pharmacists knowledge of the ASP as shown by the increase in the total number of interventions documented and interventions related to de-escalation of antimicrobials. Calculated DDD monitoring per month showed some trends in our antimicrobial usage, but due to limited data trends are inconclusive. Expanding antimicrobial monitoring and standardizing intervention documentation by educating and training decentralized pharmacists to the revised ASP has increased the quality and quantity of antimicrobial related clinical interventions.

3-145

Category: Infectious Diseases

Title: High dose-extended interval tobramycin therapy in cystic fibrosis patients at a tertiary academic medical center

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Purpose: Since late 2005 our hospital has utilized High Dose-Extended Interval Tobramycin Therapy (HEITT) for patients with cystic fibrosis (CF). There is minimal literature available on the application of this approach in clinical practice. We sought to evaluate clinical practice of HEITT dosing as well as safety in adult CF patients at our institution.

Methods: A retrospective review of adult CF patients receiving HEITT from September 2005 to February 2011 was approved by our pharmacy peer review committee and institutional review board. Patients with renal dysfunction at baseline, status-post lung transplant, or those receiving concomitant inhaled tobramycin were excluded from our analysis. Endpoints included average initial and final weight-based dose, percentage of patients with a dose increase, and time to goal peak. Goal peak was defined as a tobramycin concentration of greater than 20 mg/dL. Safety endpoints included development of nephrotoxicity while receiving HEITT, defined as a doubling of serum creatinine or an increase of 0.5 mg/dL or greater, and ototoxicity documented in the medical record.

Results: A total of 282 inpatient cases were included in the retrospective analysis. The average initial and final tobramycin doses were 10.3 and 10.7 mg/kg, respectively (p value less than 0.0001). The average initial peak was 21.5 mg/dL. Thirty nine percent of patients received at least one dose titration due to an initial peak that was less than goal. Eighty five percent of patients eventually achieved goal tobramycin concentrations, with an average time to goal was three days. Nephrotoxicity occurred in two cases (0.7 percent), while there were zero documented cases of ototoxicity.

Conclusion: A mean starting dose of 10.3 mg/kg of HEITT achieved an average peak above the pharmacokinetic goal in our cohort of cystic fibrosis patients. A moderate percentage of patients required a dose increase to achieve adequate peak levels. Overall HEITT was associated with a low rate of both renal and ototoxicity. Further research is needed to evaluate microbiological and clinical efficacy of HEITT in adult CF patients.

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Category: Infectious Diseases

Title: Progress of a dedicated antimicrobial stewardship program at a large academic medical center: a 2 year report

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Purpose: Overuse of antibiotics can lead to unnecessary cost, adverse effects such as Clostridium difficile colitis, and the development of resistance. UMass Memorial Medical Center is a large academic medical center with over 800 beds, with many opportunities for antimicrobial stewardship. In November of 2008 a daily, prospective stewardship program was implemented at our University campus, and in December of 2009 a bi-weekly program was established at our Memorial campus. Each campus has a dedicated clinical pharmacist and Infectious Disease attending that focus on education and prospective review of broad spectrum antimicrobial use on the acute care floors. We report on the progress of our stewardship program after two and a half years of dedicated, prospective intervention by evaluating the types of interventions made and the rates of acceptance in acute care areas.

Methods: Over a two and a half year period from November 2008 to May 2011, data was collected to identify the quantity, quality and rates of acceptance of antimicrobial stewardship interventions. Patients on selected antibiotics were identified via Sentri7, and later Theradoc, both real-time patient surveillance rules engines. Antibiotics reviewed included broad spectrum agents often over-utilized including levofloxacin, ciprofloxacin, piperacillin/tazobactam, aztreonam, intravenous vancomycin and others. Interventions were made on all acute care floors on both campuses of our large academic medical center. Demographic data collected included patient age, sex, allergies, history of recent hospitalization, diabetes and admission from nursing home, outside hospital or home. Information was also collected in regards to use of current and past antibiotics, indication, relevant clinical data (i.e. urinalysis, chest x-ray), microbiology including sensitivities, days of total antimicrobial therapy, white blood cell count, and temperature. Based on this information, our stewardship team reviewed patients for one hour each weekday, or bi-weekly at Memorial campus, and recommendations were communicated directly to the primary team. Antimicrobial stewardship recommendations, acceptance of recommendations, length of therapy, length of stay, and mortality were recorded.

Results: 1556 patients antimicrobial regimens were reviewed over a two and a half year period, for a total of 2,039 total antibiotics reviewed. Interventions were made in 830 of 2039 antibiotics reviewed, and 65.7% (545/830) were accepted. Types of accepted interventions included discontinuation,

streamlining, dosage adjustment and others (change to oral therapy, antibiotic addition or recommend ID consult) and occurred 47% (255/545), 24% (133/545), 14% (76/545) and 15% (81/545) of the time, respectively. The most common antibiotic indication for patients in whom interventions were made included respiratory infections in 36% (297/830), 58% of which were healthcare- associated or hospital-acquired pneumonia and 36% community-acquired pneumonia. Other common indications included urinary tract infections in 24% (201/830), intra-abdominal infections in 15% (122/830), and skin/soft tissue infections in 13% (105/830). Overall, 46% percent (386/840) of interventions involved patients receiving levofloxacin, followed by 23% receiving piperacillin/tazobactam, 18% receiving vancomycin, 7% receiving ciprofloxacin, other antibiotics made up the remaining 6%.

Conclusion: Over 65% of antimicrobial stewardship team recommendations were accepted, and a majority of these interventions were associated with levofloxacin. Overuse of fluoroquinolones and piperacillin-tazobactam is a major problem at our institution and at many other institutions. Based on our interventions, it is evident that focusing on broad spectrum antimicrobials such as fluoroquinolones, piperacillin/tazobactam and vancomycin is advantageous and also leads to antimicrobial cost savings. In addition, this prospective program allowed us to identify problem areas with subsequent roll-out of new hospital-wide guidelines such as those focusing on treatment of pneumonia and intra-abdominal infections, as well as a restriction for the use of aztreonam.

3-147

Category: Infectious Diseases

Title: Evaluation of management and clinical outcomes of Clostridium difficile in hospitalized patients

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Purpose: Clostridium difficile is a gram positive, spore forming anaerobic organism that is associated with nosocomial diarrhea and can result in dehydration, electrolyte disturbances, renal injury, bowel perforation, and pseudomembranous colitis. C. difficile infection (CDI) is associated with significant morbidity, mortality and increased cost to the health care system. A recent update to the CDI guidelines addresses classification and treatment of patients according to severity of disease. This study aimed to evaluate adherence to the updated guidelines according to treatment selection and dosage, and also determine if adherence affected clinical outcomes at a large academic institution. Additionally, this study observed factors that influence the management of CDI.

Methods: This study was a retrospective, observational, single center study of all patients who were positive for C. difficile from April 1, 2010-October 10, 2010. A list of all C. difficile positive results as assessed via polymerase chain reaction was generated from the microbiology lab. Patients were excluded if they were less than 18 years old, pregnant, incarcerated, being treated for the second recurrence or more, or enrolled in an investigational drug study. The electronic patient medical record was used to collect data and included demographics, antibiotic history, white blood cell count, serum creatinine, and CDI treatment. The data was used to determine if there is a significant difference in all-cause mortality, length of stay, or recurrence in between patients treated according to the guidelines (adherent) vs. those who were not (non-adherent). Secondary endpoints include overall adherence to evidence-based treatment guidelines, service initiating therapy, and association of antibiotics or proton pump inhibitors with CDI.

Results: There were 146 C. difficile positive patients screened for inclusion. Fifty-five patients were excluded due to outpatient status, being beyond the 1st recurrence, age < 18, pregnant, or incarcerated. Of the 90 patients that were included, 50 (56%) were treated according to guidelines, and 40 (44%) were not. There were more mild disease severity patients in the adherent group, and more severe patients in the non-adherent group. The most common reason for non-adherence was inappropriate drug selection (n=32, 59%). There was no difference with respect to all-cause mortality, length of stay, or readmission between adherent and non-adherent groups. There remained no difference in outcomes when the adherent and non-adherent groups were stratified by severity of disease. Overall, penicillins and IV vancomycin were statistically associated with CDI, and more patients were exposed to PPIs (n=70, 77%)

than those with no documented PPI exposure (n=21, 23%). There was no difference in prescribing habits between teaching and non-teaching services.

Conclusion: In general the adherence to CDI guidelines in our institution needs improvement. Since there was no difference between services initiating therapy, education is warranted throughout the institution. The major focus of the education will be targeted at appropriately classifying patients according to disease severity to improve appropriate drug selection. No difference in outcomes was found, but due to power limitations, a larger sample is necessary for potentially finding a significant difference in future studies.

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Category: Infectious Diseases

Title: Implementation of an antimicrobial stewardship program (ASP) in an acute care hospital: one and a half years later

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Purpose: Antibiotics and other anti-infective agents are some of the most commonly used medications in the inpatient setting. Inappropriate use and overuse of these agents have serious consequences, such as the emergence and dissemination of bacterial resistance, adverse drug reactions, and escalating healthcare costs. The goal was to implement an antibiotic stewardship program (ASP) to optimize clinical outcomes while minimizing the unintended consequences of antimicrobial treatment.

Methods: The ASP team was developed by clinical pharmacy personnel under the guidance of an infectious disease specialist. Members of the stewardship program are: an infectious disease physician, clinical pharmacists with infectious disease training, infection preventionist, and microbiologist. The ways in which antibiotic misuse were targeted are as follows: formulary restriction, strict drug use criteria and pharmacist preauthorization for use of selected antibiotics and antifungals, optimization of drug dosing, timely de-escalation of broad spectrum empiric antibiotics, and improvement in duration of treatment. The clinical pharmacists are responsible for the majority of antibiotic management throughout the hospital; however, infectious disease specialists are available for consultation in more complex cases. Each day the ASP pharmacist reviews computer generated reports of patients started on restricted antibiotics, patients on antibiotics greater than 10 days, patients on triple antibiotics greater than 3 days, patients with multi-drug resistant (MDR) pathogens, and positive clostridium difficile cultures. Each patient is reviewed in depth and if necessary, recommendations for modification of therapy are made directly to the physician. The ASP pharmacists are available for consultation by wireless phone Monday through Friday from 0930-2000. In order to continually improve the program and handle challenging issues, the ASP team meets each month to discuss topics, develop new policies and review cases with unaccepted ASP recommendations.

Results: The clostridium difficile infection (CDI) rate (number of CDI/patient days x 10,000) has declined on average since the start of the program in November, 2009. The rate at that time was 9.0, as of March 2011 the rate was 3.5; an overall reduction of 5.5. The antibiotic cost per patient day was at an all time high of 29.62 dollars in the third quarter of 2009. Since that time we have reduced the cost per patient day to 16.97 dollars as of the first quarter, 2011. This is an overall reduction of 12.65 dollars per patient

day, or 43 percent. With closer examination of comparable quarters before and after ASP implementation, there has been an average reduction across quarters of 5.40 dollars per patient day, or 20.7 percent. Review of restricted antibiotics (tigecycline, daptomycin, ertapenem, and doripenem) shows a significant decrease in the use of these agents when averaged per patient day.

Conclusion: Implementation of an antibiotic stewardship program in the acute care setting has shown to be successful. Pharmacist recommendations are widely accepted and appreciated by hospitalists and intensivists alike. As the program has progressed over the last year and a half, we have seen changes and improvements in the prescribing practices of many physicians, as well as documentation in the electronic medical record stating indication and intended duration of treatment. It is important to note that over time we have also seen a large increase in the number of consultations the pharmacists receive from physicians regarding antibiotic selection, dose optimization, duration of treatment, and assistance with outpatient regimens upon discharge.

3-149

Category: Infectious Diseases

Title: Evaluation of the cost effectiveness of primary prevention in Human papillomavirus (HPV) related cervical cancer

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Purpose: Cervical cancer is one of the most common malignancies in women, ranking third in the leading gynecologic cancers in the United States. As one of the principal risk factors for this disease state, HPV continues to be a concern amongst not only patients but health care providers as well. Uncertainties exist due to the absence of long term data regarding currently available vaccines and limited information regarding the epidemiology of cervical carcinogenesis. Furthermore, questions regarding vaccine efficacy, coverage, duration of protection, ideal screening interval, and when vaccination is no longer considered cost effective have yet to be answered. Cost effective strategies to reduce the incidence of cervical cancer are a priority; however, recommendation must rely on study models and assumptions. It is thus imperative to evaluate what literature is currently available in such a way that will foster future research and allow new data to be compared and analyzed.

Methods: We conducted a comprehensive literature search for all data available in the United States involving women vaccinated against HPV related cervical cancer to determine the cost effectiveness of primary prevention for this disease state. We analyzed these articles and incorporated them into our evaluative study report. While investigating these studies and articles, we critically analyzed their models, critiqued their methods, and ultimately determined whether this form of prevention seemed economically desirable and which combination of vaccination and screening interval proved optimal.

Results: Overall, the studies agreed that vaccination should be completed by an early age (usually 12 years old) without the option of catch up vaccinations for older women. The models that were utilized to simulate HPV related pathogenesis typically began to follow their cohort population within the age range of 9 to 12 years, for which the vaccine is approved. Although much is still unknown about the efficacy and duration of coverage of the vaccine, the majority of the studies suggest changing the guidelines to allow less frequent screenings for women who were vaccinated. Even with vaccination, however, evidence suggests the continued need for screening every 2 years or every 3 years in women over 30. The assumptions that were made within the current literature for these parameters vary greatly. Efficacy ranged between 70 to 100% and the duration of protection was evaluated at 10 years, 15 years, or lifelong. Currently, the majority of the studies assumed lifelong immunity with 100%

efficacy. After inflation of costs utilized in each of the models to the present year, the cost per QALY for their suggested regimens ranged from $4,663 to $231,216, with the median being $50,425.

Conclusion: The median cost per QALY found could be considered cost effective when utilizing the common threshold of $50,000 to $100,000 per QALY. Vaccinating girls by 12 years of age with less frequent screening intervals versus current screening practices is recommended as the optimal regimen.

3-150

Category: Infectious Diseases

Title: Clinical Outcomes & Cost Savings from Using Povidone-Iodine Ophthalmic Solution

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Purpose: During the national erythromycin ophthalmic ointment shortage, PPH switched to povidone-iodine 2.5% ophthalmic solution for the prevention of ophthalmia neonatorum. The incidence of neonatal conjunctivitis before and after the switch was compared to determine the effectiveness of povidone-iodine 2.5% ophthalmic solution in preventing ocular infections. A cost analysis of using alternative antimicrobials was performed as part of the study.

Methods: This study was a retrospective chart review of electronic medical records from a community-based health system in Southern California. Outcome data for infants born during the erythromycin ophthalmic ointment shortage was compared to infants who were born prior to the drug shortage. We sought to determine if switching to povidone-iodine 2.5% ophthalmic solution had placed newborns at higher risk for neonatal conjunctivitis.

Results: Between October 2009 and May 2011, PPH had 22 documented cases of neonatal conjunctivitis. There were 7,341 births during this time frame which computed to an infection rate of 0.3%. The incidence of neonatal conjunctivitis in 2008 when erythromycin ophthalmic ointment was used exclusively was reviewed. In 2008, PPH had 9 cases of neonatal conjunctivitis. There were 4,799 births that year which computes to an infection rate of 0.2%. The difference was not statistically significant. Using azithromycin 1% ophthalmic solution in unit dose aliquots would have resulted in $43,075 expenditure during the shortage. PPH spent $4,389 using povidone-iodine 2.5% ophthalmic solution, which resulted in a $38,686 savings during the crisis. When erythromycin ophthalmic ointment became available again, its cost had increased 12 times to that prior to the shortage. Had PPH switched back to using erythromycin ophthalmic ointment in May 2010, the projected expenditure would have been $42,060. The expenditure for povidone-iodine 2.5% ophthalmic solution during the past 11 months was $5,888, resulting in a $36,172 savings.

Conclusion: Povidone-iodine 2.5% ophthalmic solution was found to be an effective alternative agent for the prevention of ophthalmia neonatorum. There was significant cost savings associated with its use compared to other agents.

3-151

Category: Investigational Drugs

Title: Assessment and restructuring of investigational drug services at a large, non-profit, tertiary academic medical center

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Purpose: In addition to sound dispensing processes, provision of investigational drug services on a large scale requires ongoing assessment of the business model employed and the quality of services rendered. An effective investigational drug service (IDS) can support opportunities for researchers, healthcare organizations, patients, and study sponsors to benefit from the rewards of well designed and executed clinical trials. The desire to maximize these benefits prompted a large, non-profit, tertiary academic medical center to reevaluate its IDS model.

Methods: The institution identified primary areas of interest among investigators and members of administration that included reevaluation of the IDS business units revenue and expenses, fee structure, policy and procedures, customer service, and quality assessment (QA) practices. There were additional concerns identified within the Pharmacy Department related to accessibility and scheduling of IDS staff. The facility created an IDS Program Director position with the primary responsibility of identifying and addressing these issues along with providing oversight for the approximately 400 studies involving medications at the insititution. The facilitys goal is to maintain IDS as a budget neutral cost center. Fees are reexamined by the Finance Department periodically and adjusted according to the revenues and expenses generated by the service. Upon examination of monitoring and reporting practices for both financial and quality performance, it became evident that a structured reporting tool was needed to aid in assessment and tracking. Additionally, multiple processes within the IDS were not governed by specific policies and procedures. Instead, many processes were found to be the result of professional experience and historical practice and were supported by inadequate documentation. Likewise, no formal customer service feedback had been acquired recently by the service.

Results: Financial and quality dashboards were created to monitor the services performance. Financial reporting categories for workload, productivity, cost avoidance, and profit/loss were created. Quality reporting categories included storage condition audit results, binder documentation audit results, and randomization audits along with other items. The dashboard is updated monthly and distributed to the IDS staff as well as various members of the department and facilitys management team. Overall response to the dashboard has been very favorable. Various standard operating procedures (SOPs) were developed in an effort to formalize the processes of the IDS and to address any issues related to compliance with applicable regulations and policies. Each team member was consulted and encouraged to provide input during the drafting of these SOPs as were many of the investigators utilizing the services of the IDS. The IDS staff now has formal processes and references that were once lacking. The SOPs have also led to less difficulty during site initiation and monitoring visits. In an effort to remedy

issues and tension with the Central Pharmacy staff, an IDS work and on call schedule was developed to aid in the provision of after hours coverage for the service. The new IDS work schedule no longer relies on coverage from the Pharmacy staff during normal business hours. In fact, the IDS staff has been assisting with normal department functions as needed. These changes along with a structured communication plan have been well received. Customer service is now evaluated for both internal and external costumers. A survey for Pharmacy staff has been developed as has a survey for investigators and research associates. Results have been favorable.

Conclusion: Measurement and reporting of key functions such financial performance, QA, and customer service along with sound policies and procedures are essential to creating a successful IDS. Assessment and retooling of these items at a large, non-profit, tertiary academic medical center has resulted in a new level of respect for and functioning of the service.

3-152

Category: Investigational Drugs

Title: Cost analysis of a hospital based investigational drug service

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Purpose: The goal of this analysis is to calculate the potential acquisition cost (PAC) of medications that were supplied at no cost by the study sponsors for studies that the Investigational Drug Service (IDS) provided services over a period of one year. The secondary goal was to calculate the net pharmacy budget savings of the IDS by comparing the PAC and associated IDS study fees to the cost of IDS personnel.

Methods: Studies serviced by the IDS from 5/1/2010 to 4/30/2011 were evaluated for potential acquisition cost (PAC). PAC was calculated by determining the acquisition cost of all study medications during the evaluation period. PAC for non-approved study medication was calculated using the acquisition cost of the approved standard of care for the particular disease state. Net pharmacy budget savings was calculated by subtracting salaries and benefits of IDS personnel from the PAC plus IDS study fees for the one-year period.

Results: Studies serviced by the IDS had a PAC of $1,811,000 for the one-year period. IDS fees totaled $222,000. Salaries and benefits of IDS personnel were $275,000. The net pharmacy budget savings was $1,758,000.

Conclusion: IDS participation in sponsored drug studies can provide substantial savings to the pharmacy budget.

3-153

Category: Investigational Drugs

Title: Development and implementation of a cross-audit tool to assist with quality assurance of research medications utilized in clinical trials

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Purpose: The Research Pharmacy at Beth Israel Deaconess Medical Center conducts cancer relevant clinical research on human subjects with four other Harvard clinical institutions under the umbrella of the Dana Farber/Harvard Cancer Center. These other institutions include Brigham and Women's Hospital, Children's Hospital Boston, Dana-Farber Cancer Institute and Massachusetts General Hospital. A cross-audit tool was created to assist with the quality assurance of research medications utilized in clinical trials between these institutions. The goal of the cross-audit is to remain in an "audit ready" state at all times by ensuring that the research pharmacies are in compliance with all aspects of IRB approved protocols and policies.

Methods: Members of the research pharmacies at Beth Israel Deaconess Medical Center and Dana-Farber Cancer Institute worked collaboratively to develop a functional cross-audit tool. The cross-audit tool is divided into the following sections: criteria to audit associated with a predetermined acceptable standard, a brief description of what source materials to audit based on the specific criteria, audit results, analysis, and corrective action (if necessary). The working group determined that cross-audits should be completed every other month on research protocols that are actively enrolling subjects at both institutions. Senior Research Pharmacists would perform the audits.

Results: The first cross-audit was conducted in May, 2011 and took approximately 6 hours to complete. Two research pharmacists conducted the audit. No major protocol deviations or violations were identified in regards to the distribution and control of research medications. Minor issues were identified with documentation and record-keeping, including missing information on prescriptions, incorrect error corrections, and missing information on packing slips.

Conclusion: The research pharmacy cross-audit tool proves to be a useful and proactive quality assurance program to assist research pharmacies in staying compliant with all aspects of IRB approved protocols and policies. Factors which influence the success of the program include adequate staffing to allow the time necessary to perform a complete and comprehensive audit as well as coordination between differenct institutions within close proximity of each other. We hope to continue to utilize the cross-audit tool and expand its use to the other Harvard clinical institutions.

3-154

Category: Investigational Drugs

Title: Pharmaceutical appointment in clinical trials

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Purpose: Clinical investigation demands the establishment of multidisciplinary teams. Clinical trials credibility and reputation depends on the security, responsibility, transparency and tracing with which the clinical trial medicine and medical devices are used and conducted. Pharmaceutical appointment in clinical trials practice is a patient-centered and outcomes oriented.

Methods: A pharmacist with advanced training in clinical trials practice and ICH-GCP guidelines is responsible to monitor pharmacy activities. The pharmacist: - Conducts an interview and records the patient's pharmacotherapeutic information. The data collected is evaluated and appropriate information is supplied in order to ensure adherence, safety and effectiveness; - Assures that the patient has the correct and sufficient investigational product, information and necessary knowledge to carry out the clinical trial plan; - Reviews, monitors and explains modifications of the therapeutic plan as necessary and appropriate, in accordance with the patient and investigational team.

Results: Three pharmacists are responsible for the Clinical Trials Department of the Pharmaceutical Services. During 2010, we were involved in 93 clinical trials, from which 12% were phase II, 81% phase III and 4% phase IV. These clinical trials enrolled 765 patients and were undertaken by 18 centers, with 32 sponsors and 122 different investigational products. We carried out 3251 pharmaceutical visits. These pharmaceutical consultations allowed us to achieve a medium therapeutic adhesion rate of 98.3% with 0 drop outs.

Conclusion: The high level of professional skills and proficiency of an experienced pharmaceutical team proved to be of extreme importance in the correct conductance of the clinical trial, as well as, the adherence and security of the patient to the investigational product and concomitant drugs under study. A relationship based upon caring, trust, open communication and cooperation between patient and pharmacist must be encouraged.

3-155

Category: Investigational Drugs

Title: Description of clinical trials design involving a Spanish pharmacy hospital service

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Purpose: Research and development are very important areas for pharmacy services (PhS). Randomized controlled clinical trials (CT) have become the gold standard to prove the efficacy of an intervention. This paper goal is to analyze the design, methodology, clinical services and investigational drugs of actives CT which participate (management and dispensation) the PhS of a 500-bed care Spanish general hospital.

Methods: Descriptive and retrospective study to analyze the design and methodology of actives CT. We used the CT protocols to define the number of centers implicated, randomization, blind or open CT, number of treatment arms, comparative element, phase, statistic and duration, clinical services and investigational drugs implicated. We also realized descriptive statistics.

Results: We analyzed 65 CT. The study design was in 98.5% multicentric, 92% of the CT were randomized, 63% had double-blind design, 74% two treatment arms, 92% were comparatives CT being 41.5% of them compared with placebo. Relating to the phase, 17% were phase II, 77% phase III and 6% phase IV. As the type, 73.9% were designed as superiority trials, 13.8% as non inferiority trials and 12.3% were one-arm trials. Analysis of efficacy values were calculated for intention to treat in 80% meanwhile security aspects were descriptives in 95%. The average duration of CT was 26.1 months (range 1-126), excepting 10.8% that can last up to disease progression or to drug toxicity. Medical services implicated in CT were 41.5% oncology, 24.6% neurology, 7.6% pneumology, 7.6% digestive, 3% endocrinology, 3% psychiatry, 3% haematology and 9.7% others. A 93.7% of neurology CT and 33.3% of oncology CT studied new drugs.

Conclusion: The most frequent CT in the PhS was a multicentric, randomized, double-blind, with two treatment arms, controlled, phase III study and proposed as a superiority trial. It would be required statistical analysis of security values which was mainly descriptive. Oncology was the most important clinical service implicated in research. Neurology was the service with more new investigational drugs.

3-156

Category: Nutrition Support

Title: Calculating the electronic refractive index of the pediatric parenteral nutrition final product

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Purpose: The preparation of parenteral nutrition (PN) is a complex process, consisting of up to 37 different compounds. As such, PN is considered a medium-risk sterile preparation by USP <797> definition, and has the potential for causing serious harm to the patient if compounded incorrectly. Previous studies have established a linear relationship of the refractive index (RI) to the concentration of dextrose and amino acids in a base solution. A previous study developed an equation that calculates the RI value of a completed PN product, even after introducing additional ingredients to the dextrose and amino acid base solution. The purpose of this study is to validate that equation by comparing the calculated RI value of PN versus the measured RI value of PN as a potential method for quality assurance in pediatric PN compounding.

Methods: The equation used to calculate the RI value for each PN solution is based on the contributions of individual ingredients to the RI value of the finished product. This calculated value is then varied using a range of two standard deviations plus or minus 0.0045, thus producing a range of acceptable RI values. This range of plus or minus 0.0045 is capable of detecting a 3.46% change in dextrose concentration and a 2.27% change in amino acid concentration, within the standard manufacturing limits of 5%. The equation was validated by comparing the calculated RI value to the measured electronic RI value of 1057 different pediatric PN solutions using the correlation factor for statistical analysis. The measured RI was taken using an electronic refractometer with an accuracy of 0.00004.

Results: Of the 1057 samples, the calculated RI value was very similar to the measured value, being highly correlated with an r-squared value of 0.94 ($p < 0.0001$). Using a range of two standard deviations, plus or minus 0.0045, 99.8% of the samples fell into range.

Conclusion: This study confirms that there is no statistical difference between the calculated RI and the measured RI value in the final product of a pediatric PN solution. Quality assurance using a calculated RI value range when measuring the electronic RI is possible. This can be done quickly by personnel compounding PN to confirm compounding accuracy of dextrose and amino acid concentrations in the final product. In conclusion, comparing the calculated RI range to the measured RI value in pediatric PN

solutions can be used as end product testing for reducing compounding errors and potential patient harm.

3-157

Category: Nutrition Support

Title: Utilizing the parenteral nutrition (PN) ingredient shortages to improve nutritional care and reduce waste

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Purpose: Over the past four years medication shortages have nearly tripled, directly impacting various patient populations in acute care settings throughout the country. Baystate Medical Center (BMC) is a 653 bed tertiary care teaching institution that has developed a Drug Shortage Management Team to effectively identify ingredient and process alternatives for all shortages. Prior to the national amino acid shortage in August of 2010, BMC had minimal operational and clinical processes in place to ensure appropriate patients were ordered parenteral nutrition by appropriate providers. As a result we sought to use the shortage as an opportunity to reset all processes around parenteral nutrition (PN) and ensure patients who needed intravenous nutrition had access to it.

Methods: Our clinical pharmacy leadership team collaborated with the clinical nutrition team to create eligibility criteria for patients requiring parenteral nutrition; we utilized the ASPEN guidelines to create these criteria, and limited ordering access to appropriate clinicians via CPOE. Clinical changes were approved through our hospital pharmacy and therapeutics committee. All ASPEN recommendations for adult and pediatric parenteral nutrition were adopted and implemented. The most critical success factor was restricting parenteral nutrition so that a clinical dietitian consult was required; also approved was order entry only by a dietician or clinical pharmacist. We utilized twelve months of historical PN volumes to assess the impact of the changes.

Results: Parenteral nutrition ingredient shortages led to a critical examination of parenteral nutrition processes and the development of an effective management plan. We also were able to strengthen the working relationships between the clinical pharmacy and clinical nutrition team. Education of clinical pharmacists was conducted to ensure competency in the care of the patient receiving parenteral nutrition. The Pharmacy Department has identified and engaged a clinical pharmacist to serve as a nutrition support leader for education, oversight, and management of PN. Clinical dietitian consults and restricting order entry has resulted in a 3 TPN/PPN per day reduction (approximately 22% of our daily volume) based on the previous 12 months. Despite changes in ingredient availability, BMC has maintained the practice changes with continued success.

Conclusion: We utilized the PN ingredient shortages to identify opportunities for better nutritional care. We were able to implement new guidelines for use, maintain supply throughout the shortage period and eliminate approximately 22% of our PN use that may have previously been inappropriate.

3-158

Category: Oncology

Title: Impact of a pharmacist-driven pain rounding initiative conducted in hospitalized cancer patients

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Purpose: Chronic pain is one of the most common symptoms reported by oncology patients and management often requires complex medication regimens. As medication experts, pharmacists play a key role in optimizing pain management outcomes and can be critical to the success of the medication regimen. Chronic pain management was identified as an area of improvement in hospitalized oncology patients in our institution. In order to improve this aspect of patient care, we developed and implemented a pharmacist-driven inpatient rounding service that incorporated coordination of multiple care providers, bedside patient rounds, and practice guidelines allowing pharmacists to enter medication orders per accepted guidelines. Our goal was to evaluate the value of this initiative through both subjective patient pain scores and objective data including medication changes, dose adjustments, and initiation of supportive care modalities to the initial treatment regimen.

Methods: We implemented a daily team rounding process lead by a pharmacist that incorporated input from nursing, physician staff, and other appropriate ancillary disciplines. Patient eligibility criteria included patients admitted to the inpatient service with a non-surgical diagnosis receiving either a) two or more opioid medications or b) receiving opioid medication via PCA pump. Guidelines for treatment of chronic pain were approved by institutional committees and were based on previously established NCCN compendia guidelines. Data collection was performed from February 22, 2011 through May 31, 2011. Information was collected via review of the patient electronic health record as well as verbal patient interview questionnaires.

Results: 21 patients ranging in age from 23-64 years (mean 49 years) were eligible for study inclusion. Disease states included primarily solid tumor malignancies (90%), with biliary (14%), colorectal (14%), and pancreatic cancer (14%) occurring most commonly. Patients were followed for the duration of admission which ranged from 2 to 20 days (average 6.8 days). On admission, 52.4% (11/21) patients were not receiving an appropriate chronic pain medication regimen; which was defined as a long-acting opioid in combination with a short acting opioid for breakthrough pain. The remaining 10 patients were found to be receiving suboptimal dosing. The number of pain medications ordered on admission ranged from 1-5 (average 3.2). Bowel regimens were ordered upon admission in 12/21 (57%) patients. Following 2 days of intervention by the pain rounding service, all patients (21/21) were receiving an appropriate chronic pain regimen, with 52.4% (11/21) of patients initiated on new medication, and 47.6% (10/21) patients receiving higher doses of opioid medication. 19/21 patients (90.4%) also required

initiation or escalation of bowel regimen medication doses. Prior to a visit from the pain team, patients stated a subjective overall pain level of 6.23 (range 1-10). Following pain team intervention at 48 hours, pain level decreased to an average level of 2.9 (range 1-5.5, $p<0.0001$). When asked if their pain needs were being adequately addressed on a scale 1-10 (10 being completely addressed), the average answer was 4.9 (range 1-10). This perception significantly improved after 48 hours of pain team intervention to 9.5 (range 6-10, $P<0.0001$).

Conclusion: The initiation of a pharmacist-driven inpatient rounding service was valuable in improving both objective and subjective outcomes related to chronic pain management in our oncologic patient population.

3-159

Category: Oncology

Title: Medical team based clinical pharmacist lowers cost of medicines in head and neck induction cancer chemotherapy

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Purpose: In Japan, pharmacists have both a dispensing and clinical role. This study was designed to evaluate the benefit of team-based clinical pharmacy in cancer chemotherapy.

Methods: Subjects include head and neck cancer inpatients who received induction chemotherapy, TPF(docetaxel, cisplatin, and 5FU) or TPS(docetaxel, cisplatin, and 5FU), from June 2010 to December 2010(Group A) and also from November 2009 to May 2010(Group B). A retrospective study was performed using both patient records and medical fee receipts. In group B, a pharmacist was responsible for clinical pharmacy interventions and also dispensing. In group A, a pharmacy resident, acting as a team-based clinical pharmacist, provided interventions with three physicians. The endpoints of this study were: (1) To determine the duration of hospitalization, (2) To determine the medical costs, (3) To determine the number of pharmacist interventions that changed the treatment of the patients, and (4) To determine the receive fee-for-service reimbursement by pharmacists. The statistical difference was determined by Mann-Whitneyfs U test. Differences with P<0.05 was considered significant.

Results: There were 29 patients and a total of 67 chemotherapy sessions in group A while there were 36 patients and a total of 91 chemotherapy sessions in group B with no significant differences in age, performance status, and type of cancer. The results are: (1) Duration in hospitalization is statically significant shorter in group A than group B. (Group A v.s. Group B: 8.7±2.6 days v.s. 10.3±5.3 days, p=0.03) (2) Total medical cost except anticancer medicine and clinical examination was statistically significant lower in group A than group B (Group A v.s. Group B: 47,300±26,400 yen v.s. 51,580±54,020 yen, p<0.001). (3) In group A, there were 1.7 pharmacist interventions per chemotherapy (total 114 interventions) to change patients' pharmaceutical care compared to 0.06 pharmacist interventions per chemotherapy (total 6 interventions) in group B. Of the 114 interventions in group A, 23 interventions (20%) were related to chemotherapy. (4) In group A, it took 7.2 days to receive weekly fee-for-service reimbursements by pharmacists compared to 9.7 days in group B.

Conclusion: A team-based clinical pharmacist could contribute to reducing costs of medicine in chemotherapy and reducing the duration of hospitalization.

3-160

Category: Oncology

Title: Disintegration of chemotherapy tablets for oral administration in patients with swallowing difficulties

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Purpose: The administration of solid oral chemotherapeutics can be problematic in pediatric and adult patients with swallowing difficulties. Inability to swallow tablets can compromise compliance and may lead to poor clinical outcome. The current technique of tablet crushing to aid in administration is considered an unsafe practice by organizations such as the National Institute for Occupational Safety and Health (NIOSH) and the American Society of Health-System Pharmacists (ASHP) due to the potential exposure to hazardous dust. By developing a technique to disintegrate tablets in an oral syringe, the risk associated with tablet crushing can be avoided. The purpose of this study was to determine the feasibility of using disintegration in an oral syringe for the administration of oral chemotherapeutic tablets. Busulfan, cyclophosphamide, dasatinib, imatinib, mercaptopurine, methotrexate, mitotane, and thioguanine tablets were tested.

Methods: Tablets were placed in an oral syringe and were allowed to disintegrate in tap water. Various volumes and temperatures were tested to identify which combination allows for complete disintegration of the tablet in the shortest amount of time. Testing of disintegration involved two steps. First, disintegration was tested by pouring the dispersion prepared in an oral syringe through a wire screen. Then, tablet dispersions that completely passed through the screen were tested again by ensuring that the dispersion passed completely through the tip of an oral syringe. The oral syringe disintegration method was considered feasible if disintegration occurred in < 15 minutes and in < 20mL of tap water. Duration longer than 15 minutes was considered unacceptable due to the potential for drug decomposition. Volumes larger than 20mL were consider unsuitable for administration to infants and young children and adults with swallowing difficulties.

Results: The following tablets were shown to disintegrate within 15 minutes and in less than 20mL of tap water: busulfan, cyclophosphamide, dasatinib, imatinib, methotrexate, and thioguanine. For these drugs, drug-specific information pamphlets describing the technique were prepared for patients or caregiver use. Mercaptopurine and mitotane did not pass one of the methods of disintegration. Mitotane would not pass through the syringe and mercaptopurine did not disintegrate adequately to pass through the wire screen.

Conclusion: Disintegrating oral chemotherapeutic tablets in a syringe provides an enclosed system to administer hazardous drugs. This method allows for patients and caregivers to safely administer oral

chemotherapeutic tablets in the hospital or at home, avoiding the creation of hazardous dust. The oral syringe method is not limited to chemotherapy medications.

3-161

Category: Oncology

Title: Retrospective chart review of the safety and efficacy of loratadine and pegfilgrastim post-chemotherapy

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Purpose: Medical oncologists anecdotally prescribe antihistamines such as loratadine with colony-stimulating growth factors to treat or prevent bone pain associated with the injections. Filgrastim and pegfilgrastim are frequently known to cause both muscle and bone pain, with an incidence of bone pain of 25 to 45 percent. In 12 percent of patients, bone pain requires non-opioid analgesic treatment. In 6 percent of patients, bone pain is severe enough to require treatment with opioid analgesics. There is little evidence in the medical literature regarding the efficacy or safety of the combination of antihistamines and colony-stimulating growth factors. The purpose of the study was to determine if utilizing a single dose of loratadine prior to pegfilgrastim was associated with a lower incidence of bone pain or any increase in side effects when used for febrile neutropenia prophylaxis in patients receiving chemotherapy.

Methods: Patients were included if they received same day loratadine and pegfilgrastim post-chemotherapy as identified from a pharmacy database medication utilization report. Once patients were identified, a retrospective chart review was completed using a standardized data collection tool to gather data during a defined 6 month time period. Patient demographic data was collected as well as the quantity of pegfilgrastim doses, quantity of pegfilgrastim dose reductions, analgesic and antihistamine outpatient regimen, and notations regarding presence or absence of bone pain.

Results: 87 patients were ranged in age from 32 to 82 years (mean 52.8 years), 44 percent were male. The majority of patients had a solid tumor malignancy (n equals 80, 90 percent). The remaining patient population had lymphoma (n equals 7, 8 percent). The most common cancer types were lung (23 percent), colorectal (17 percent), breast (16 percent), and pancreatic (13 percent). Ten patients (11 percent) had an antihistamine listed in their outpatient medication regimen as ongoing therapy. There were 66 (76 percent) patients who had at least one opioid analgesic listed in their outpatient medication regimen, of which 44 percent (n equals 38) were prescribed a short-acting opioid only, 5 percent (n equals 4) were prescribed a long-acting opioid only, 28 percent (n equals 24) were prescribed both a short- and long-acting opioid, and 24 percent (n equals 21) were not on any opioid analgesics. Three patients in our sample had pegfilgrastim dose reductions and one patient had pegfilgrastim discontinued for future cycles due to related bone pain. Twelve patients (14 percent) had some relief

from loratadine dosing on same day as pegfilgrastim. Six patients (5 percent) had no relief from loratadine. The remaining 80 percent of patients had no chart notations documenting effectiveness or ineffectiveness of loratadine. There were no reports of side effects.

Conclusion: The combination of loratadine and pegfilgrastim given on the same day appears to be well-tolerated and possibly an efficacious option for the prevention of bone pain in an oncology population diagnosed with a solid tumor malignancy or lymphoma.

3-162

Category: Oncology

Title: Compliance with extended-duration low molecular weight heparin thromboprophylaxis after major abdominal surgery for gynecologic malignancy

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Purpose: Deep vein thrombosis (DVT) and pulmonary embolism (PE) after gynecologic surgery result in significant morbidity and mortality. The incidence of venous thromboembolism (VTE) in gynecologic cancer patients after major abdominal surgery has been reported to occur later in the post-operative course, with up to 36% of events occurring after 4 weeks. Both the American College of Chest Physicians (ACCP) and American Congress of Obstetricians and Gynecologists (ACOG) recommend extended-duration low molecular weight heparin (LMWH) thromboprophylaxis for up to 28 days be considered in this high risk population. Patient compliance with self-administration of LMWH for this duration following hospital discharge has not been reported. The purpose of this study was to determine patient compliance with extended-duration enoxaparin following exploratory laparotomy in the gynecologic oncology population.

Methods: This prospective study was approved by the institutional review board. Informed consent was waived as participation did not affect diagnosis or treatment. Patients undergoing major abdominal surgery for gynecologic malignancy discharged with a total of 28 days of enoxaparin thromboprophylaxis qualified for this study. Following completion of 28 days of enoxaparin, clinical pharmacists contacted the patients by telephone to assess compliance. Patients responded to a brief questionnaire regarding missed doses, timing of administration, and adverse effects.

Results: Fifty-one patients were discharged with extended-duration enoxaparin thromboprophylaxis between December 2010 and March 2011. Thirty-six patients (71%) were reached for follow up. Eighty-eight percent of these 36 patients completed the entire 28-day course. In patients who did not complete all doses, 83% missed 1-5 doses. No VTE events within 3 months of surgery occurred in these patients. The most common side effects reported were bruising (37%) and pain at the injection site (14%).

Conclusion: Patient compliance with extended duration LMWH prophylaxis in the gynecologic oncology population remains high. Patient compliance can be further confirmed with syringe counts at follow up clinic visits.

3-163

Category: Oncology

Title: Calcium channel antagonists prevent oxaliplatin-induced acute peripheral neuropathy; Retrospective analysis

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Purpose: Our recent studies using animals suggest that L/T-type calcium channels/transient receptor potential melastatin 8 pathway plays a critical role in oxaliplatin (L-OHP)-induced cold hyperalgesia. The co-administration of calcium channel antagonists inhibited L-OHP-induced increase in the response to cold stimulation in rats. The purpose of this study was to clarify retrospectively whether L-OHP-induced acute peripheral neuropathy is prevented in patients receiving calcium channel antagonists.

Methods: The medical records for patients who received modified FOLFOX6 regimen at Kyushu University Hospital from January 2008 to December 2010 were examined. The patients with known peripheral neuropathy, brain metastasis, prior L-OHP-containing chemotherapy, and medications reported to ameliorate various neuropathies were excluded. The endpoint is an occurrence of acute peripheral neuropathy including cold-induced perioral paresthesia, difficulty in swallowing, pharyngolaryngeal dysesthesia, throat and jaw tightness and dysphonia. To avoid the interfusion of chronic phase of neuropathy, the data for first 4 cycles of modified FOLFOX6 were used. Kaplan-Meier curves were used to assess the incidence of neuropathy.

Results: Of 200 patients receiving L-OHP, 84 patients were excluded due to the exclusion criteria. Calcium channel antagonists had been taken by 26 of 69 male patients, but only 3 of 47 female patients. Therefore, in the present analysis, the male data of the groups with and without calcium channel antagonists (N=26 and 43, respectively) were compared. The patient age was significantly higher in the group with calcium channel antagonists (70 vs 62, $p<0.01$). The incidence of acute peripheral neuropathy increased with increasing cumulative dose of L-OHP. The cumulative incidence curve was significantly lower in the group with calcium channel antagonists ($p<0.05$, log-rank test).

Conclusion: The present study indicated that calcium channel antagonists inhibit the development of acute peripheral neuropathy in patients receiving modified FOLFOX6 regimen.

3-164

Category: Oncology

Title: Generic docetaxel extended stability study

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Purpose: Docetaxel is available as trade name product (Taxotere, Sanofi-Aventis). This formulation includes polysorbate 80 and 13% ethanol. The company advised a compounded stability of 4 hours after preparation. A new generic docetaxel (Hospira) formulation contains polysorbate 80, polyethelene glycol and 28% Ethanol. The company advised 8 hour stability after compounding. Extended stability studies have documented that the compounded trade name product is stable at room temperature for 35 days. The following study was conducted to determine if an extended stability could be determined for this new generic formulation

Methods: To determine stability at all possible combinations docetaxel was prepared at 4 different concentrations in D5%W inn PAB (Braun) IV bags. (40 mg in 100 ml D5%W (0.4 mg/ml), 60 mg/100 D5%W (0.6 mg/ml), 250 mg/ 250 ml D5%W (1 mg/ml) and 125 mg/250 ml D5%W (0.5 mg/ml) The product was stored at room temperature and exposed to light. All bags were prepared in triplicate and labeled A, B and C for each concentration tested. A 0.5 ml sample was removed for each test and placed in a amber chromatography vial, sealed and kept at 4C until tested by High Performance Liquid Chromatography (HPLC). Standards were prepared from the injectable product and mixed with water. The standards were 0.2, 0.4, 0.6, 0.8, 1.0 and 1.2 mg/ml and used for a linearity test. The R2> 0.995 and run each day of the study. A stability indicating HPLC method was taken from the literature and adjusted for a shortened elution time of 1.60.1 minutes. The apparatus was an Agilent 1100, with mobile phase of 0.05 mM phosphoric acid 33% with acetonitrile 67%. The stationary phase was a Supelco reverse-phase C18 3m 4.6X 150 nm. The injection volume was 10mcL and the peak was assessed at 232 nm. Each container was samples at 0, 6, 24, 48 and 72 hours and again at 7 and 14 days. Each HPLC test was conducted in triplicate and the results reported as the mean with standard deviation. The RSD for all assays was < 1.5% demonstrating good uniformity and reproducibility of the assay.

Results: Each group of three samples was compared to a bracketed reference standard. Inter-day variation was less than 1%. Three dimensional plots of all wavelengths and elution times revealed no new peaks were generated by this experiment. After 14 days there was no significant change from the original concentrations for all solutions tested. Due to limitations of USP 797 on sterility issues, the study was concluded at 14 days.

Conclusion: Docetaxel (Hospira) is stable in D5%W (PAB bags) for 14 days at room temperature of concentrations of between 0.4 to 1.0 mg/ml.

3-165

Category: Oncology

Title: Influence of dexamethasone on blood glucose levels in cancer patients with diabetes

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Purpose: Dexamethasone (DEX) is used to prevent nausea and vomiting, allergic symptoms, and edema in many cancer chemotherapies. Since DEX is well known to elevate blood glucose levels, much attention should be paid to the levels in cancer chemotherapy especially in patients with diabetes. However, there has been insufficient information on this matter in such patients. The purpose of this study was to clarify the influence of DEX on blood glucose levels in cancer chemotherapy in patients with diabetes.

Methods: We conducted a retrospective chart review of 36 inpatients who concomitantly received DEX, anticancer drugs and oral hypoglycemic agents or insulin in Kyushu University Hospital from January 2009 to October 2010. The medical information including the administration period and doses of DEX, and fasting blood glucose (FBG) levels for each patient was obtained from electronic medical charts.

Results: Before the start of cancer chemotherapy, the FBG levels in all patients were controlled well. Of 36 patients 13 were excluded because the data of FBS levels was not collected during the chemotherapy. The doses of DEX varied from 8 to 80 mg in 23 patients, but12patients were administered 8 mg during the chemotherapy. The administration period of DEX was 1 day for 18 patients and 2 or more days for 5 patients. Seven of 18 patients (39%) who received DEX on day 1 only showed a marked elevation of FBG levels (more than 300 mg/dL on day 1). In 4 of 18 patients (22%) high FBG levels were maintained until day 2. The highest FBG levels were observed before dinner on day 1. The FBG levels of patients receiving insulin were relatively higher than those of patients receiving oral hypoglycemic agents. No patients were observed diabetic ketoacidosis or hyperosmolar hyperglycemic states.

Conclusion: These results suggest that the administration of DEX markedly elevates blood glucose levels in cancer chemotherapy in patients with diabetes. Therefore, appropriate counteract against elevation of blood glucose levels is required when DEX is administered to such patients.

3-166

Category: Oncology

Title: Influence of continuing education on pharmacist knowledge and competence in chemotherapy-induced nausea and vomiting

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Purpose: Despite significant progress in the prevention and treatment of chemotherapy-induced nausea and vomiting (CINV), results remain suboptimal. An estimated 70-80% of patients undergoing chemotherapy experience CINV. Unfortunately, CINV prevention and treatment strategy is confounded by multiple guidelines and diverse practitioner preferences. Healthcare professional review of clinical trial results and discussion regarding appropriate incorporation into therapeutic decision making is necessary to provide the highest quality patient care. Increasing awareness of pharmacists on similarities and differences amongst practice management strategies helps to benchmark individual practices against ones professional peers. Pharmacist focus on CINV can contribute to improved patient quality of life as well as provide pharmacoeconomic benefit to the healthcare system.

Methods: Outcomes assessments were gathered during 40 independent continuing education activities held within medical institutions and communities across the USA. At the beginning of each activity, participants were asked a series of case-based questions to assess baseline knowledge, competence, and identify practice patterns. The assessments were repeated after each activity in order to determine change. Barriers to implementing the information learned were captured via a 6-week electronic survey. Educational gaps were identified through documentation and comparison of current best practices versus actual participant responses.

Results: A total of 347 pharmacists (39%) participated in the multidisciplinary program, which was also comprised of 148 physicians (16%) and 271 (29%) nurses. The number of chemotherapy patients cared for each month ranged from 1-10 (30%) to > 40% (32%). This represents a potential impact of 18,736 patient lives. In assessing the ability to define therapy goals for antiemetic regimens, pharmacist baseline knowledge gap was 70% with just 30% of participants able to correctly identify the desired duration of anti-emetic efficacy post chemotherapy administration. Post program completion, 70% correctly identified a 5-day duration. Prior to the program, 63% demonstrated competence in assessing patient risk factors for CINV which increased to 87% post program completion. Furthermore, 67% were able to identify an appropriate acute CINV regimen for highly emetogenic chemotherapy which increased to 90% post program. Finally, at baseline 47% correctly identified which 5HT3 antagonist is

FDA approved for prevention of delayed nausea and vomiting which increased to 69% after the educational program. The most common antiemetic guidelines used were institution developed pathways (36%) and NCCN guidelines (36%), followed by ASCO (18%), or ASHP (4%) guidelines. The most common 5HT3 antagonist used in their practice setting was ondansetron (72%) followed by palonosetron (18%), granisetron (9%), and dolasetron (1%). The use of aprepitant for highly emetogenic chemotherapy regimens was always (59%), sometimes (33%), and never (9%). Just 29% had dispensed or recommended olanzapine for the indication of nausea and vomiting. At 6-weeks post program completion, barriers to applying the information learned into daily practice included patient financial barriers (38%), institutional financial barriers (36%), potential side effects (16%), and perceived efficacy (10%).

Conclusion: The data suggest educating pharmacists on clinical trial results along with discussion of optimal translation of this information into patient care increases pharmacist knowledge and competence in CINV management.

3-167

Category: Oncology

Title: Retrospective analysis of antibiotic prophylaxis in afebrile, neutropenic patients

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Purpose: Prior to November 2010, the Infectious Diseases Society of America (IDSA) did not recommend routine antibiotic prophylaxis for afebrile neutropenic patients due to previous studies showing lack of survival benefit and concern for antibiotic resistance. However, recent studies have revealed that antibiotic prophylaxis was associated with reduced mortality, febrile episodes, and bacterial infections in neutropenic patients. The purpose of this study is to assess the efficacy of antibacterial prophylaxis in afebrile neutropenic patients receiving intensive inpatient chemotherapy.

Methods: The institutional review board approved this 10-year retrospective analysis of patients treated with high-intensity chemotherapy between July 1, 2000 and June 30, 2010. Patients were included if they had a diagnosis of non-Hodgkins lymphoma, acute leukemia, or high grade multiple myeloma; were treated with a highly myelosuppressive chemotherapy regimen; and had neutropenia for greater than or equal to 7 days during the first cycle of intensive chemotherapy. Patients were excluded if they had documented fever or infection within 1 week prior to starting chemotherapy, or if they received parenteral antimicrobial treatment less than or equal to 5 days preceding the development of neutropenia. The incidence of febrile neutropenia in patients who received prophylaxis was compared to those who did not during the first cycle of chemotherapy. This study also compared the incidence of infection, sepsis, ICU admissions, duration of hospitalization, and death between the two groups. The students t-test was used to evaluate the outcomes.

Results: Thirty-six patients met the inclusion criteria. Twenty patients received antibacterial prophylaxis whereas 16 patients did not. When comparing outcomes between patients who received prophylaxis versus those who did not, the incidence of fever was 70 percent versus 69 percent (P equals 0.94); the incidence of infection was 35 percent versus 38 percent (P equals 0.65); and the incidence of sepsis was 25 percent versus 13 percent (P equals 0.36). Patients who received prophylaxis had an average duration of hospitalization of 25 days versus 26 days for patients with no prophylaxis (P equals 0.79). One patient in each group was admitted to the ICU (P equals 0.88), and one patient who received prophylaxis died due to infection (P equals 0.38). Febrile patients had an average neutropenic duration of 18 days versus 11 days in afebrile patients (P equals 0.036). All patients who were neutropenic prior to chemotherapy developed fever versus 62 percent of patients who were not previously neutropenic (P equals 0.052).

Conclusion: Due to the small sample size, there was no statistical difference in outcomes (i.e. fever, infection, and sepsis) in neutropenic patients who received prophylaxis versus those who did not. The findings reported in this study suggest that febrile episodes occurred more frequently in patients with longer neutropenic duration, which could place them at higher risk of developing infections. As currently recommended by the updated IDSA guidelines, it is reasonable to consider antibiotic prophylaxis for high risk patients.

3-168

Category: Oncology

Title: Dapsone-induced methemoglobinemia in a patient with acute lymphocytic leukemia admitted with severe Legionella pneumonia

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Purpose: Dapsone is an anti-bacterial used as an alternative to the first line therapy (sulfamethoxazole-trimethoprim) for Pneumocystis pneumonia. Methemoglobinemia is a known toxicity of this drug. However, dapsone-induced methemoglobinemia in an acute lymphocytic leukemia (ALL) patient with severe Legionella pneumonia has not been previously reported. We describe a 37 year-old male (height 66 in, weight 111 kg, body mass index 39.5 kg/m2) with pre-B cell ALL that was admitted for severe Legionella pneumonia sepsis, rhabdomyolysis, and multiple organ failure. The patient originally presented to an outside hospital five days earlier with acute mental status changes, generalized fatigue, and fevers. He was currently on his 14th cycle of chemotherapy. The patient was found to be neutropenic and was started on broad-spectrum antibiotics. He was also continued on dapsone for Pneumocystis jiroveci pneumonia prophylaxis, which he had been taking for the last 1 1/2 years due to a potential methotrexate interaction with sulfamethoxazole-trimethoprim (SMZ-TMP). He was subsequently intubated for respiratory failure. A methemoglobin level was obtained and reported as 24.5%. After a repeat methemoglobin level of 28.7%, intravenous methylene blue 100 mg was given for a total of two doses after which the methemoglobin level decreased to 2.5%. The patient remained intubated for 4 more days after the treatment of methemoglobinemia and was subsequently extubated. He was discharged home in stable condition. Based on a calculated Naranjo score of 7, dapsone use was the probable cause of methemoglobinemia. This patient developed severe sepsis with multi-organ failure which resulted in acute liver and renal insufficiencies. The decreased metabolism and excretion of dapsone and its toxic metabolite is the likely cause of methemoglobinemia in this case. Critically ill immunocompromised oncology patients require careful monitoring for dapsone-induced methemoglobinemia. Liver dysfunction and renal failure are both possible causes for increased toxicity with relatively benign doses of dapsone.

Methods: N/A

Results: N/A

Conclusion: N/A

3-169

Category: Oncology

Title: Patient cost for extended-duration enoxaparin after major abdominal surgery for gynecologic malignancy

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Purpose: Deep vein thrombosis (DVT) and pulmonary embolism (PE) after gynecologic surgery result in significant morbidity and mortality. The incidence of venous thromboembolism (VTE) in gynecologic cancer patients after major abdominal surgery has been reported to occur later in the post-operative course, with up to 36% of events occurring after 4 weeks. Both the American College of Chest Physicians (ACCP) and American Congress of Obstetricians and Gynecologists (ACOG) recommend extended-duration low molecular weight heparin (LMWH) thromboprophylaxis for up to 28 days be considered in this high risk population. However, third-party coverage for VTE prophylaxis in abdominal surgery is often limited to 12 days duration based on FDA-approved prescribing information. As a result, clinicians are sometimes hesitant to prescribe extended-duration enoxaparin due to concerns of high cost to patients. The primary purpose of this study was to determine the average patient cost for extended-duration enoxaparin prophylaxis. The percentage of patients requiring prior authorization and who qualified for the Lovenox Patient Assistance Program (PAP) were also assessed.

Methods: This prospective study was approved by the institutional review board. Informed consent was waived as participation did not affect diagnosis or treatment. Patients undergoing major abdominal surgery for gynecologic malignancy discharged with a total of 28 days of enoxaparin thromboprophylaxis qualified for this study. Test claims for extended-duration enoxaparin were submitted for each patient prior to hospital discharge. Patient cost and the percentage of patients requiring prior authorization and those qualifying for the PAP were collected.

Results: 370 patients were discharged with extended-duration enoxaparin thromboprophylaxis between October 2009 and May 2011. The average patient cost to complete 28 days of enoxaparin prophylaxis was $74 (median $21, range $0-1210). Prior authorization was required for 38 patients (10%). Two patients (0.5%) qualified for the Lovenox Patient Assistance Program. A decrease in the average patient cost from $96 to $50 (median $33 to $10) for enoxaparin prophylaxis was also observed after generic enoxaparin approval in July 2011.

Conclusion: Our results support affordability of extended-duration enoxaparin prophylaxis after major abdominal surgery for cancer. Although patient assistance programs do exist, the majority of patients do not meet criteria for approval.

3-170

Category: Oncology

Title: Analysis of antitumor drugs irrational prescription in the ward

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Purpose: Analysis of antitumor drugs irrational prescription mixed in pharmacy intravenous admixture servers (PIVAS).

Methods: Collected antitumor drugs prescription in PIVAS from October 2009 to October 2010 , and statistics and analysis for their rational use.

Results: Irrational prescription, there were 44.57% concerned with solvent selection28.26% concerned with drug concentration , 27.17% concerned with improper out off label. Pharmacist intervened all of the problems , more than 99% were accepted.

Conclusion: Pharmacists in PIVAS play an important role in the rational use of drugs for patients, and provide a safe and effective drugs. To further improve the rational use of antitumor drugs, its necessary for pharmacists to carry out drug education to the doctors, and train a qualified nurses team for rational use of antitumor drugs, and it is very important to build a smooth communication way with medical term.

3-171

Category: Oncology

Title: Survival benefits associated with chemotherapy in patients diagnosed with pancreatic cancer

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Purpose: Pancreatic cancer is the fourth most common cause of cancer-related deaths in the United States. Median age of diagnosis in patients with pancreatic cancer is 72. Previous trials have concluded that chemotherapy improves survival in both the adjuvant and palliative settings, but limited data exists in the elderly population. This retrospective study was designed to identify the benefit of chemotherapy in elderly patients diagnosed with pancreatic cancer.

Methods: Data on patients diagnosed with pancreatic cancer from 1993 to 2008 was collected from the Cancer Information Resource File. Complete data on age and gender of patients, stage, tumor characteristics, treatment, and overall survival were available on 16,694 patients. Data was analyzed by age in three groups: less than or equal to 50 years (group A), 50 to 70 years (group B), and greater than 70 years (group C). Multivariate Cox regression analysis adjusted for age, gender, grade, histology, stage, site, surgery and radiation. This project was exempt from Institutional Review Board approval as anonymous data was collected from a national database.

Results: Of the 16,694 patients analyzed, 9 percent were in group A, 47 percent group B, and 44 percent group C. The majority of patients had adenocarcinoma histology (group A 96 percent, group B 98 percent, group C 98 percent). Significantly less patients in group C had surgery (group A 24 percent, group B 25 percent, group C 18 percent), radiation (group A 35 percent, group B 33 percent, group C 21 percent), or chemotherapy (group A 69 percent, group B 60 percent, group C 38 percent). Multivariate Cox regression analysis suggested chemotherapy had significant benefit in overall survival after adjusting for age, gender, grade, histology, stage, site, surgery and radiation [overall survival benefit: group A 26 percent, group B 65 percent, group C 49 percent (p value less than 0.001)].

Conclusion: Chemotherapy benefit was statistically significant in all age groups; however, older patients received chemotherapy less frequently than younger patients. Hence, we conclude that patients with pancreatic cancer who have a performance status that will tolerate chemotherapy should receive it. Prospective trials are needed to determine the clinical benefit of chemotherapy in the aging population.

3-172

Category: Operating Room Pharmacy

Title: Safety and immunogenicity of recombinant human thrombin: pooled data from ten clinical trial

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Purpose: Recombinant human thrombin (rThrombin; RECOTHROM) is an active topical hemostatic agent that promotes local hemostasis when applied to a site of bleeding. Pooled adverse event and antibody data from 10 clinical trials (Phase 1 Phase 4) in adult and pediatric patients were analyzed to assess the safety and immunogenicity of treatment with rThrombin.

Methods: In each study, rThrombin was applied topically with either an absorbable gelatin sponge or spray applicator during a single surgical procedure on Day 1. Adverse events were monitored from Day 1 to Day 29. Immunogenicity analyses were performed on baseline and Day 29 samples using sequential enzyme-linked immunosorbent assays. Antibodies to rThrombin were further evaluated for their ability to neutralize the activity of native human thrombin.

Results: A total of 644 patients were treated with rThrombin. Types of surgical procedures included spinal (34% of patients), major hepatic resection (12%), peripheral arterial bypass (22%), arteriovenous graft formation for hemodialysis access (17%), and synchronous burn wound excision and skin grafting (16%). Median overall age was 58 years (range: 0.9 89) and 55% of patients were male. Median rThrombin administered per patient was 12.4 mL (range: 1-60; 1000 IU/mL rThrombin was administered for 99% of patients). Incision site pain (47% patients), procedural pain (33%), and nausea (26%) were the most commonly reported events overall. The most common adverse events in patients aged 0-16 years (N=29) were procedural pain (41%), pruritis (41%), and anemia (31%). The incidence of adverse events varied by type of surgical procedure; e.g., muscle spasms were most common after spinal procedures, pruritus was most common after burn wound excision, and hypokalemia, hypomagnesemia, and hypophosphatemia were most common after hepatic resection. Five of 609 patients had developed antibodies to rThrombin at Day 29, approximately 1 month after treatment (0.8%; 95% CI: 0.4%, 2.8%). These antibodies did not neutralize human thrombin.

Conclusion: Recombinant human thrombin was well tolerated; adverse events were consistent with those expected for the surgical settings studied. Less than 1% of patients developed antibodies to rThrombin, and these antibodies did not neutralize the activity of human thrombin. These results support the safety of rThrombin as a hemostatic agent in a variety of surgical settings for patients of varying ages.

3-173

Category: Operating Room Pharmacy

Title: Management of drug shortages in the perioperative setting

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Purpose: Drug shortages can be a challenge to healthcare professionals. There is a high potential for patient harm and significant cost implications when medications suddenly become unavailable. Anesthesia agents such as succinylcholine, neostigmine, glycopyrrolate, remifentanyl, vecuronium, and cisatracurium are a few of the affected medications that are used as standards of practice in the perioperative setting. Shortages of these products has largely impacted the way our providers care for patients and how pharmacy must make product available for use. As a large academic hospital, the Operating Room (OR) Pharmacy Satellite has needed to collaborate with internal and external care providers to develop management plans for navigating through many shortages that have affected the perioperative setting. We describe strategies used in the perioperative setting to manage drug shortages experienced from 2009 to mid 2011.

Methods: Examples of these strategies include: reducing quantities or removing available product in anesthesia trays, implementing medication use restrictions, introducing alternative products, and implementing pharmacy prepared premixed syringes. Multiple strategies were implemented on some agents such as vecuronium where the product was removed from anesthesia trays, alternative strength vials were purchased and premixed syringes were prepared. For cisatracurium, an alternative product was purchased, vials were removed from anesthesia trays and a restriction was placed on its use. For example, patients needed to have a serum creatinine greater than 2. For succinylcholine, we implemented restrictions on its use as well as decreasing the quantities in the anesthesia trays. The OR pharmacy has also developed a system for updating providers of current shortages via a white board at the pharmacy window.

Results: By working together and properly educating staff, the OR pharmacy has been able to decrease use and waste of medications on national shortage. For example, we decreased our usage of succinylcholine from 50 vials per day prior to the shortage to less than 10 vials per day implementing multiple strategies as discussed above. Similar results were seen with other medications as well. While some facilities have witnessed postponements and cancellations of procedures due to the shortages, we have managed to prolong available supply and continue surgeries as scheduled.

Conclusion: Although you cannot predict drug shortages, proper planning and a formal management system will help decrease the risk of harm to our patients.

3-174

Category: Operating Room Pharmacy

Title: Analysis of pharmaceutical services in operating room

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Purpose: Pharmacy services in Japan have traditionally consisted of dispensing, drug information and inventory management practices. Pharmacistfs impact related to the implementation of medication safety standards, drug therapy optimization, and other clinical interventions have not been adequately reviewed in settings such as the operating room. As a result, these activities have not become the standard of practice. In this study, we evaluated the clinical interventions contributed by pharmacists working in the operating room of Hiroshima University Hospital, and their rate of acceptance.

Methods: We carried out a retrospective analysis of all clinical interventions and drug information provided in the operating room from February 2009 to April 2009. We also investigated the acceptance rate of these interventions and drug information recommendations that pharmacists provided to physicians and nurses.

Results: In a 3-month period, pharmacists clinically intervened in 94 cases. These interventions were accepted by physicians or nurses. The most common intervention recorded was the prevention of adverse drug events. The major information provided to physicians and nurses was on usage, dosage, stability, incompatibility, pharmacological effects and adverse effects (20.0%, 17.4%, 10.9%, 8.7%, 10.9%, 23.9%, respectively). The overall acceptance rates for the interventions based on the information were 90.4%.

Conclusion: In Japan, pharmaceutical services in operating room have not been well demonstrated and evaluated. However, our findings clearly showed that physicians and nurses required the drug information provided by the pharmacist in the operating room. Furthermore, the acceptance rates for the intervention were extremely high. It is suggested that these services might be quite important in optimizing drug therapy and preventing adverse effects. Additionally, the economic impact was identified through the cost reduction in drug therapy. Accepted clinical interventions reduced the cost of the drug therapy by approximately 4,818 dollars during the period. It is suggested that stationing pharmacists in the operating room might be indispensable for hospital administration in the points of view for the medication safety and cost reduction.

3-175

Category: Operating Room Pharmacy

Title: Pharmacist participation in annual safety orientation for incoming clinical anesthesia program (CA1) residents

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Purpose: Perioperative preparation of sterile products is a routine and necessary task for anesthesiologists. Even in institutions where pharmacy provides medications in ready-to-use form, pharmacy preparation of all potential intraoperative medications is not feasible or cost-effective. However, medical residents accepted into anesthesiology training programs have rarely received training in safe technique for preparation of sterile products, nor does formal training typically occur during the residency program. Direct observation of medication preparation technique of anesthesia residents often reveals unsafe practices. The breadth of the problem is further evidenced by multiple reports in medical literature and the lay press of patient harm due to contamination or errors occurring during preparation of medications by anesthesiologists. Pharmacy was invited to participate in a three-day safety orientation for incoming CA1 residents, and used the opportunity to lay the groundwork for safe medication practices.

Methods: An interactive slide presentation was developed which presented medication-related case scenarios in which patient harm occurred, followed by analysis of the identified contributing factors. Medication safety pitfalls were grouped into four categories: contamination, wrong drug, wrong dose, and other. Recommended best practices were then presented. Polling questions were inserted throughout the presentation to engage the participants. Finally, residents were provided with needles, syringes, alcohol swabs, vials, ampules, and labels, and practiced aseptically drawing up medications and labeling them appropriately.

Results: Medication-related regulatory standards and safe practices were introduced at the onset of the anesthesiology training program. The residents participated fully in the interactive presentation, and appreciated the opportunity for hands-on practice in preparing medications. Pharmacy was invited to participate the following year with a longer time allotment. Pharmacists demonstrated their expertise and their roles as educational resources and team members.

Conclusion: The annual CA1 safety orientation series was established in 2010 by anesthesia leadership, with the goal of raising awareness of issues residents will face in training and practice. While it is acknowledged that hard outcomes will be difficult to measure based on a single educational intervention, it is hoped that the groundwork for a culture of safety will be established. The opportunity

to participate in the annual safety orientation for incoming CA1 residents offers pharmacists a forum in which to raise awareness of medication safety issues, establish a baseline knowledge level of safe medication practices, and demonstrate their role as integral members of the anesthesia team.

3-176

Category: Operating Room Pharmacy

Title: Optimizing the use of inhaled anesthesia gases in the operating room

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Purpose: Both sevoflurane and desflurane are haloalkane, volatile liquid inhalation anesthetic agents utilized in the operating room for both induction and maintenance of general anesthesia in inpatient and outpatient surgery settings. At our institution, sevoflurane and desflurane are formulary anesthetic agents. A recent 6-month report of inhaled gases purchases revealed an increase in use of desflurane compared to sevoflurane, warranting identification of opportunities for improvement and implementation of strategies to assure appropriate use of inhaled anesthetic gases. The primary objective of this project was to characterize the current usage patterns of sevoflurane and desflurane in the operating room. Secondary objectives were to evaluate literature and develop strategies for best clinical practice and effective use of these agents.

Methods: All adult patients who received sevoflurane or desflurane in the operating room between February 1, 2010 and February 29, 2010 were evaluated through a retrospective chart review, specifically anesthesiology records, nursing intra-operative records, and post anesthesia care unit records. Data collected included: demographics, surgical procedure, average length of procedure, average flow rate of inhaled gas, average length of inhaled gas delivery, average time to emergence, average length stay and adverse events in the post anesthesia care unit. Annualized cost to institution was assessed and literature evaluation was performed to optimize the use of sevoflurane and desflurane inhaled anesthetic agents.

Results: A total of 719 patients were included in the final analysis. In 51% (366/719) of surgical procedures, patients received sevoflurane and in 49% (353/719) patients received desflurane. Both desflurane and sevoflurane were utilized in orthopedic procedures (32.5%, 115/353 versus 37%, 135/366 respectively). Average length of procedure was 1 hour and 24 minutes for patients receiving desflurane versus 55 minutes for patients on sevoflurane. Average length of drug delivery for desflurane was 1 hour and 39 minutes compared to 1 hour and 9 minutes for sevoflurane procedures. Average time to emergence was 19 minutes for desflurane and 16 minutes for sevoflurane. Average length of post anesthesia care unit stay was similar for both agents (2 hours and 15 minutes). Post anesthesia care unit adverse events occurred most frequently in procedures lasting from 60minutes to 120minutes for both inhaled gases (99 events with desflurane versus 77 events with sevoflurane). Recommendations for desflurane and sevoflurane use were established via Anesthesia Subcommittee and included: use and

avoidance of desflurane over sevoflurane in specific patient populations and procedures as well as maximum flow rates restrictions.

Conclusion: The use of inhaled anesthetic agents, specifically desflurane has posed a significant financial impact to our institution. Evaluation of inhaled anesthetic agents in the operating room revealed opportunities for improvement which included: recommendations/restrictions for desflurane and sevoflurane use, anesthesiologist and nurse anesthetist education on proposed changes, and tracking and reporting of monthly inhaled gases purchases. Despite these changes, there are additional opportunities for improvement, including development of inhaled gases guidelines, operating room staff education and ongoing data monitoring to further guide and promote use of these anesthetic inhaled agents.

3-177

Category: Operating Room Pharmacy

Title: Operating room pharmacist journal club: one year later

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Purpose: Operating room (OR) pharmacists practice in a specialized setting in which unfamiliar medications unique to that practice setting are used, and familiar medications are used in unique ways. Professional development of pharmacists rotating through the OR satellite pharmacy was recognized as a priority in the pharmacy department. A journal club was found to be a practical format for establishing and maintaining a baseline knowledge level in topics directly related to the practice of pharmacy in the operating room setting.

Methods: The OR pharmacists gathered for a planning retreat. A monthly journal club was agreed to, with the first years topics to be review articles suitable for establishing a knowledge base. Topics were identified that related to the practice of pharmacy in the operating room. These topics included: inhaled anesthesia, intravenous anesthesia/induction agents, local/regional anesthesia, malignant hyperthermia, neuromuscular blocking agents, pain management, postoperative nausea and vomiting, and surgical site infections. Literature was identified which covered each individual topic. Each OR pharmacist was responsible for reading the articles, contributing to the discussion, and participating in the development of competency questions. The pharmacists planned an end of year retreat to assess the overall progress, and identify additional topics to be covered.

Results: All operating room pharmacists have read and discussed the articles and answered all competency questions for the eight identified topics. The articles and questions were organized into learning modules for reference and use in future training. The modules will also be used for student teaching, as the OR pharmacists are planning to develop a fourth year pharmacy student experiential rotation site.

Conclusion: The operating room pharmacist journal club was successful in determining appropriate topics for review, developing competency questions related to selected articles, and developing a comprehensive set of modules. These modules will serve beneficial for training new pharmacists in the OR pharmacy as well as developing an experiential rotation site for pharmacy students. The pharmacists who have participated in the journal club feel that the knowledge base gained from the program has elevated their confidence in practicing pharmacy in the operating room setting.

3-178

Category: Pain Management

Title: Assessment of a pain management initiative in adult oncology patients

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Purpose: Pain is the most common and feared symptom of cancer, as well as the most under-treated disease side effect. Under-treatment is usually attributed to inadequate prescribing, under-use of opioids by the healthcare team, and poor pain assessment. An interdisciplinary approach to pain management with a focus on educating providers about adequate assessment and opioid dosing has been shown to be effective at overcoming treatment barriers. The purpose of this study is to assess the outcomes of a pain management initiative that encompasses education about pain assessment and documentation, opioid dosing and titration, and management of opioid side effects at UAB Hospital.

Methods: A pain management initiative was initiated on the oncology/hematology inpatient ward to include all patients admitted between January 1, 2011 and March 28, 2011. Prior to initiation, the house and nursing staff were educated about pain assessment and documentation and optimal opioid dosing and titration. In order to provide a comparative group, pain assessment and documentation data was collected after the above education and prior to implementation of the algorithm.

Results: After implementing the initiative on the hematology/oncology medical ward, approximately 77% and 90% of patients achieved pain score values 3 within 48 hours of hospital admission and on the day of hospital discharge, respectively. Comparatively, the pre-pain initiative group had 63% and 76% of patients achieve pain score values 3 within 48 hours of hospital admission and on the day of hospital discharge, respectively. Physician and nursing adherence to the pain initiative was also assessed. In the post-pain initiative group 27/30 patients were prescribed pain medication on admission, compared to 24/30 in the pre-pain initiative group. This resulted in pre-pain and post-pain initiative physician adherence rates of 80% and 90%, respectively. The nursing adherence rate was 77% in the post-pain initiative group. In the pre-pain initiative group, the adherence rate was 73%.

Conclusion: Based on the percentage of patients who achieved pain scores 3 within 48 hrs of admission and at hospital discharge along with only one documented adverse event the oncology pain initiative was safe and effective in oncology patients of UAB Hospital. In an effort to facilitate continued improvement in patient pain scores, monthly education will continue to be directed towards the physician staff. There will also be continued oversight of nursing documentation of pain scores with monthly audits.

3-179

Category: Pain Management

Title: Standardized patient-controlled analgesia (PCA) order set reduces naloxone administration rate

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Purpose: A review of naloxone usage at Saint Vincent Health Center (SVHC) found nearly half of the patients receiving naloxone were on patient-controlled analgesia (PCA). The majority of patients on PCA were opioid-naive and receiving a basal rate. In an effort to improve safe PCA use, the current PCA order set was revised.

Methods: Following initial review of naloxone use, the standardized PCA order set was revised to include pre-determined regimens without a basal rate for opioid-naive patients and patients at high risk for adverse events. The revised order set was implemented in September 2010. A follow-up evaluation was completed to track the naloxone administration rate and characterize prescribing patterns with the revised order set.

Results: During the baseline period, 2.5% of patients on PCA received naloxone and 65% of these patients had a basal rate. Following implementation of the revised PCA order set, the naloxone administration rate for patients on PCA decreased to less than 1% with 40% of these patients prescribed a basal rate. Surgical specialties were the most frequent prescribing group and 77% of patients were prescribed a pre-determined regimen. Thirteen percent of patients required a change to the initial PCA regimen prescribed; the majority of these patients were opioid tolerant and required an increase in dose or addition of a basal rate.

Conclusion: Implementation of a standardized PCA order set with pre-determined regimens for opioid-naive patients and patients at high risk for adverse events reduced the rate of naloxone administration.

3-180

Category: Pain Management

Title: Evaluation of pain assessment and management in cancer patients

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Purpose: Pain is one of the most common associated symptoms in oncological patients. It develops a number of devastating physical and psychological symptoms. NCCN guidelines 2010 recommend comprehensive assessment and optimal management for all oncological patients to improve their quality of life. The purpose of this study was to evaluate the current pain assessment and management plans in cancer patients.

Methods: We conducted a prospective multicenter observational study in three Lebanese university hospitals. Men and women aged 18 years and above were observed if they have had any type of cancer, more than one day of hospitalization, cancer related pain, and receiving analgesics. Patients with brain metastasis, bone fractures, organ obstruction and perforation, or surgery as part of treatment regimen were excluded. 508 patients were screened over a period of 4 months, where 100 patients have met the eligibility criteria and were observed. The primary outcome measure was evaluation of pain assessment adherence to the NCCN guidelines. Secondary outcomes included evaluation of adherence of pain management approaches in terms of: choice of opioidal agent, dosing of opioidal agent, and administration of non-opioidal analgesics. Data are expressed as frequencies, and evaluation of primary and secondary outcomes utilized analysis of linear regression.

Results: Out of 100 patients, 82 percent were not adhered to the pain assessment guidelines versus 18 percent adhered to the pain assessment guidelines (P equals 0.002).Although patients were assessed by a health care provider during initial hospitalization, yet, no tool was used for assessment, and there was no documentation of measured pain intensity, as well as, reassessment after treatment intervention was not routinely performed. For the pain management adherence, 76 percent were adhered versus 24 percent were not adhered, P equals 0.006. The non-adherence was in the choice of opioidal agent (61.8 percent versus 38.2 percent, P equals 0.003), and in the dosing of opioidal agent (75.5 percent versus 24.5 percent, P equals 0.001). Well adherence was observed in terms of non-opioidal analgesics use (72.5 percent were adhered versus 27.5 percent were not adhered, P equals 0.01).

Conclusion: Poor overall adherence to NCCN guidelines was found, and the gaps were related to pain assessment and management recommendations. Awareness regarding pain assessment, the choice of

opioidal agent and the dosing of opioidal agent are essential not only to improve the overall adherence to the guidelines, but also patients' quality of life.

3-181

Category: Pain Management

Title: Intravenous acetaminophen for post operative pain management at Veterans Administration Medical Centers (VAMC): cost minimization analysis

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Purpose: Intravenous (IV) acetaminophen (APAP), an agent which has been used for a number of years in European countries, has just received approval from the Federal Drug Administration (FDA) for use in the U.S. While IV APAP's current place in therapy is not entirely clear, its introduction into the market creates an opportunity to expand the analgesia multimodal approach to better control acute post operative pain. Based on the lack of published data in the U.S., we performed a cost minimization analysis utilizing European data to determine the possible role of IV APAP post operatively in orthopedic surgeries performed at the Veterans Administration Medical Centers (VAMC). A cost minimization analysis was conducted to determine the cost implications of IV APAP when given concurrently to orthopedic post operative adult patients receiving IV morphine for pain management, aiming to provide useful information to hospital P&T committees for making informed health care decisions.

Methods: Since secondary data sources were utilized for this analysis, approval from the institutional review board was non applicable. A cost minimization analysis was completed from a health care perspective with the purpose of determining costs associated with IV APAP use post operatively. This analysis was completed using TreeAge Pro to model the potential role of IV APAP given concurrently with IV morphine to reduce post operative pain. Data solely from orthopedic studies were selected for the purpose of establishing a more focused analysis. The VAMC system was chosen so as to conduct the analysis using the resources of a closed payment system. This simulation model randomized VAMC patients undergoing orthopedic surgery into one of two groups, receiving either IV APAP plus IV morphine or IV morphine plus no adjunct treatment. A 24 h time frame was chosen for analysis, as this represents the time in which most post operative pain is experienced and analgesic agents are typically administered.

Results: Both treatment arms were shown to be effective at treating post operative orthopedic pain; however, costs in doing so varied. The average individual patient additional cost of the morphine only (no treatment) group was $5.99, while the average individual patient additional cost of the APAP plus morphine group was $44.11 for the first 24 h post surgery. One VAMC reported about 550 orthopedic surgeries performed per year at their site (26). Therefore, if all patients were treated with IV morphine

alone, the incremental drug cost for the group would be $3,291.75. If the group were treated with IV morphine and IV APAP, the incremental cost for the group would be $24,257.75. This difference of $20,966 per year could be extrapolated to estimate the incremental drug costs at other VAMC sites that are performing similar numbers of surgeries per year.

Conclusion: The cost of IV APAP far surpassed that of IV morphine when used to treat post operative pain. However, the cost of post operative suffering was not included because of its subjectivity, potentially wide variation, and absence of available cost data for pain and suffering in the literature for the short time horizon of post surgical circumstances. For these reasons, we conducted a cost minimization analysis, since this seemed the most viable option based on the available data. Other factors also contribute towards the preference of morphine use alone in clinical practice besides the direct costs of IV APAP. For instance, clinician experience in using morphine is well established due to its common place in practice. Furthermore, while IV APAP can be considered a safe and effective drug for pain control, there are few economic benefits that IV APAP appears to have over morphine for acute pain control given their equivalent effectiveness and clinician experience with IV morphine alone.

3-182

Category: Pain Management

Title: Cost-impact of tapentadol immediate release (IR) from the hospital perspective: an estimation using a literature-based model

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Purpose: While opioids are an essential option for pain management, they are often associated with treatment-limiting gastrointestinal (GI) adverse events (AEs), which may increase overall medical resource utilization. Published literature has demonstrated lower incidence of GI AEs for tapentadol IR compared with oxycodone IR at equianalgesic doses, yet little data are available on the economic impact of such improvement. The objective of this analysis was to model the extent to which use of tapentadol IR 100 mg in place of oxycodone IR 15 mg would impact the total number of GI AEs (i.e., nausea, vomiting or constipation) and associated effects on hospital costs among patients with acute postsurgical pain.

Methods: A literature-based Excel spreadsheet model was developed to estimate the total number of AEs and costs associated with incremental hospital length of stay (LOS) for an assumed cohort of patients using oxycodone IR 15 mg or tapentadol IR 100 mg every 4 to 6 hours. AE rates were based on a Phase III clinical study of postsurgical patients treated with tapentadol IR or oxycodone IR. AE-related incremental LOS data were from a recently published study using Premier Perspective database. Mean daily hospital cost was obtained from the Healthcare Cost Utilization Project (HCUP) 2008 national estimate. Wholesale acquisition costs were used for drug costs. The base case assumed that 3% or 5% of admissions would utilize tapentadol IR in a hypothetical hospital setting with total of 1,500 admissions. All costs were in 2008 US dollars.

Results: The total number of GI AEs and costs declined when 3% of oxycodone IR utilization was assumed to be replaced with tapentadol IR (GI AEs of 1,095 vs 1,089 cases; costs of: $2,967,976 vs $2,950,900). With a reduction of 6 GI AEs, the cost was reduced by $17,076 and the net savings amounted to $14,300 after the cost of tapentadol IR was factored in. When 5% of oxycodone IR was replaced with tapentadol IR, a total of 11 GI AEs was eliminated, and the total cost reduction and net savings were $28,460 and $23,834, respectively.

Conclusion: Results from this model demonstrated potential cost savings of using tapentadol IR in place of a traditional mu-opioid, from the perspective of hospitals. In the absence of sufficient real world data,

a literature-based modeling approach may assist hospitals when assessing the cost impact of opioid-related GI AEs in the inpatient setting.

3-183

Category: Pain Management

Title: The impact of insurance type on pain management in hospitalized patients: A multicenter study from a third world country

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Purpose: Background: For over 20 years, studies have documented that pain is amongst the most common and distressing symptoms experienced by individuals with serious chronic diseases such as cancer. Yet to this date, many patients still are not assessed and do not receive sufficient medication to manage their pain resulting in distress and poor quality of life. Despite the international efforts to implement guidelines and protocols for pain management, data on factors influencing the correctness of therapy is frail. In the Middle East, the effect of the insurance type on the appropriateness of pain management is lacking. Objectives: The objectives of this study is to evaluate the influence of the different insurance type and hospital class admission on the appropriateness of pain management in different Lebanese health care centers, in both cancer and non-cancer population

Methods: A Lebanese multi-center, prospective, chart review, study was conducted over three months. Appropriateness of pain management was determined as per WHO guidelines. Institutional Review Board (IRB) approvals were obtained from each hospital.

Results: A total of 582 questionnaires were filled from 19 Lebanese hospitals representing the country. Gender distribution was almost equal (56% females, 44% males), and the mean age was 50.4 years. The average hospital stay was almost 5 days (mean=4.9, S=4.7). Patients were distributed between 4 different hospital units: surgery (47.4%), internal medicine (35.6%), intensive care unit (9.3%), and the remaining 7.7% were from the coronary care unit. As far as patients class and payment method, half of the sample (51.2%) were admitted to the second class, and covered by the National Social Security Funding (NSSF) (45.8%). The correctness of pain treatment combination was overall comparable in different patients class. Around 28% of the first class patients, 59% of the second class patients and 13% of the third class patients received appropriate pain treatment combination versus 27%, 55% and 18% respectively who received inappropriate pain treatment combination respectively. (P=0.284) As for the insurance type effect, 23% of self-payers, 22% of insurance covered patients, 44% of NSSF covered patients and 14% of patients covered by the Ministry of Health received appropriate pain treatment combination vs. 24%, 26%, 47% and 10% respectively who received inappropriate pain treatment combination respectively (P= 0.443, 0.127, 0.274, and 0.09 respectively). Similar results were found when comparing pain treatment regimen among different classes and with the different insurance type.

Conclusion: This study revealed that patients insurance type and class of admission had no effect on the appropriateness of pain management in several medical centers throughout Lebanon. Hence, the need to evaluate other possible contributing factors is crucial.

3-184

Category: Pain Management

Title: Impact of pharmacist recommendations in surgery patients with suboptimal pain control

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Purpose: The Joint Commission mandates that pain should be considered the fifth vital sign, every patient should have a thorough pain assessment and the right to adequate pain control. With surgery, the first 24 to 48 hours post-operation is the time interval of the greatest change in analgesic needs. Although pain decreases with time, patients may still experience severe pain after the first 24 hours following surgery. Uncontrolled postoperative pain is associated with increased risk of pulmonary and cardiovascular complications, chronic pain, and may delay time to discharge or recovery. This study looks at the impact of pharmacist recommendations in surgery patients whose pain is not controlled as determined by nursing on patient-reported pain scores as well as nursing and patient satisfaction.

Methods: Pain rounds, consisting of a multidisciplinary team: midlevel practitioner, patient care manager, charge nurse, and pharmacist, were implemented on the surgery unit. Nursing identifies patients whose pain is not optimally controlled, and then the pain team discusses and interviews the patients. The pharmacist makes recommendations on the patients' pain medications, which are then implemented by the midlevel practitioner. A chart review was performed to determine the minimum, maximum, and average patient-reported pain scores of these patients. The pain scores before and after implementation of pharmacists recommendations were compared. A sub-analysis was performed to determine whether there were differences with the degree of pain score changes in opioid-tolerant patients. Nursing perception surveys were administered at the beginning of pain rounds and three months later to assess change in perceptions of pain management before and after the implementation of pain rounds. The hospital routinely sends out surveys through a third-party company to patients to determine patient satisfaction with their hospital stay. This study also looks at change in patient satisfaction scores from before and after the implementation of pain rounds.

Results: From January through March 2011, there were a total of 51 patients discussed during pain rounds, 40 patients were included in the study. Out of these patients, 29 and 34 patients respectively, reported a decrease in their maximum and average pain scores ($p<0.001$). There was no statistical significance in change with respect to the minimum patient reported pain scores ($p=0.33$). Sixteen patients were considered opioid-tolerant. Out of the opioid tolerant patient reported pain scores, 15 patients reported a decrease in their maximum and average pain scores whereas only one patient reported no change ($p<0.001$). There was no statistically significant changes with respect to minimum

patient-reported pain scores in opioid-tolerant patients (p=0.43). Nursing perception of pain management did not change with the implementation of pain rounds. However, they strongly agreed having a pharmacist involved in managing patients pain and helping make recommendations is valuable. The patient satisfaction surveys from the third quarter of Fiscal Year 2011 included 90 patients on the inpatient surgery floor with satisfaction in the 51st percentile. From the same time period in 2010 there were 136 respondents and satisfaction was reported in the 16th percentile.

Conclusion: Pharmacist participation in pain rounds on the surgery unit has a positive effect on nursing and patient satisfaction. Patients average and maximum pain scores decreased after pharmacist intervention. Pharmacist involvement can be especially beneficial in dealing with opioid tolerant patients pain control following surgery. Additional studies are needed to determine if these results can be expanded to include other patient populations.

3-185

Category: Pain Management

Title: Opioid-related adverse events increase length of stay and drive up total cost of care in a national database of postsurgical patients

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Purpose: The primary objective of this retrospective study was to identify any relationship between opioid use and related adverse drug events (ADEs) with increased length of stay (LOS) and total cost in patients undergoing some of the more common surgeries in hospitals in the United States.

Methods: The de-identified Premier database was queried for this study. Selection criteria included the following inpatient surgeries: open colectomy, laparoscopic colectomy, laparoscopic cholecystectomy, total abdominal hysterectomy, and hip replacement surgery in patients 18 years of age and older between September 2008 and August 2010. Data related to the surgeries such as 3M APR-DRG severity of illness, length of stay (LOS), total cost, pain therapeutics used, diagnosis and procedure codes were captured. Adverse drug events (ADEs) were defined using ICD-9 diagnosis codes. Length of stay (LOS) and total cost outliers were defined as 1 standard deviation above the mean values. Patients with ADEs in the population were matched (up to 1:3 ratio) to patients without ADEs on age (+/- 3 years), severity of illness and gender. If a match could not be found for a patient with an ADE, the patient was excluded. Descriptive statistics and logistic regression were used to analyze the outcomes of LOS and total cost. A p-value of <0.05 was considered statistically significant.

Results: Prior to matching the incidence of opioid related ADE was 26.5%. There were 42,469 individuals with an opioid related ADE matched to 127,325 without an opioid related ADE. The mean unadjusted LOS for patients with an opioid-related ADE was statistically significantly longer than for patients without an opioid-related ADE; 5.1 days (SD 3.7) versus 4.0 days (2.6) ($p<0.0001$). The mean unadjusted total cost of hospitalization that included an opioid-related ADE compared to the cost of hospitalization without an opioid related ADE was $18,310 (SD 11,534) and $17,232 (SD 10,156), respectively. Patients who experienced an opioid-related ADE had a larger percentage of LOS and total cost outliers compared to patients who did not experience an opioid related ADE; LOS: 12.2% versus 5.0% and cost 8.0% vs. 5.0%, respectively. Patients with opioid related ADEs had 2.1 times higher adjusted odds (95% CI 2.1-2.2) of being a LOS outlier compared to patients without opioid related ADEs and 1.3 times higher adjusted odds (95% CI 1.3-1.4) of being a cost outlier. The adjusted cost variation from the baseline cost was $1,640 comparing opioid related ADE to non-ADE and an adjusted LOS variation from baseline LOS of

0.71 days. There were statistically significant differences in these outcomes between the two groups for all independent surgical procedures.

Conclusion: Patients from the Premier database who underwent one of the following surgeries: open colectomy, laparoscopic colectomy, laparoscopic cholecystectomy, total abdominal hysterectomy, and hip replacement surgery and experienced an opioid-related ADE were matched with patients (of similar age, gender and severity of illness) who did not experience an opioid-related ADE. Those that experienced an opioid related ADE had a statistically significantly longer LOS and a higher total hospitalization cost than those without an opioid related ADE. Reducing the incidence of opioid-related opioid related ADEs by reducing overall consumption or dosages may in turn reduce LOS and associated hospital costs. Further investigations regarding the impact of dosage on the incidence of opioid related ADEs would shed additional light on how to reduce LOS and hospitalization costs.

3-186

Category: Pain Management

Title: Methadone-induced QT prolongation

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Purpose: A 57 year old female was admitted to the hospital for symptomatic ventricular tachycardia with a QTc of 537. Her only past medical history was chronic back pain, for which she was being treated with methadone 40mg every 8 hours. The patient was admitted to the intensive care unit and was treated with lidocaine. All electrolytes were found to be within normal limits and cardiac catheterization showed only low ejection fraction. Once the patient was stable, she transferred out of the intensive care unit to a telemetry floor. It was after transfer that a pharmacist was reviewing the patients medication profile and noticed the patient was on methadone. The methadone was discontinued and converted to an equivalent oxycodone dosage. The QTc progressively improved over the next week going from 537 to 428. Although QT prolongation is listed as an adverse event in methadones product information, even warranting a black box warning, many providers are unaware of this adverse event. Furthermore, methadone therapy is not commonly altered in the inpatient setting due to the lack of provider familiarity.

Methods: N/A

Results: N/A

Conclusion: N/A

3-187

Category: Pain Management

Title: Development and evaluation of a pain medication schedule and pain management chart

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Purpose: Patients on numerous pain medications may face pain management problems which may include being unsure of timings to take pain medication and whether if medications should be taken on a regular basis or on a when necessary basis. The American Pain Society proposed that the first step to improve pain management is to record and assess patients reports of pain. Hence, this study was carried out to design a pain medication schedule (PMS) and a pain management chart (PMC) and to assess their usefulness from the patient and healthcare professionals point of view.

Methods: A pain medication schedule (PMS) was designed to remind patients when and how to take their medications. A pain management chart (PMC) was designed to allow patients to record the severity of pain experienced and the possible triggers that may have led to the pain. In addition, a pain medication flipchart was designed to communicate important medication information to the patients. The PMS and PMC were then issued out to patients on pain medication and patients were taught how to use each tool. After which, a survey was designed and distributed to the patients and healthcare professionals to assess their perception of each tool, which includes the user-friendliness and the benefit of using the tools (e.g. improvement in medication compliance).

Results: A total of 20 sets of pain medication schedules (PMS) and pain management charts (PMC) were issued to suitable candidates. Out of these 20 candidates who agreed to participate in this study, 3 dropped out of the study; resulting in a participation rate of 85.0%. Eight participants (47.1%) rated PMS as a useful pain management tool. The remaining 9 participants (52.9%) rated PMS as not a useful tool as it did not help to improve their medication compliance. Four participants (23.5%) rated PMC as a useful tool. The remaining 13 participants (76.5%) did not find the PMC useful as it did not help to manage his or her pain condition better. Sixteen healthcare professionals (HCP) were interviewed to assess the usefulness of the PMS and PMC from the healthcare professionals point of view. Twelve out of 16 HCP (75.0%) interviewed agreed that the PMS was a useful tool, with some strongly agreeing that the PMS would be of use to the pain patients.

Conclusion: A relatively equal number of positive response and negative response towards the pain medication schedule (PMS) was received. The routine documentation of the possible triggers and pain

intensity of any breakthrough pain using the pain management chart (PMC) by patients was not well-received. Patients were not keen in filling up the charts when they experienced pain. However, these responses were obtained from a patients point of view. On the other hand, the healthcare professionals felt that the PMS and PMC could be a useful tool in the management of pain patients. As this study was carried out on a small sample size (n=17), the results obtained might not be able to be extrapolated to the general population. Hence, further larger-scale studies considering demographic characteristics and patient profiles should be carried out to verify the study results.

3-188

Category: Pain Management

Title: Development of a comprehensive pain management order set at a large tertiary care hospital

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Purpose: Controlling patients pain is an important goal for improving patient comfort, satisfaction and functioning. The objective of this project was to design a comprehensive pain management order set that will optimize medication regimen while minimizing side effects.

Methods: Selection of medication was designed to be via a pre-printed order set with check boxes for standard doses and options for alternate dose or frequency. Hold parameters were established for sedation, respiratory rate less than 14 per minute or systolic blood pressure less than 100 mmHg. Choice of medication for acute pain was based on pain severity score of 1 to 10 for mild (1 to 3) to moderate (4 to 6) and moderate to severe pain(4 to 10). Dosage guidelines to prescribers were incorporated for elderly, renal or hepatic dysfunction. Cautionary statements were written for renal or liver disease, sleep apnea, COPD, oxygen dependence and the elderly. The pain management order set also included medications for chronic pain, local pain, mucositis, and neuropathic pain. In order to minimize side effects, orders for bowel regimen and nausea or vomiting were provided. Nonpharmacologic methods to assist with pain control were also available as options.

Results: Medication choices based on pain score of 1 to 10 for mild (1 to 3) to moderate (4 to 6) pain included oral acetaminophen, ibuprofen, tramadol and intravenous ketorolac. Oral or parenteral opioids were chosen for moderate to severe pain score of 4 to 10: oxycodone, morphine, hydromorphone or fentanyl. Chronic pain opioid analgesics were oral sustained release oxycodone, sustained release morphine or topical fentanyl patch. Local topical anesthetics were lidocaine patch and capsaicin cream. For oral pain relief associated with mucositis, magic mouthwash or viscous lidocaine were chosen. Neuropathic pain regimen comprised of gabapentin or pregabalin. In addition, bowel regimen and antiemetic choices were available. Nonpharmacologic methods to assist with pain control included guided imagery, reiki, music and art therapy. A page of reference information to prescribers was attached at the end of the pain management order set. This comprised of a table of relative equianalgesic potencies of opioids, fentanyl patch initial dosage guidelines based on opioid requirements and a table of chemical classes of opioids.

Conclusion: Alleviating patients pain while minimizing side effects is an important goal. Development of a comprehensive pain management order set to optimize medication regimen, provide guidance to prescribers and control side effects facilitates the accomplishment of this goal.

3-189

Category: Pharmacy Technicians

Title: Development of a pharmacy technician training program to support advancement of the health-system pharmacy practice model

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Purpose: Health-system pharmacy practice models are quickly evolving to keep pace with healthcare reform and the demand for efficient, high quality health care. Pharmacy technicians must play a key role in supporting the delivery of safe and effective medication therapy to patients. The demand for highly skilled pharmacy technicians will continue to grow as roles expand. Traditional pharmacy technician training is often inconsistent, resulting in variable levels of education and experience. We report the development of a health-system pharmacy technician training program that ensures consistent and valuable education and training, producing highly qualified and certified technicians, capable of filling expanding roles within the pharmacy practice.

Methods: A pharmacy technician training advisory committee was established to assess the skills of the current pharmacy technician staff, opportunities for advancement within the profession, and the required level of education and training for new technicians. A resulting six-month program was developed to cover 360 hours of didactic education including topics related to inpatient pharmacy, ambulatory pharmacy, pharmacy law, pharmacology, pharmacokinetics, calculations, hospital purchasing, decentralization, and research. Topics are instructed by qualified pharmacists and technicians from the health-system. The program includes 130 lab hours, including pharmacy practice in sterile and non-sterile compounding, chemotherapy, intensive care, surgery, inpatient and ambulatory pharmacy, pediatrics, and mail order pharmacy. Additionally, students are required to complete 600 experiential hours in both inpatient and ambulatory pharmacy practice settings.

Results: Eight technician students were accepted to the inaugural class which began in April 2011 with anticipated graduation in September 2011. Managers throughout the health-system anticipate hiring graduates of the training program, confident that they possess advanced skills necessary to expand the practice model. The technician training program fulfills the health-systems employment needs with highly qualified and trained technicians. Application for ASHP accreditation has also been submitted.

Conclusion: Health-system pharmacy technician training programs must support evolving pharmacy practice models. Hospital trained technicians who complete our formal program will acquire a broad skill set and satisfy employment needs system-wide. The program will be continuously evaluated to ensure the highest level of training to meet system-wide demands. The training program will continue with two graduating classes annually.

3-190

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Improving prescription label directions to enhance patient comprehension

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Purpose: The lack of clarity in prescription labels leads to increased cost of therapy due to non-compliance, decreased effectiveness of therapy and medication misadventures. Therefore, to improve pharmaceutical care and reduce cost of therapy we need to improve the current default directions for use that are preprogrammed in the computer and printed on the label. The California Board of Pharmacy has recently finalized new prescription container labeling regulations. These regulations set forth phrases of directions for use to be implemented in prescription labels to enhance patient understanding. The study objective is to determine if the default wording of prescription label directions are preferred by patients compared to an alternative label based on the new California labeling regulations.

Methods: VA patients were surveyed anonymously over a four week period. The questionnaire contained four sample prescription labels; each sample included a default and an alternative label. The survey asked patients to choose the wording they prefer.

Results: For each set of labels, the alternative label was chosen more often as preferred by patients. On average 60% of the time the alternative label was chosen as preferred. Although, 87% of patients stated that the current default prescription label directions are easy to understand, 60% of patients also stated that prescription label directions need to be improved.

Conclusion: In our study the majority of patients preferred the new phrases of directions for use set forth by the California labeling regulations. This finding verifies that patients prefer simple and explicit directions for use. There is a need for standardized patient centered prescription labels that use simple and clear language to improve medication compliance and reduce medication adverse events decreasing overall cost of therapy.

3-191

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Risk factors for hypoglycemia related hospitalization in patients with type 2 diabetes on oral antidiabetic agents

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Purpose: To identify risk factors for hypoglycemia hospitalization in type 2 diabetes.

Methods: Using the 2004-2008 MarketScan database, we identified patients with type 2 diabetes, taking oral antidiabetic drug (OAD) agents with > 12 months of continuous eligibility. We conducted a nested case control study, selecting cases with an inpatient admission for hypoglycemia (first event). We used 10:1 (controls: cases) risk-set sampling and matched on date of cohort entry (+/- 1 month). The final sample was 1,339 cases and 13,390 controls. We assessed patterns of OAD use (creating 3 groups, continuous, intermittent and non-users), other medications with known risk of hypoglycemia, prior visits for hypoglycemia, micro- and macrovascular complications and other comorbidities in the 180 days prior to their index date. A conditional logistic regression model identified independent predictors (IP) of hypoglycemia hospitalization.

Results: Cases had similar demographics to controls, but had higher levels of comorbidity; for example 13.4% of cases had diabetes with complications versus 5.3% of controls. In multivariable modeling, the strongest IP was prior emergency department hypoglycemia visits (OR=9.62; 95% CI=5.05-18.34). Prior outpatient visits for hypoglycemia had an OR=7.94 (95% CI=5.72-11.02) of inpatient hypoglycemia admission. Continuous metformin users had a 35% lower rate of inpatient hypoglycemia admission (OR=0.65; 95% CI 0.55-0.76) and intermittent metformin users a 23% lower rate (OR=0.77; 95% CI 0.65-0.92) than non-users of metformin. For sulfonylureas, continuous users (OR=2.34; 95% CI 2.00-2.74) and intermittent users (OR=2.04; 95% CI 1.70-2.45) had increased rates of inpatient hypoglycemia admission, each relative to non-users of sulfonylureas. Use of thiazolidinediones or other oral antidiabetic agents were not predictive of hypoglycemia admission.

Conclusion: Our study adds important knowledge of risk factors for severe hypoglycemic events resulting in hospitalization. Particular attention should be given to previous outpatient or emergency department visits for hypoglycemia.

3-192

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost and quality implications of opioid-based post surgical pain control in total abdominal hysterectomy: a study of cost outliers and opioid related adverse events

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Purpose: The primary objective of this study was to identify any relationship between opioid use and increased length of stay (LOS) and overall cost in patients undergoing a total abdominal hysterectomy (TAH) in an acute care health system.

Methods: The institutional review board approved this case-control study including a review of patient records. An initial query of an electronic database identified 3654 TAH patients who had undergone surgery from Jan 1, 2007 through December 31, 2010, from which 100 patients with the longest LOS (outliers) were selected. Patients were eligible if they had undergone a TAH (ICD-9 68.49) and had no evidence of malignancy. The outliers were matched 1:1 to control patients (those remaining in the database) based on age (18-49 years vs. 49-80 years) and the presence/absence of diabetes mellitus. The medical records of outliers and controls were reviewed for opioid use and opioid-related adverse events prior to, during, and after surgery, through hospital discharge. The total opioid dose was quantified as opioid burden, calculated by using the standard equianalgesic dose values obtained from the literature, with each equianalgesic opioid unit equal to 10 mgs of intravenous morphine sulfate.

Results: A total of 194 patients (97 matched pairs of outliers and controls) met all inclusion criteria. There were no differences between outliers and controls with respect to age, body mass index (BMI) and race. The overall LOS in the outlier group was 8 days (192 hours) compared with 2.5 days (60 hours) in the control group ($p < 0.01$). Outliers (vs. controls) spent a mean of 41 more hours between hospital admission and entering the OR ($p<0.01$). Outliers spent a mean of 91 more hours between PACU discharge and hospital discharge ($p<0.01$). The opioid burden in outliers was twice that seen in controls; 150 morphine mg equivalents compared to 70 mg morphine equivalents, $p < 0.01$. Respiratory adverse events were 10-fold more common in outliers than controls (12% versus 1%, $p<0.01$), and a two-fold increase in gastrointestinal adverse effects was seen (44% versus 19%, $p<0.01$). A comparison of total cost for admission between outliers and controls demonstrated significantly higher costs in the outlier group ($14,275 versus $5,745).

Conclusion: TAH patients with a prolonged LOS utilized statistically significantly more opioid (two-fold) and experienced more opioid-related adverse events (respiratory and gastrointestinal). These patients may be more complex to manage both pre- and post-surgically, as evidenced by a significantly longer

time period from admission to surgery. The total admission cost for these patients undergoing TAH in a single acute care health system was significantly higher in outliers compared to the control group.

3-193

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Innovative pharmacist-led strategies to promote health care worker influenza immunization

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Purpose: A national survey conducted in 2009 revealed that only 49% of health care workers (HCW) had received the seasonal influenza vaccination, failing to achieve the Healthy People 2010 target of 60%. Failure by HCW to receive influenza vaccination creates risk for not only the unimmunized individual, but also to other individuals with whom they come in contact, including patients. Social media tools are an emerging trend in dissemination of patient education and professional information and may be beneficial in influenza vaccine campaigns. We developed a novel influenza education program that utilized social media and an Internet web site. The purposes of this study were threefold: (1) Characterize HCW knowledge, attitudes, and behaviors regarding influenza and influenza vaccination (2) Create a replicable model that utilizes innovative communication and promotional strategies, integrated with traditionally successful approaches, to increase HCW acceptance of influenza vaccination (3) Evaluate the impact of the intervention on HCW influenza vaccination rate.

Methods: The School of Pharmacy partnered with the affiliated academic hospital's Departments of Pharmaceutical Services and Employee Health for this study. An electronic questionnaire was distributed to all employees, followed by a brief questionnaire at point of vaccination to characterize HCW knowledge and perceptions regarding influenza and influenza vaccination. This study sought to incorporate innovative pharmacist-led strategies into the existing Employee Health flu campaign to improve HCW influenza vaccination. Pharmacist-maintained social media sites, including Facebook and Twitter, were utilized to disseminate influenza campaign information. A central website included links to the social media sites and links to other websites such as ASHP Stop the Flu It Starts with You! and the Centers for Disease Control and Prevention. Nominal incentives for HCW participation were distributed throughout the campaign. Pharmacists and pharmacy practice residents served as immunizers at the influenza campaign kick-off. Big screen televisions with live Twitter and Facebook feeds were available at this event to encourage utilization of the social media sites.

Results: The electronic general questionnaire garnered 920 responses (14.2%) from the hospital employee population. The point of vaccination questionnaire was completed by 1,917 (46.7%) of 4,109 vaccinated individuals. From the general survey, individuals who had previously received the influenza vaccination did so primarily "To protect myself" (80.7%); the primary reason cited for not previously

receiving the influenza vaccination was "I am worried about side effects" (36.4%). Of individuals vaccinated in 2010 who had not received the vaccine in 2009, 45% agreed or strongly agreed that pharmacists played a visible role in this years flu campaign; however, 43% neither agreed nor disagreed. For individuals vaccinated in 2010 but not 2009, the most commonly used resource for flu information was friends or co-workers (47%). The social media sites stayed active from October 2010 through May 2011. The Facebook site gained 47 lifetime "Likes" and 4,791 post views; the Twitter site had 7 followers. The overall vaccination rate in 2010 - 2011 was 64% compared to 60% in 2009 - 2010.

Conclusion: HCW knowledge and attitudes paralleled results found in previous studies. A modest increase was observed in the institutional vaccination rate. While replicable, a barrier to implementation of this social media model that must be considered is administrative policy related to social media access in the workplace. It is difficult to directly discern the impact of the social networking and Internet tools utilized in this program from the influenza immunization campaign as a whole.

3-194

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacists in advocacy and immunizer roles (PAIR): Measuring the impact on healthcare worker immunization rates

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Purpose: To integrate pharmacist-provided influenza immunization of health care workers into an existing employee immunization program. Our objectives were to determine the effectiveness of pharmacist: 1) activities on employee intention to become immunized against influenza; and 2) education, advocacy, and direct immunization activities in difficult to reach health system workers.

Methods: The institutional review board approved this prospective, cross-sectional, pilot conducted between October 2010 and June 2011. Six of the nine pharmacist immunizers, two pharmacy residents and the principal investigator participated in the program outreach activities. Educational Activities: The inservice covered influenza risk factors, benefits of receiving vaccination, and general vaccine information. Pharmacy residents were asked to schedule in-services to units. An informational session was advertised to those who had declined and/or not received influenza vaccination and held during the week prior to the required response date of December 13, 2010. Informational session content was similar to the inservices. A three question survey measuring participants perceived susceptibility to the flu, benefit to receiving the influenza vaccine, and intent to receive influenza vaccination was administered to in-service and informational session participants. Immunization Activities: The ambulatory pharmacy provided influenza vaccinations to employees for 5 hours after the closure of Employee Health Services twice a week. Data regarding vaccinations were tracked using a handheld device. We obtained 2009-2010 and 2010-2011 immunization data from Employee Health Services for employees completing the short response survey and for employees immunized by pharmacists.

Results: Educational Activities: Two inservices and one informational session were conducted. Thirty-six participants completed the three-item survey for a 100% response rate. Only 5.6% responded indicating that they thought their risk of flu as a healthcare worker was lower than perceived prior to the inservice. Approximately forty percent (41.6%) of participants reported a higher perceived risk and 44.4% reported that their perceived risk had not changed as a result of the educational session. Compared to their pre-session perceptions, participants reported an increase (63.9%), decrease (5.6%) or no change (22.2%) in their perceived ability to protect patients and co-workers by influenza vaccination. When asked how likely they were to receive the flu vaccine after speaking with a pharmacist, 38.9% of participants

indicated they were more likely to receive the flu vaccine and 47.2% reported an unchanged likelihood. Of session participants for which both 2009/2010 and 2010/2011 immunization data were available, 42.9% received vaccinations both years and 42.9% switched from former declination to vaccinated. One person was formerly vaccinated and declined the 2010/2011 vaccination and one person declined both years. Immunization Activities: Six pharmacists provided 187 influenza vaccinations to employees at the ambulatory pharmacy. Three pharmacists gave 79% of all pharmacy vaccinations. During the current immunization season, 6,280/7,483 (83.9%) of employees were vaccinated, with pharmacists immunizing 187/6,280 (3%) of those vaccinated. Of the 187 employees immunized by pharmacists, 76.5% were categorized as patient care providers and 23.5% were categorized as not providing patient care. Of the 187 employees vaccinated by pharmacists, 43/187 (23.0%) had declined immunization the previous year, 118 (63.1%) had received the vaccine during the 2009 season, and the remainder were new hires with unknown prior year immunization status.

Conclusion: Fewer inservices were scheduled than anticipated. Educational activities were effective with more than a third of attendees perceiving a higher level of risk of getting the flu, almost two-thirds reporting increased ability to protect others from the flu by being vaccinated themselves, and over a third reporting an increased likelihood that they would receive the vaccine. Most vaccines were administered by only three pharmacists. Although only a small fraction of employees were immunized by pharmacists, almost a quarter had declined immunization the previous year. Perceptions about pharmacist involvement in immunization activities were elicited in a related survey administered to all pharmacists. Survey data are currently being evaluated.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

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

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Purpose: Broad spectrum beta lactam antibiotics are commonly used to treat nosocomial infection either alone or in combination with another antibiotic. Beta lactam antibiotics have bactericidal effect which is time dependent. Therefore using a continuous infusion therapy is rational. This study evaluates clinical efficacy and cost reduction in using continuous infusion in comparison to intermittent infusion of piperacillin- tazobactam in Intensive Care Unit (ICU) patients at 'Barzilai' medical center.

Methods: A retrospective study was preformed to patients who received piperacillin- tazobactam for pseudomonas aeroginosa susceptible infection during a six years period (2005-2010). The study got the hospital's RBA approved. All patients receiving piperacillin- tazobactam more than five days of treatment, without any change in antimicrobial treatment were included. Data on demographic characteristics, microbiology, co-morbidity, mortality, re-hospitalization, length of treatment and of hospitalization were collected and compared between groups. Statistical evaluation was performed with the t and chi square tests.

Results: A total of 99 critically ill patients comprised the two study groups; 56 received piperacillin-tazobactam continuously (9 g/ 150 mL or 13.5 g/ 150 mL over 24 hours), and 43 patients received an intermittent infusion (4.5g / 100 mL every 8 hours), during 0.5 h. No significant differences were observed in base- line clinical characteristics between the two groups, length of stay (LOS), mortality during treatment, and length of treatment. A significant difference was found regarding re-hospitalization rate and cost of treatment, when using the continuous infusion of piperacillin-tazobactam.

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

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Utilization and Costs of Mental Health Medications for End-Stage Renal Disease Patients Enrolled in Medicare Part D, 2007

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Purpose: There are approximately 548,000 patients in the U.S. with end-stage renal disease (ESRD), either maintained on chronic dialysis therapy or having received a kidney transplant. Reported rates of mental health disorders among this group are higher than reported rates among the general Medicare population. However, there have been no published studies in the Medicare Part D ESRD population on mental health drug treatment. The purpose of this study was to examine the utilization and out-of-pocket (OOP) and total drug costs of mental health medications among adult dialysis and kidney transplant patients enrolled in a Medicare Part D plan during 2007, compared to the general Medicare Part D population without ESRD (non-ESRD).

Methods: All adult patients continuously enrolled in Medicare Parts A, B and D throughout 2007 and alive as of December 31, 2007 were eligible for inclusion. Part D claims data maintained in Medicare's Chronic Condition Warehouse were used to determine utilization and costs. To identify the ESRD population, registry data from the United States Renal Data System were linked to Part D data. Utilization, OOP, and total drug costs were examined for different classes of medications: antidepressants, antianxiety agents (excluding benzodiazepines), antipsychotics, and dementia medications. Utilization and costs were examined by patient characteristics (sex, age, race/ethnicity, duration of ESRD), Part D plan type, Low Income Subsidy (LIS) status, and geographic region.

Results: CHARACTERISTICS: There were 165,202 dialysis patients, 43,079 transplant patients, and 21,888,854 non-ESRD patients who met inclusion criteria. Transplant patients were more likely to be male, younger, Non-Hispanic White and not receiving the LIS (non-LIS) compared to dialysis patients. DEPRESSION: Utilization of antidepressants was highest among dialysis patients (28.8%) followed by non-ESRD patients (25.7%) and transplant patients (24.9%). In all three groups, females had higher utilization compared to males, and Non-Hispanic Whites had higher utilization compared to other minority racial/ethnic groups. Utilization decreased with increasing age in the non-ESRD population; this trend was not noted for ESRD patients. Across all three groups, utilization of antidepressants was higher for patients enrolled in PDP plans compared to MAPD plans, and higher among LIS patients. ANXIETY: Antianxiety medications were utilized by 10.3% of dialysis patients compared to 4.0% of transplant patients and 6.5% of non-ESRD patients. Across all three groups, utilization was higher among females

compared to males and among patients enrolled in MAPD plans compared to PDP plans. Utilization increased somewhat with increasing age for ESRD patients, in contrast to the trend of lower utilization with increasing age among non-ESRD patients. PSYCHOTIC DISORDERS: Antipsychotics were utilized by 10.0% of dialysis patients, 6.4% of transplant patients and 9.2% of non-ESRD patients. Non-ESRD patients were more likely to have used atypical antipsychotics compared to older agents; the opposite trend was noted for dialysis and transplant patients. Across all three groups, a higher percentage of females, patients enrolled in PDP plans, and LIS patients utilized antipsychotics. Both non-ESRD and transplant patients had decreasing use with increasing age, whereas dialysis patients had fairly constant use across age groups. Within the ESRD population, non-Hispanic White patients had higher utilization compared to minority racial/ethnic groups. DEMENTIA: Medications used to treat dementias were utilized by 4.9%, 2.3% and 0.7% of non-ESRD, dialysis and transplant patients, respectively. Across all three groups, higher utilization was noted for older patients, females and non-Hispanic Whites. Cholinesterase inhibitors was the predominant class used, with donezepil the most utilized agent within this class for all three groups. OOP COSTS: OOP costs were much lower for LIS patients compared to non-LIS patients across all three groups. OOP costs for mental health medications for non-LIS patients comprised 8.0% and 8.5% of all Part D drug costs for dialysis and transplant patients, respectively, compared to 21.3% for non-ESRD patients. Highest OOP costs were noted for dementia medications, the atypical antipsychotics, and the SNRI class of antidepressants. TOTAL COSTS: Total drug costs for mental health medications comprised 21.6% ($65 per member per month [PMPM])and 8.9% ($14 PMPM) of all Part D costs for LIS and non-LIS patients in the non-ESRD group, compared to 3.6% ($20 PMPM) and 3.0% ($10 PMPM) for LIS and non-LIS dialysis patients and 3.5% ($18 PMPM) and 2.7% ($10 PMPM) for LIS and non-LIS transplant patients.

Conclusion: The antidepressant medication class was the most utilized mental health class among those examined. Dialysis patients had higher utilization of mental health medications compared to transplant patients. Transplant patients had lower utilization of all mental health medications compared to non-ESRD patients. LIS Patients had significantly lower OOP costs compared to non-LIS patients. Both OOP and total costs for mental health medications were lower in ESRD beneficiaries compared to the general non-ESRD Medicare Part D population. The complex overall drug treatment for persons with ESRD may present challenges for successfully managing mental health conditions.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness of fulvestrant 250mg versus 500mg in postmenopausal women with estrogen receptor-positive metastatic breast cancer and disease progression after antiestrogen therapy

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Purpose: To determine the cost-effectiveness of fulvestrant 250 mg compared to 500 mg in postmenopausal women with estrogen receptor-positive metastatic breast cancer and disease progression after antiestrogen therapy.

Methods: A Markov model was constructed to find the incremental cost-effectiveness of fulvestrant 250 mg monthly when compared with 500 mg monthly. The model duration was 24 months. Clinical efficacy data inputs were derived from a phase III clinical trial demonstrating a statistically significant increase in progression-free survival in patients receiving 500 mg versus 250 mg. Cost data utilized were all relevant Ambulatory Payment Classification payment rates from the 2011 Medicare Outpatient Prospective Payment System. A Monte Carlo simulation was performed to test the model at various costs per month values. A sensitivity analysis was used to determine the robustness of the model with regard to all inputs.

Results: The incremental cost-effectiveness ratio as determined by the Markov model was US$10,972 per month of progression-free survival. If one assumes a payer is willing to pay $10,000 per month, which is currently commonly paid for oncology treatments, then fulvestrant 250 mg monthly was cost-effective in 75% of cases when inputs were analyzed using Monte Carlo sensitivity analyses. A series of one-way sensitivity analyses showed this result is robust to geographical variation in the cost of drug administration and physician exam.

Conclusion: Despite an FDA-approved labeling change for fulvestrant in September 2010, fulvestrant 250 mg monthly appears to be a cost-effective option in the target population considering previously published annual willingness-to-pay values in oncology. From a third party payer perspective, the value of fulvestrant 500 mg monthly is not cost-effective for this target population.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Saving money on daptomycin

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Purpose: At this small community hospital, use of daptomycin may be sporadic and three or more patients on therapy at the same time are rare. All intravenous (IV) medication doses are prepared in a 797-compliant IV suite. Daptomycin (DAP) is an antimicrobial used for the treatment of a variety of gram-positive infections, such as skin and soft tissue infections (SSTI), bacteremia (B), and infective endocarditis (IE). The dosing of DAP is based on patient weight and disease state. Patients are typically prescribed 4 mg/kg for SSTI and 6 mg/kg for B and IE. DAP is supplied in a 500 mg vial, therefore leftover drug from a patient's dose is frequent. Refrigeration stability data for reconstituted drug indicate 48 hours expiration, whereas stability data for reconstituted and diluted drug indicate 10 days expiration. The purpose of this investigation was to determine if there was cost savings associated by diluting the leftover drug for longer stability and utilizing it for the patient's next dose or for a new patient's dose.

Methods: All clinical research represented in this abstract was approved by the appropriate ethics committee or institutional review board. All patients who had received DAP from January 2010 through May 2011 were identified in the pharmacy database. Data included date, dose, frequency and duration of therapy. The number of vials needed to compound the listed doses was calculated. This was compared to purchases for accuracy. The number of vials needed if extended stability was used was also calulated. Comparison between the two groups was made using Chi square with $p < 0.05$ considered significant.

Results: The number of vials needed to compound the required doses during the evaluation period was 296. The number of vials purchased during the same period was 300. Using the extended stability, the number of vials needed to compound the doses was 241. This was a reduction of 55 vials (18.5%). This was a significant reduction ($p < 0.01$).

Conclusion: Further diluting the reconstituted daptomycin solution and thereby extending the refrigerated stability time can realize significant cost savings.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Community hospital's experience with the sepsis guidelines and the RI ICU Collaborative

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Purpose: St. Joseph Health Services of RI is a community, non-teaching hospital that participates in the RI ICU Collaborative. Part of the Collaborative's work includes improving each hospital's effectiveness in treating sepsis via implementation of the the International Surviving Sepsis Campaign (SSC). It was a goal of the Collaborative to reduce mortality by 25% while also increasing improvement in sepsis bundle compliance. A review was undertaken to compare our baseline compliance and mortality data to the data resulting after implementation of the sepsis bundle elements.

Methods: Baseline data collection occurred from July 2008 thru March 2009. During that time order sets were being developed for the first six hours of sepsis/resuscitation, initial twenty-four hours/management, antibiotic orders, and a low-dose steroid policy were developed, approved, and in-serviced to the critical care staff and physicians. In addition, the emergency room sepsis "lab" bundle was created. All these necessary elements were in place and implemented for April 1, 2009. The data was then reviewed for April 2009 thru March 2010.

Results: Results showed an improvement in eight of ten quality indicators from the SSC bundles. The eight indicators with improvement included lactate within six hours improving from a baseline of 26.3% to 48%, antibiotics within the appropriate time line of 69.5% to 77%, hypotension treatment from 8.4% to 27.6%, CVP monitoring from 1% to 2.4%, low-dose steroids from 26.7% to 45%, drotrecogin administration from 0% to 3%, glucose control from 35.8% to 54%, and median IPP control of 48.5% to 83%. Mortality decreased from 36.8% at baseline to 32.3% (12% reduction) in the year after implementation of the new order sets.

Conclusion: Improvements have been made in the treatment of our septic patients. Areas for further interventions in the treatment of these patients have also been highlighted and work continues within our critical care unit.

3-202

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Qatar University pharmacy students interest in international experience rotations: related concerns and knowledge

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Purpose: This survey for Qatar University pharmacy students was conducted to determine 1) knowledge of global health; 2) interest in exchanges and 3) personal and logistic barriers to international professional experience rotation exchanges.

Methods: In this on-line survey, conducted between January and June 2011, participants were recruited from all students enrolled in Qatar University Pharmacy professional degree program. The survey domains addressed 1) demographic characteristics of the respondents; 2) knowledge of global health trends; 3) knowledge of the regulatory status of select medications in different countries; 4) interest in an international exchange and 5) areas of concern related to participation in an international pharmacy student exchange program. Descriptive statistical analyses and group comparisons were carried out using correlation statistics and linear regression analysis.

Results: A total of 60 surveys were collected from students in their first through fourth professional year (77% response rate, N=77). Eighty-eight percent of the students were interested or very interested in an international pharmacy exchange program, with Canada (87%) and the United States (88%) identified as preferred countries to engage in medication management (77%), pharmacy dispensing (72%) and research (60%). The Qatari students identified issues related to housing (67%), overall cost (57%), cultural differences (55%) and personal safety (52%) as areas of concerns regarding an exchange. In the domains of general global health trends related to infectious disease and medication regulation, the students performed at 32% and 18% correct responses respectively.

Conclusion: Students from the College of Pharmacy in Qatar, though interested in international exchange programs, have significant concern regarding safety and cultural barriers to such a program. Qatari students interested in an international exchange will require additional education on global health trends and medication regulation in North America. Host institutions should pursue opportunities to address these concerns as efforts are established toward reciprocal exchanges.

3-203

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost effectiveness of levonorgestrel intrauterine device compared to combined oral contraceptives: a study targeting adverse events and financial incentives for women participating in MassHealth

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Purpose: Although combined oral contraceptives (COCs) are the more widely used contraceptive option compared to intrauterine devices (IUDs), users may not be adherent to daily oral therapy leading to higher additional costs associated with unwanted pregnancy. This study was conducted to determine the cost-effectiveness of levonorgestrel IUD (Mirena) compared to COCs from the perspective of the state public payer, MassHealth. Two additional factors were taken into consideration: the cost of adverse events and the provision of a financial incentive to women who chose the IUD over COCs.

Methods: A Markov model was constructed to compare the costs associated with the use of the IUD and COCs, along with the costs incurred from method failures (e.g. birth, abortion) and various adverse events common to each method over a 5-year period. Adverse events for each method were different, and only the most serious and life threatening of those events (e.g. thromboembolism for COCs, uterine perforation for IUD) were included in the model. Sensitivity analyses were performed on costs associated with both IUD and COCs as well as on the amount of a financial incentive.

Results: The total costs associated with IUDs and COCs were $291.49 and $1,093.06, respectively. The average annual effectiveness was 80.0% for IUDs and 72.6% for COCs. The IUD method dominated the COCs method with better outcomes and lower costs. Tornado analysis showed that the incremental cost effectiveness ratio (ICER) was most sensitive to the cost of the IUD. In addition, the IUD method continued to be dominant when the annual financial incentive ranged from $0 to $160 in one-way sensitivity analysis.

Conclusion: The IUD was found to be cost effective relative to COCs from the perspective of MassHealth. Since there is less reliance on patient adherence when using a long-acting reversible IUD method, this analysis showed that a state optional financial incentive program could be created to support an increase in the use of IUDs, thereby potentially decreasing the incidence of unintended pregnancies and generating greater savings in health expenditures. However, ethical considerations must be evaluated prior to the implementation of such a program.

3-204

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of clinical outcomes in patients converted from atorvastatin to rosuvastatin: a retrospective chart review

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Purpose: The purpose of this study was to compare the clinical outcomes of change in LDL, maintenance of NCEP III LDL goal, change in lipid profiles, and safety profiles in patients converted from atorvastatin to rosuvastatin.

Methods: The institutional review board approved this retrospective chart review. This study evaluated 100 veteran patients 18 years of age and older who received atorvastatin therapy, were converted to rosuvastatin therapy between January 2010 to July 2010, and had a lipid panel measured within 6 weeks to 6 months pre and post switch date. Patients were excluded if they: did not have an initial and follow-up lipid profile within 6 weeks to 6 months pre and post switch date, had not refilled their atorvastatin or rosuvastatin for at least 6 months, were followed outside the local hospital facility area, or died prior to completing the study requirements. The primary effectiveness outcome was change in LDL after the conversion from atorvastatin to rosuvastatin. Secondary outcomes of change in: the percentage of patients at NCEP-ATP-III LDL goal, total cholesterol, HDL, and triglycerides after the conversion from atorvastatin to rosuvastatin were evaluated. Safety outcomes included patient reported adverse events; conversion back to atorvastatin due to intolerance; change in creatine phosphokinase (CPK), liver function tests (LFTs) [aspartate aminotransferase (AST), and (alanine transaminase) ALT]; change in the number of patients with more than 3 times the upper limit of normal (ULN) of CPK; and change in the number of patients with more than 3 times ULN of AST or ALT. It was determined that a minimum sample of 88 patients was needed to detect a significant reduction of 7 mg/dl in LDL with an expected 20 mg/dl standard deviation in LDL, in order to obtain a 90% power with a two-sided alpha of 0.05.

Results: The conversion resulted in statistically significant reductions in mean LDL (-8.64, $p = 0.002$) and median total cholesterol (-6.5, $p = 0.002$). Non-statistically significant increases in the percentage of patients at NCEP-ATP-III LDL goal after the conversion (60% to 73%, $p = 0.072$) were found. Effects on HDL, triglycerides, LFTs, and patient tolerability were comparable. The number of patients with CPK > 3 x ULN increased from 1 to 2 patients after the conversion, $p < 0.001$.

Conclusion: Rosuvastatin is at least as effective as atorvastatin in reducing LDL and there is a trend toward greater effectiveness of patients achieving their LDL goal with rosuvastatin compared to atorvastatin. Rosuvastatin is associated with maintaining similar lipid and LFT profiles compared to atorvastatin.

3-205

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Development and implementation of an interactive, online sepsis educational module for hospital pharmacists

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Purpose: Hospital pharmacists working in an acute care environment must be familiar with the latest evidence-based recommendations regarding the treatment of sepsis. Our goal was to demonstrate the feasibility of using an evidence-based online pilot program to educate hospital pharmacists on the pathophysiology and treatment of sepsis.

Methods: A novel interactive, online pilot educational module concentrating on the pathophysiology and treatment of sepsis and severe sepsis was developed and distributed to hospital pharmacists practicing in an acute care environments at various hospitals in the country. The training module incorporated different teaching methods, including case-based learning, self-learning via live voice-over slide set, and active live discussion via web-based conferencing software. The voice-over slide set topics included fluid resuscitation, proper empiric antibiotic use, and supportive care including steroids, glucose control and activated protein C. The participants were also given a sepsis case with probing questions to help them develop their own therapeutic plan for the simulated patient. Finally, a content expert facilitated an active, live discussion of the case with the participants. The discussion used web-based conferencing technology with active learning through the use of polling questions. At the beginning of the module and part of the educational packet, a comprehensive list of pertinent references, including studies, guidelines, and review articles on sepsis were distributed to the participants. Module evaluations were distributed to evaluate the quality of the program using a 5-point Likert scale (Strongly Disagree = 1, Strongly Agree = 5).

Results: A total of 46 participants, with an average age of 33.9 plus/minus 9.9 years, were enrolled in the pilot educational module. Of these participants, 20 had not completed a pharmacy residency and 20 completed either a PGY1 or PGY2 residency. Six participants were currently enrolled in a residency program. Thirty-five participants had a PharmD degree. At baseline, 58.7% (27/46) of participants reported that they were not comfortable designing a pharmacotherapeutic plan for patients with sepsis before enrolling in the module. In the post module evaluation, the majority of participants felt that the course objectives were met (median score 5). The highest rated portion of the program was the online discussion (median score 5), followed by the case study and reference list (both, median score 4.5). The

voice-over slide set was least liked by participants (median score 4), however nearly all participants rated this favorably. Overall evaluation of the program was high (median score 4.5).

Conclusion: Online education modules are feasible to educate hospital pharmacists at different practice sites around the nation on the pathophysiology and treatment of sepsis. Multiple teaching methods can be used to help increase satisfaction of the modules. Evidence-based training modules like these can be developed and implemented to increase knowledge in other areas of critical care.

3-206

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical and economic review of bazedoxifene as a cost-effective alternative to raloxifene for the treatment of osteoporosis in postmenopausal women with a high risk of fractures

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Purpose: Provide a clinical efficacy and economic comparison of bazedoxifene to raloxifene in order to aid healthcare professionals in determining the role of bazedoxifene in the treatment of osteoporosis in postmenopausal women in the United States

Methods: A MEDLINE literature search was performed for published articles available through April 2011. Keywords used include raloxifene and bazedoxifene. The literature search was limited to articles written in English and to safety or efficacy clinical trials conducted in humans or economic analyses. Articles in which bazedoxifene is combined with conjugated estrogens were excluded. Articles for disease states other than postmenopausal osteoporosis were also excluded. After exclusion criteria were applied, 7 articles were reviewed for bazedoxifene. 5 articles were reviewed for raloxifene, 3 of which were duplicates also used for bazedoxifene. Additional information was obtained from the National Osteoporosis Foundation website as well as from databases by the FDA and EMA.

Results: There are 3 phase III trials that evaluate the efficacy and safety of bazedoxifene compared to placebo and/or raloxifene. In at 6-month, phase III trial, treatment with bazedoxifene and placebo resulted in an increase in BMD at the lumbar spine of 0.41% and -0.32% respectively at 6 months ($p<0.01$).(11) Increase in BMD in bazedoxifene vs. placebo at the femoral neck was -0.08% vs. -0.69% ($p=0.014$), femoral trochanter 0.5% vs. -0.23% ($p=0.01$), and total hip was -0.03% vs. -0.77%, respectively ($p<0.001$).(11) In a 3-year, phase III trial, compared to placebo, bazedoxifene 20mg, bazedoxifene 40mg and raloxifene 60mg reduced the risk of new vertebral fractures by [42% (HR, 0.58; 95% CI, 0.38-0.89), 37% (HR, 0.63; 95% CI, 0.42-0.96), and 42% (HR, 0.58; 95% CI, 0.38-0.89)], respectively.(12) The incidence of all nonvertebral osteoporosis-related fractures was 5.7%, 5.6%, 5.9%, and 6.3% for bazedoxifene 20mg, bazedoxifene 40mg, raloxifene 60mg and placebo, respectively.(12) In a 2-year, phase III trial, median percent changes from baseline of total cholesterol were -2.86 ($p<0.05$), -0.32, -4.23 ($p<0.05$), -6.27 ($p<0.05$), and 1.46 for bazedoxifene 10mg, bazedoxifene 20mg, bazedoxifene 40mg, raloxifene 60mg and placebo, respectively. (13) Mean percent changes for LDL-C were -2.97 ($p<0.05$), -5.76 ($p<0.05$), -9.66 ($p<0.05$), -11.82 ($p<0.05$), and 2.63, and mean percent changes for HDL-C were 1.08 ($p<0.05$), 0 ($p<0.05$), -3.4, -2.89, and -2.94, respectively.(13) The most common adverse events that were

experienced in the clinical trials were headache, infection, pain, back pain and arthralgia.(12,13) The incidence of fibrocystic breast disease was significantly higher in the raloxifene 60mg group (0.8%) compared to bazedoxifene 20mg (0.3%) and bazedoxifene 40mg (0.2%) (p≤0.05).(16) 2 economic analyses evaluating the cost-effectiveness of SERMs for the treatment of osteoporosis were reviewed. Kanis et al. compared the cost-effectiveness of raloxifene to placebo based on treatment efficacy data adapted from the MORE study The results of this study indicate that in the United Kingdom, raloxifene is a cost-effective SERM when used as a treatment of osteoporosis in women at an increased risk of vertebral fractures, and improvements in cost per QALY were seen in both patients at an increased risk of vertebral fractures and in patients with an increased risk of cardiovascular disease. Borgstrom et al. recently investigated the cost-effectiveness of bazedoxifene compared with placebo in multiple countries in Europe using the FRAX algorithm to determine fracture risk. Results determined that the extent of the cost-effectiveness of bazedoxifene is largely dependent on the populations fracture risk, and that bazedoxifene has the potential to be a cost effective alternative to raloxifene for treatment of osteoporosis in European women.

Conclusion: Bazedoxifene improves BMD at lumbar spine, total hip, femoral neck, and femoral trochanter regions, decreases incidence of new vertebral fractures, and positively affects the lipid profile of postmenopausal women with osteoporosis. Cost analysis based on mixed fraction risk ratios in Europe and the United Kingdom, indicate highly variable effects on cost per QALY measures of cost-effectiveness. Cost benefits may come from the antagonist effects of bazedoxifene on breast and uterine tissue; however, this effect has not been well established in human trials, and therefore its clinical benefit cannot be determined. Based on available studies, bazedoxifene can be considered an effective second line agent for the treatment of osteoporosis in postmenopausal women, and may have greater efficacy in reducing the risk of vertebral fractures in postmenopausal women at higher risk of fractures. Currently, bazedoxifene has not proven to be a cost-effective alternative to raloxifene.

3-207

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Outreach visits by clinical pharmacists improve screening for the metabolic syndrome at a psychiatric ward

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Purpose: In 2007, an internationally acknowledged screening tool for the metabolic syndrome (MS) was presented as a part of clinical guidelines for the treatment with antipsychotics at the psychiatric ward at Odense University Hospital, however, chart reviews from May 2008 to April 2009 revealed that the screening tool was not sufficiently implemented. Few screening tools were identified in the charts, and for 22% of the patients, all 5 required screening values were documented. The purpose of the current study was to investigate whether a systematic implementation of a screening strategy for the MS would increase adherence with guidelines for screening, and whether this would improve follow-up of patients by the general practitioner.

Methods: Patients were included in the study if they 1) during the period from 18 May 2009 to 30 April 2010 were admitted to one of three wards at the psychiatric ward, 2) were >18 years, 3) had a diagnosis of schizophrenia or affective disease, 4) resided in Odense community, 5) were admitted for at least 10 days and, 6) were treated with one or more risk medications: antipsychotics and mood stabilizing medications (valproate, carbamazepine and lithium). Forensic patients were excluded. Criteria used for identifying MS corresponded to criteria published by the International Diabetes Federation and were: presence of central obesity (circumference of at least 94 cm for males, and at least 80 cm for females) plus any two of the following four factors: 1) raised triglycerides: at least 150 mg/dL (1.7 mmol/L) or specific treatment for this lipid abnormality, 2) Reduced HDL cholesterol: less than 40 mg/dL (1.03 mmol/L) in males and less than 50 mg/dL (1.29 mmol/L) in females or specific treatment for this lipid abnormality, 3) Raised blood pressure: systolic BP at least 130 or diastolic BP at least 85 mm Hg or treatment of previously diagnosed hypertension, 4) Raised fasting plasma glucose (FPG) at least 100 mg/dL (5.6 mmol/L) or previously diagnosed type 2 diabetes. The intervention was conducted by two clinical pharmacists attending conferences at the study wards, where a patient case was prepared and discussed regarding use of the screening tool. Informed consent was obtained from patients for GP follow up. The study was approved by The Danish data protection agency.

Results: The clinical pharmacists attended 160 conferences during the project period. All together, 112 patients were included; 54% were males and the average age on admission was 43.2 years. The screening tool was used for 81% of the patients. MS was identified for 42% of the patients, while

insufficient data for MS identification was present for 16%. Of the patients with identified MS, 17% were encouraged or had established a consultation with their GPs before discharge.

Conclusion: The study showed that conference attendance by clinical pharmacists at a psychiatric ward led to an increase in the use of a screening tool. However, room for improvement regarding the use of the screening tool and follow up among GPs still exists.

3-208

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacist counseling of heart failure patients and impact on readmissions at a community hospital

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Purpose: Heart failure (HF) is a major public health problem in the US. HF is the most common Medicare diagnosis related group (DRG) hospital discharge with more Medicare dollars spent on HF than for any other diagnosis. The average hospital stay for treatment of this disease is nine days. Nationally approximately 30 to 40 percent of patients are readmitted within six months of hospitalization. About 23 percent of these patients are readmitted within thirty days and these readmissions are not reimbursed. This program was implemented to determine what impact pharmacists can have on reducing HF readmissions within thirty days at a community hospital.

Methods: Working with members of the medical staff, training and education on HF and patient counseling was provided to pharmacists and education materials were developed for patients. Patients are identified for pharmacists HF counseling by medical staff who notify pharmacy by consult requests through the hospitals integrated clinical IS system, or by physician extenders working in the hospital with their physician groups. Pharmacists assigned clinical shifts evaluate HF patients, review their medication profiles, provide and document the counseling events. Counseling involves an interaction with the patient and available family members or care givers. HF counseling includes education on HF disease, reasons for certain medication prescriptions, how they work, and potential adverse effects. Counseling also focuses on compliance with medications, importance of daily weights, a low salt diet, and life style modifications. Pharmacists address signs and symptoms of worsening HF and the importance of when to notify the physician versus coming to the hospital emergency room. Pharmacists spend about 90 minutes preparing for, conducting, and documenting the counseling event. Pharmacist counseling occurs as an addition to standard education given by other healthcare providers. Hospital records were audited for readmissions, for any reason, occurring at or within 30 days of a primary admission DRG of heart failure. The hospitals patient financial services estimated a $4,200 cost per HF readmission.

Results: For the period December 2010 through April 2011, there were 52 patients admitted with a primary diagnosis of HF (DRG 291,292,293). Pharmacists provided HF counseling to 14 of these evaluable patients. These patients experienced approximately 50 percent fewer readmissions compared to patients who did not receive pharmacist counseling for a net estimated $22,500 cost savings. Hospital administration includes this program in their preferred provider discussions with insurers.

Conclusion: Pharmacist counseling reduces all cause readmissions for patients with a primary diagnosis of heart failure.

3-209

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Formulary review and budget impact analysis of ustekinumab for the treatment of moderate to severe plaque psoriasis: a MassHealth perspective

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Purpose: Plaque psoriasis is the most prevalent autoimmune disease in the United States, affecting roughly 7.5 million people or 2.2% of the population. Treatments for this disease are typically chronic and can be costly to patients and the healthcare system. Ustekinumab was approved in 2009 for the treatment of moderate to severe plaque psoriasis. This study reviews clinical and economic evidence of ustekinumab and assesses the budgetary impact of adding ustekinumab to the formulary of the public health insurance program for low to medium income residents of Massachusetts (MassHealth). The budget impact analysis (BIA) explores the budget impact of adding ustekinumab as a treatment for plaque psoriasis by evaluating a theoretical increase in use of ustekinumab.

Methods: We performed a literature search using PubMed with the terms: ustekinumab, psoriasis, economic, and cost. Our inclusion criteria targeted literature that pertained to ustekinumab efficacy, patient quality of life, or the cost of using biologics for the treatment of plaque psoriasis. Our search produced 124 studies, of which six met our inclusion criteria. We then created a formulary review examining the clinical and economic evidence meeting our inclusion criteria. Our BIA was implemented from the perspective of the MassHealth payer. The scenarios compared in this BIA examine the impact of the theoretical increased use of ustekinumab for plaque psoriasis and its effect on the MassHealth budget. We assumed ustekinumab to capture 50% of the market share, as etanercept holds roughly 50% of the current market share. The projected ratio of the older biologics was determined based on trends. The population of interest was those with moderate to severe plaque psoriasis in the MassHealth population requiring biologic therapy. We extrapolated the national incidence of plaque psoriasis and the proportion of those requiring biologic therapy onto the MassHealth population and set the study population to 243 people. The population was divided into those weighing greater or less than 100 kg, as this reflects the proportion of patients receiving the 45 mg or 90 mg dose of ustekinumab. The time horizon of this study was separated into the budget impact for the first year of treatment, and costs for subsequent years. Budget costs were confined to total treatment costs of plaque psoriasis with biologic therapy. Total monitoring, administration, and acquisition costs were included based on the payer perspective. Sensitivity analyses were conducted on the acquisition, monitoring, and administration

costs of ustekinumab, projected ustekinumab market, and proportion of patients requiring ustekinumab 90 mg versus 45 mg.

Results: Our formulary review shows that ustekinumab is more effective and has a safety profile equal to etanercept, the current standard biologic therapy. A cost per responder analysis has shown ustekinumab to be superior to etanercept in cost effectiveness. Our BIA shows that the cost to MassHealth for biologic treatment of plaque psoriasis in 243 patients increases by over $2.6 million to a total of roughly $6.7 million given the projected market shares. The cost for consecutive years of treatment increases by roughly $1.3 million to just under $5 million. It is clear that the acquisition cost of ustekinumab, both 45 mg and 90 mg, is the main factor contributing to the budget increase.

Conclusion: If ustekinumab were to become the main treatment for moderate to severe plaque psoriasis it would have a substantial impact on the MassHealth budget. Therapeutic outcomes were not considered in the BIA, but were discussed in our formulary review. Clinical and economic evidence is limited given the short time ustekinumab has been on the market, and further cost effectiveness studies should be analyzed to determine if ustekinumab is appropriate first line therapy for plaque psoriasis. Our analysis demonstrates an example of the proposed budget impact of this treatment strategy.

3-210

Category: Quality Assurance / Medication Safety

Title: Development and evaluation of an antidiabetic medication training manual for pharmacists at UAB Hospital

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Purpose: The purpose of the project is to assess current diabetic therapy knowledge of UAB Hospitals pharmacists and develop a standardized training document for pharmacists in order to improve patient care at UAB Hospital.

Methods: Eligible participants were all pharmacists employed at UAB Hospital. The training material was developed by a multidisciplinary team utilizing the most current literature and resources in diabetes care. A twenty question multiple-choice exam was developed using the training material and was administered via the pharmacys intranet website. After the exam, the training material was posted for the pharmacists to review. Two weeks after posting the material the original exam was re-administered. Assessment of the results was undertaken to evaluate the effectiveness of the training material and pharmacists knowledge of diabetic therapy.

Results: Ninety-seven pharmacists participated in the pre-survey and 38 participated in the post-survey. Thirty-eight participants were included in data analysis. On the pre-exam the average score was 57%, with an exam pass rate (scores 70%) of 16%. On the post-exam, the average score was 81%, with an exam pass rate of 82%. No significant differences in test scores were noted among participant demographics including length of practice, residency training, or board of pharmacy specialty certification.

Conclusion: Providing pharmacists with a standardized diabetes training manual improved antidiabetic therapy knowledge, as indicated by significant improvements on post-exam performance.

3-211

Category: Quality Assurance / Medication Safety

Title: Impact of pharmacist-based medication counseling on inpatient satisfaction

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Purpose: Patient satisfaction has been a concern for hospitals and health care systems to identify areas of improvement in an increasingly competitive market. Recently, this has been intensified by the Federal Patient Protection and Affordable Care Act of 2010 (P.L. 111-148) which will soon determine financial reimbursement by Centers for Medicare and Medicaid Services (CMS) based on the standardized Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. At South Pointe Hospital, HCAHPS surveys reflected insufficient patient understanding of their medications. To address this issue, a pharmacist-based medication counseling program was implemented. The purpose of this study was to evaluate the effectiveness of this program.

Methods: Staff pharmacist scheduling was altered to accommodate a three hour overlap, which enabled a pharmacist to conduct patient rounds on medicine and surgery nursing floors Monday through Friday. Patient candidates were identified based on alertness, orientation and complexity of medication regimen. Upon completing a medication review, patients were counseled regarding the use and side effects of their medications. Surveys were administered to patients via random distribution by Press Ganey and results were reported to the hospital quality department. If a patient received a new medication while in the hospital, he or she was asked how often they were told what the new medication was for and what potential side effects may occur. The patient could respond with never, sometimes, usually or always for both questions individually. The primary outcome of this study was to compare the always response to these two questions combined for three quarters prior to program implementation to three corresponding quarters after program implementation. The secondary outcomes were to compare the always response before and after implementation for both questions individually. To evaluate primary and secondary outcomes, a Fishers exact test was used and an alpha value < 0.05 was assigned to detect a significant difference.

Results: A total of 2,093 surveys were received (792 pre-program and 1,301 post-program) and included in the analysis. A significant improvement in the always response was detected for the primary outcome (both questions combined, 51% before and 56% after program implementation, p=0.0418). For secondary outcomes, the always response rate to the question regarding what the medication was for improved significantly (38% before and 62% after, p=0.035), however statistical significance was not

achieved for the question regarding potential side effects (38% before and 41% after, p=0.3605). When corresponding quarters were compared individually, a consistent 5% improvement in the primary outcome was found.

Conclusion: At South Pointe Hospital, patient satisfaction regarding medication education was improved through a pharmacist-based counseling program without requiring additional employees. Improvement in patient understanding regarding what medications are for appears evident; however patient understanding of medication side effects remains low. Increased emphasis in medication side effects during patient education will be necessary to further enhance patient satisfaction.

3-212

Category: Quality Assurance / Medication Safety

Title: Assessment of the efficacy and impact of student pharmacist intern completion of admission medication reconciliation

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Purpose: Studies indicate that over twenty five percent of hospital prescribing errors can be attributed to incomplete medication histories. Literature also supports that student pharmacist intern involvement in admission medication reconciliation improved the accuracy of medication histories documented. The purpose of this study is to enhance patient safety by improving the accuracy of medication histories through admission medication reconciliation. The objective is to determine if admission medication reconciliation performed by a pharmacist intern within 24 hours of admission improved the accuracy over one completed by nursing staff, which is the current standard of care in our health system. We will also assess the impact of pharmacist intern involvement by tracking the number of recommendations accepted by prescribers within 24 hours.

Methods: The institutional review board approved this prospective, multi-center trial that took place at two community hospitals within a multi-hospital health system. Pharmacist interns obtained informed consent and completed a total of 317 medication reconciliation interviews within 24 hours of admission. Pharmacist interns then compared their completed medication reconciliation form against nursing documentation and current inpatient medications. They wrote a concise note detailing any discrepancies and summarizing their recommendations. This note was reviewed with a preceptor and placed in the patient chart. Pharmacist interns then re-checked the patients chart to see which recommendations were accepted by prescribers within 24 hours.

Results: Eighty-one percent (257/317) of the medication reconciliation interviews performed were included in the analysis. Patients were excluded for a variety of reasons including incomplete data collection, incorrect documentation or no medication reconciliation completed by nursing within 24 hours. A total of 1502 home medications were reviewed and interns documented 476 discrepancies. Nearly seventy percent (331/476) of discrepancies were omissions, where a home medication was not documented on the inpatient medication history. Other discrepancies included wrong doses, wrong drugs, incomplete entries and additions. Additions were defined as a medication the nurse documented as a home medication, although the patient was not currently taking it at home. Of the 476 discrepancies documented, 44 were felt to warrant a pharmacy recommendation. Recommendations

were made to add significant omitted medications and to correct major dose and frequency discrepancies. Fifty-two percent (23/44) of the recommendations made to prescribers were accepted.

Conclusion: Pharmacist interns were more accurate than nursing staff when completing admission medication reconciliation interviews. Pharmacist intern recommendations were fairly well received by prescribers with over fifty percent being accepted. Utilization of pharmacist interns to complete admission medication reconciliation interviews may be an option for health systems with limited resources.

3-213

Category: Quality Assurance / Medication Safety

Title: Implementation of risk-reduction application for the Pharmacy information system to reduce dispensing errors of Look-alike or sound-alike (LASA) drug names

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Purpose: Mix-ups between two products with a similar name have led to harmful or fatal medication errors. The JCI requires from each organization to maintain and annually review a targeted list of look-alike and sound-alike (LASA) drug name pairs that could be confused with each other. A policy was devised in 2006 at the American University of Beirut Medical Center to include all specific safety strategies for a specified list of potential look-alike/sound-alike medication combinations identified by the Pharmacy-Nursing Committee based on ISMP and USP LASA list, and internal staff reports. The potential for error is high because the Lebanese drug market includes medications from different countries of origin with no standardization in the nomenclature of brand names. The Policy included different risk reduction strategies to reduce confusion between these drugs (e.g. storage in separate locations, provide dosage range checks in the computer system, extra labeling step, limit supply to set strengths or concentration which will avoid confusion, review of medication errors and potential errors reported and publication of ISMP for potential additions to the LASA medication list) The AUBMC Formulary drugs were screened and a LASA list of 38 name pairs was devised and distributed to all Nursing Units. Pharmacy and Nursing staff were educated regarding the specific safety strategies required for each LASA medication combination. The effectiveness of these strategies were monitored and during 2009, ten adverse drug event reports were filled by the pharmacists and were related to the wrong processing of handwritten orders. These errors were related to the poor handwriting of the physicians, the high workload and the reliance on the pharmacists memory of problematic name pairs.

Methods: The Pharmacy designed an application to build an automatic alert at the point of order entry for any LASA name. The drugs where categorized by group of confusion names (e.g. Lasix- lanoxin-Losec), then by subgroup which was created by filling with the individual name of the drug (e.g. Lasix is one subgroup),at which point an alert will appear. The displayed message would link the trade name to the generic name to appear You have entered Trade name/Generic name. Risk of confusion with Trade name 1/Generic name1 and trade name 2/Generic name 2, do not process if handwriting is not clear. The application is manageable and can be updated anytime by the Pharmacy Department when adding a new product to the formulary, or purchasing a different brand name for a formulary drug.

Results: The application was launched in November 2009 with the ability to count the daily number of LASA alerts. A total of 42227 alerts were displayed over one year period (November 09-November 2010).

Conclusion: Computerized alerts to remind providers about potential problems are effective strategies to reduce dispensing errors. The work is ongoing to improve the application to support the appearance of tall man letters for LASA names.

3-214

Category: Quality Assurance / Medication Safety

Title: Impact of a simple, inexpensive barcode verification utility on dispensing errors in a centralized hospital pharmacy

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Purpose: Exploring methods to reduce dispensing errors is a key component of an effective medication management system. Errors related to intravenous medications have the potential to cause the most serious errors. At our hospital, pharmacy management was receiving reports of about one dispensing error per week related to pre-mixed intravenous medications. We evaluated the effect of a simple, inexpensive barcode verification system on dispensing errors related to pre-mixed intravenous medications.

Methods: After determining that no commercially available scanning system met the desired criteria of safety, speed, and simplicity, pharmacy management conceptualized, designed and implemented a system that met the self imposed criteria. The financial outlay, excluding programming time, was $350. As a pilot, the system was implemented for the dispensing of premixed intravenous medications. After the patient specific labels had been affixed to the medications, pharmacy technicians were required to barcode verify the medication prior to placing it in the designated area for the final pharmacist check. The pilot period ran for twelve months (June 2010-May 2011).

Results: During the pilot period, over 37,000 doses of premixed IV medications were barcode verified prior to dispensing. The utility detected 140 errors at the labeling step prior to the technician placing the medication for a final pharmacist check. No premix medications were reported as dispensed incorrectly during the pilot period.

Conclusion: Implementing an inexpensive and simple barcode verification system enabled the hospital pharmacy to essentially reduce its pre-mixed medication dispensing error rate to zero. Other potential uses of this utility would include the dispensing of high risk, as well as look alike sound alike medications. As financial resources continue to be examined, pharmacy directors must continue to look for cost effective ways to improve quality, and safety, without negatively impacting workflow.

3-215

Category: Quality Assurance / Medication Safety

Title: A potentially fatal case of mistaken identity: metformin versus oxycodone-acetaminophen

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Purpose: This case illustrates the importance of medication literacy and compliance for improved health outcomes, particularly in at-risk communities. Medications can be quite confusing for patients who take several generic prescriptions, with the potential for a variety of drug interactions and administration errors. A 51-year-old African American male with a past medical history of diabetes mellitus, hypertension, and alcohol abuse was found by EMS unresponsive at home with agonal breathing which required on-site intubation and was brought to the emergency department in respiratory distress. Initial workups were found to be blood glucose of 22 mg/dL, blood pressure of 56/30 mmHg, severe acidosis with a pH of 6.5 and bicarbonate of less than 5 mEq/L and acute renal failure with a creatinine of 2.4 mg/dL. His lactic acid level was 21.5 mg/dL. At the ED, an NG tube was placed which drained 1L of bright-red blood. Family was not available to provide an initial report. It was later found the patients home medications included metformin and generic oxycodone-acetaminophen 10/325. Later, the family corroborated the physicians suspicion that the patient had mistaken his metformin for his oxycodone-acetaminophen and was taking metformin every 6 hours to stop his pain with no improvement. The blood metformin level was 12 mcg/mL with a normal therapeutic range of 1-2 mcg/mL. The patient required one session of continuous renal replacement therapy and was extubated 3 days later after which he was transferred to the general medicine floor. On the day of discharge the patient experienced no labored respirations, blood pressure was normalized and kidney function improved. For his chronic pain, MS Contin 45mg twice daily was prescribe with gabapentin 300mg twice daily for his neuropathic pain secondary to diabetes. The above case illustrates that the Black-box warning on metformin induced lactic acidosis may be insufficient in deterring this potentially fatal complication. This is complicated by the fact that when combined with ethanol, the incidence of lactic acidosis with metformin may increase. Several medications are shaped as large oblong white pills, and may be easily confused with each other. This case supports the development of a better identification system of generics like metformin, such as the addition of a distinctive color or name imprint of the medication, rather than just randomized codes.

Methods: N/A

Results: N/A

Conclusion: N/A

3-216

Category: Quality Assurance / Medication Safety

Title: Analytical analysis of the efficiency and accuracy of tablet splitting for hospital patients

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Purpose: Our pharmacy department provides ready to use doses, including half tablets when a dose is not commercially available. Based on data collected from the computerized medical record, our volume of half tablet doses is approximately 700 per month. Accuracy is especially important in the hospital setting. In contrast to the outpatient setting where the same patient receives both halves of the tablet at different dosing times, a hospitalized patient may not receive both halves. In theory, the overall daily dose should be clinically adequate as smaller halves compensate for larger halves. However, in the inpatient setting, the other half may be either discarded or dispensed to another patient. This project was designed to test the accuracy and efficiency of different tablet splitting methods.

Methods: In the first phase, production time was the focus. A basic tablet splitter (tool C, Ezy Dose tablet cutter) was compared to two non-traditional tools (tools A and B) for splitting tablets. Ten pharmacy learners (residents or students) split ten identical tablets with each of the three tools. The time required to split the tablets, the weights of each half tablet, and the user preference were recorded. As a baseline, the weight of ten whole tablets was measured. Half tablets were considered acceptable if they did not vary by more than 10% of the expected weight (goal 69-85 grams). In the second phase, accuracy was the focus. The basic tablet splitter (tool C) was compared to another commercially available splitter (tools D, Apex Ultra pill splitter) using four pharmacy learners.

Results: In the first phase, one of the nontraditional tools (tool A) was preferred by all testers and required the least amount of time to split ten tablets (46.7 seconds, compared to 62.4 and 78.2 seconds for tools B and C, respectively). Unfortunately, the accuracy with this product was poor (average 77 grams, standard deviation 11.4, range 34-119 grams, 34% unacceptable). The second nontraditional tool (tool B) had the least accuracy (average 74 grams, standard deviation 9.8, range 42-107 grams, 43% unacceptable). Although requiring the most time, the commercially available basic tablet splitter (tool C) had the best accuracy (average 78.2 grams, standard deviation 7.5, range 42-111 grams, 20% unacceptable). In the second phase, accuracy was found to be user specific with the basic tablet splitter (tool C) when compared to the other commercially available product (tool D). The percentage of unacceptable doses varied with tool C (10-20% for two testers and 60% for the other two testers). Use of tool D resulted in consistent findings (20-25% unacceptable for all testers). Product preference was variable.

Conclusion: Although non traditional tools may be faster and easier for large volume tablet splitting, accuracy was found to be not acceptable. In our testing, commercially available products had greater accuracy and product preference was user specific.

3-217

Category: Quality Assurance / Medication Safety

Title: Comprehensive training and education on the use of doxorubicin in chemoembolization

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Purpose: Chemoembolization, a procedure where anticancer medications are directly injected into a tumor through its feeding blood supply, frequently utilizes doxorubicin admixed in a number of different ways. The Interventional Radiology Department at Beth Israel Deaconess Medical Center orders chemoembolization in one of three ways: doxorubicin admixed with lipiodol and optiray, doxorubicin admixed with optiray where lipiodol is sent separately, and doxorubicin eluded in beads. Comprehensive training and education was developed for pharmacy technicians and pharmacists focusing on the different ways to safely prepare doxorubicin for chemoembolization. In addition, the training and education was expanded to the nurses and physicians that administer the doxorubicin to assure safe handling and manipulating during the chemoembolization procedure.

Methods: The Clinical Oncology Specialist worked collaboratively with the Interventional Radiology nurses and physicians to develop a chemoembolization order template. In addition, a comprehensive procedure, describing step by step how to compound each type of doxorubicin for chemoembolization, was developed for the sterile products staff. A guideline was also developed which outlines all the steps involved in processing a chemoembolization order, from receiving the order to delivering the medication to Interventional Radiology, focusing on proper documentation and safety checks. Also, the Sterile Products Supervisors watched a chemoembolization procedure and determined that the two Interventional Radiology physicians would benefit from taking the same chemotherapy practical test that all pharmacy staff must pass prior to compounding chemotherapy and/or hazardous medications. The practical test focused on manipulating vials using negative pressure techniques as well as using closed-system transfer devices. It also focused on proper garbing and disposal/handling of chemotherpapy agents according to USP Chapter 797.

Results: The implementation of a standardized chemoembolization order template helps assure that the orders are written clearly and accurately. It guides the physicians and builds quality assurance into the process. The pharmacy staff rely heavily on the chemoembolization guidelines and compounding procedures. This has resulted in fewer questions from the staff and less errors. 100% of the 20 chemoembolization orders processed since April, 2011 have been compounded accurately, including proper documentation and safety checks. Two Interventional Radiologists passed a

chemotherapy/hazardous practical test using a florescent dye under UV light demonstrating that they could manipulate vials using negative pressure techniques and closed-system transfer devices with no more that 2 visible contamination spots on any surfaces. They also demonstrated proper garbing and handling of chemotherapy agents. The two physicians demonstrated very different techniques and understandings of the safe handling of chemotherapy agents. The practical testing helped to standardize their process and increase the comfort level of the physicians and nurses when administering and handling these agents.

Conclusion: Comprehensive training and education on the use of doxorubicin in chemoembolization procedures proved valuable for pharmacy technicians, pharmacists, nurses, and physicians. In the future, we hope to expand this type of comprehensive training and education to other complicated and specialized and/or hazardous medications.

3-218

Category: Quality Assurance / Medication Safety

Title: Improving Medication Reconcilation for Outpatient Mental Health Patients in a VA Setting

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Purpose: To improve the medication reconciliation process for patients in the outpatient mental health clinics by implementing pharmacist involvement in addressing the discrepancies found that werent addressed by the psychiatrist.

Methods: A retrospective chart review was performed at VA Black Hills Health Care System (BHHCS). Fifty charts were chosen at random from patients seen from March 1st to May 31st, 2011 in a mental health outpatient individual appointment with a psychiatrist. Charts were reviewed for the presence of medication discrepancies (in order to determine a discrepancy rate) and to determine if the discrepancies were addressed by the psychiatrist. On June 1st, pharmacists initiated assisting in the medication reconciliation discrepancy resolution process via an electronic view alert in the computerized patient record system (CPRS) from the registered nurse in the mental health clinic. A random sample of patients seen from June 1st to June 10th was reviewed for discrepancies found that were not addressed by the psychiatrist and for the medication(s) not reconciled by either the psychiatrist or pharmacist.

Results: Of the 50 charts reviewed for discrepancies and subsequent psychiatrist resolution of these discrepancies, there was a discrepancy rate of 2.5% (three charts). These three charts contained five medications that needed discrepancy resolution. These five medications were: simvastatin, metoprolol, metformin, clotrimazole cream and aripiprazole. The metoprolol and metformin were stopped by the patient, the simvastatin and aripiprazole were being taken differently than listed in the computer by the patient(s). The clotrimazole was expired, but the patient was currently using this medication. The discrepancy resolution rate was 20% with these five medications. The psychiatrist did resolve the discrepancy in dose with the aripiprazole at the time of the visit. Due to the metoprolol and metformin not being reconciled, these patients presented to the emergency department for high blood pressure and uncontrolled blood glucose respectively within one month of this discrepancy being noted. These were considered clinically significant discrepancies (giving to the fact they required the patient to seek additional care). The other discrepancies were not clinically significant as they did not require the patient to seek additional care. After pharmacist involvement in the medication reconciliation process began, another 20 charts reviewed with two discrepancies noted (two patients) for 10% discrepancy rate. Of these two discrepancies, one was terazosin with a dose different from what the patient was taking. The second discrepancy was with lisinopril where the patient had a dose increase made by the primary care provider and the medication order was not updated in CPRS. The pharmacist resolved both discrepancies (100% discrepancy resolution) within 2 days of notification via electronic view alert.

Conclusion: Given the data presented, the implementation of a pharmacist involved in the resolution of discrepancies found in the mental health outpatient individualized clinics was beneficial in getting medications other than mental health medications resolved. Psychiatrists are not always comfortable reconciling medications they did not prescribe; therefore these go unresolved if not addressed by another health care professional. Results are limited by the small sample size and small number of discrepancies found. In literature, it has been reported that medication discrepancies occur in approximately 46% of patients. Additional education for mental health RNs would be of additional benefit due to the low discrepancy rate found here as potentially all discrepancies are not being found.

3-219

Category: Quality Assurance / Medication Safety

Title: Impact of Lean process Improvement Techniques On Oncology Services at an Academic Medical Center

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Purpose: The impact of lean process improvement on oncology services at our academic medical center was evaluated

Methods: We implemented lean techniques in our oncology infusion center at one of our campuses to standardize workflow, reduce waste, and achieve significant cost savings. Process improvement goals included standardization of chemo orders, dose rounding, inventory management, reduction of waste, errors and process to provide care for patients in the outpatient rather than inpatient setting, if applicable. A team comprised of pharmacy, nursing, physicians, administration and lean consultant evaluated the entire processes to identify the gaps in workflow, organization,process improvement opportunities and outcome measurements. Value stream mapping,5S's, total quality maintenance tools were the guiding principles for the team. The initiatives were implemented at the begining of our current fiscal year.

Results: Workflow was significantly improved through the creation of accountability, standardization, and movement toward one-peice flow. The savings from the initiatives over past seven months were as follows: dose rounding $54,000, providing care in the outpatient instead of inpatient setting $110,000, standardization of ordering process/pre-authorization for reimbursement $374,000, inventory reduction $200,000. In addition, the team work between all stakeholders significantly improved communication, trust and job satisfaction among staff members.

Conclusion: Lean methodology was successfully implemented in the oncology infusion center at our academic medical center. Benefits of this process, included a saving of $738,000 over past seven months due to waste reduction, improvements in work flow,medication management processes, inventory reduction, waste reduction and pre-authorization process.

3-220

Category: Quality Assurance / Medication Safety

Title: Developing the role of medication reconciliation technicians and utilizing the technicians in an Emergency Department

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Purpose: A review of the hospitals medication errors revealed several errors involving medication reconciliation. Data analysis and root cause investigations were performed on these events. It was discovered that the root error causes were multi-factorial. However, while there were many contributing factors, each had a flaw in the information that was retrieved during the collection of the patients medication list. A quality improvement team was formed that comprised of hospital physicians, pharmacy, medication safety, nursing, administration and quality specialists. The teamed was chaired by the Vice President of Quality and Patient Safety and employed the hospitals A3 quality system to assess the problem and define an ideal state.

Methods: The Administrator of Pharmacy Services and Medication Safety Officer began the process of developing a pharmacy technician based pilot program to improve the accuracy of the medication lists collected in the health system. After reviewing the research, it was decided that two pharmacy technician positions would be created to focus on this new role. A business plan was created and presented to the hospitals senior management and the Board of Trustees to approve the new positions. The first two approved technicians would be deployed to the hospitals emergency department and focus on interviewing patients as they are admitted to the system. Special job descriptions and training were developed and used to create technicians with the abilities to perform these functions.

Results: After interviewing, selecting and training of the pharmacy technicians, the role was implemented in the emergency department. Barriers with interdepartmental communication, computer access and continuity of information needed to be overcome. Coordination of the medication list collection was achieved by pharmacy and nursing personnel. Completed and more accurate medication lists are available sooner to prescribing personnel.

Conclusion: Pharmacy technicians provide an efficient and cost-effective source for improving medication reconciliation data collection. This pilot program established the feasibility of the program. The long term strategy is for broader implementation across all network hospitals and beds as well as long-term medication error prevention data collection.

3-221

Category: Quality Assurance / Medication Safety

Title: Development and implementation of a hospital-wide safe handling program for hazardous medications

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Purpose: The number of medications classified as hazardous, as well as the recommendations on how to prepare, handle, and dispose of these medications increases and becomes more rigorous over time. A multi-disciplinary working group consisting of pharmacists and nurses was formed to review the most current recommendations on hazardous medications based on organizations such as NIOSH, ONS, ASHP, and USP Chapter 797. The purpose of the working group was to develop a list of medications which must be prepared, handled, and disposed as hazardous. The group worked to develop and implement multi-disciplinary guidelines for the pharmacy and nursing staff.

Methods: The multi-disciplinary working group met over the course of several months and identified 24 intravenous and 23 oral formulary medications as hazardous. Many of the medications on the list were always treated as hazardous while other medications were new additions to the list, ranging from amiodarone to valproate. It was decided that all intravenous hazardous medications and any oral hazardous medications which required splitting or crushing would be made in a veritcal and exhausted negative pressure hood by pharmacy technicans who are trained and tested on compounding chemotherapy and hazardous medications. 8 oral compounding procedures were developed for any oral hazardous medication in which a commercial liquid is unavailable. All hazardous medications would be delivered to the nursing units in a clear plastic bag with a bright pink sticker with the words "admin/prep precautions" clearly posted on the outside of the bag. Nurses would wear gloves when handling, administering, and disposing of any medication on the hazardous medication list.

Results: Prior to the development and implementation of a safe-handling program for hazardous medications, nurses were splitting and crushing oral hazardous medications on the nursing unit. In addition, there was a lack of consistency on which medications to treat as hazardous and which precautions to take regarding their preparation, handling, and disposal. The safe-handling of hazardous medications program resulted in decreased exposure of hazardous medications to the pharmacy and nursing staff. It also provided consistent, clear guidelines for staff to follow as evidenced by the creation of a hospital-wide nursing practice policy on the administration and preparation precautions for non-

antineoplastic medications requiring special handling. As a result, pharmacy and nursing staff are providing safer and more consistent processing of hazardous medications.

Conclusion: The development and implementation of a safe-handling program for hazardous medications proved to be a welcome and necessary opportunity to improve safety, standardize practice, and optimize patient care.

3-222

Category: Quality Assurance / Medication Safety

Title: Pharmacy department optimization of medication order verification: a lean process improvement and benchmarking initiative

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Purpose: Baystate Medical Center (BMC) is a 653-bed tertiary care, Level 1 trauma center and academic teaching institution. It is the flagship hospital of a 3-hospital integrated system. The inpatient pharmacy department provides pharmacy services 24 hours a day and 7 days a week, in order to meet the demands of all adult and pediatric medication orders. In January 2008, the inpatient pharmacy transitioned from a system-verification procedure to a process of manual verification through clinical pharmacist review as required by the Joint Commission (MM 05.01.01). As a result, clinical order review increased by 57 percent, or about 40,000 orders, over 15 months without adding additional pharmacists. This has triggered further analysis by the pharmacy leadership team around process standardization and quality of clinical order review. Pharmacy literature lacks national benchmarking data to support a safe number of orders verified per hour accounting for efficient and appropriate clinical order review. A verification process improvement team (VPIT) was established to review pharmacist order verification processes. The goal was to improve medication safety by increasing the clinical role of a pharmacist during the order verification process and establishing a safe order verification rate. The team also utilized Lean principles to evaluate and eliminate waste and work flow interruptions.

Methods: VPIT conducted a prospective, observational study employing Lean principles to evaluate pharmacist order review methods. An independent reviewer team comprised of three representatives from the division of Healthcare Quality pharmacist observed order verification on all three shifts. This review team collected data on the number of medication orders verified per hour, the number and type of staff interruptions, and the time associated with current processes. From this observation data, the team developed a value stream map of the baseline verification processes. Observation data was also used to define the cycle time of order verification and create a benchmark safe order verification rate. Other institutions were surveyed to identify average verification rates or standards for use in comparison to our observed data.

Results: The observation identified several major interruptions that impact the clinical pharmacists role, for which action plans were subsequently created. Non-clinical phone call interruptions (e.g. automated

dispensing cabinet (ADC) troubleshooting, medication replacement requests, etc) were resolved by scheduling a pharmacy technician to triage phone calls. A redesigned ADC workflow was undertaken to further reduce missing medication doses by increasing the number of technician cabinet rounds. In an effort to retrieve drug information more efficiently, the pharmacist workstations were redesigned to incorporate a dual screen display and the online pharmacy references were streamlined and updated. The pharmacy intervention database was also linked to the order verification screen, eliminating key strokes and improving intervention capture rates. The six month intervention rate average prior to implementation of the link was 72.5 interventions/1000 patient days, compared to 126 interventions/1000 patient days post implementation. At the time of the observation, the pharmacy was reviewing over 3800 orders daily, resulting in an average of 46 orders verified per hour per pharmacist per day (orders/hr/RPh). BMC pharmacist observation demonstrated an average cycle time (time to verify one medication order) of 1.71 minutes with interruptions. Using the measured cycle time we calculated a desirable pharmacist verification rate of 35 orders/hr/RPh. The review of the survey respondents showed an average order review rate between 25 and 50 orders/hr/RPh.

Conclusion: Through the application of Lean principles, VPIT was able to develop and implement action plans to address workflow waste and interruptions. We defined processes required to achieve safe and accurate clinical review of medication orders specific to BMC practices (35 orders/hr/RPh). We have since used this data to support the implementation of our unit-based practice model and expansion of our drug use and disease state management initiatives (e.g. once-daily aminoglycoside dosing, IV to PO therapy conversions, etc). In the future it is anticipated that this data will be applied to justification for additional staff positions as our organization continues to expand.

3-223

Category: Quality Assurance / Medication Safety

Title: Impact on medication administration with the implementation of a restricted room service meal delivery model in a mid-size hospital with optimal utilization of pharmacy information system

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Purpose: An increasing focus on customer service has been a critical element for heath systems over the last several years. Hospitals are looking to improve their care delivery and implement systems for the improvement of patient satisfaction scores as Medicare reimbursement will be impacted by a value based modifier. Implementation of a room service meal delivery model has been shown to increase customer satisfaction. An unanswered question about this customer service initiative has been the impact on medication administration and medication errors. Our facility implemented a room service meal delivery model in September of 2008 with restrictions on carbohydrate controlled diets to be at set times. Optimal use of our facility's pharmacy information system allows for the specific units to have varying times assigned to standard sigs associated with meals. This review will evaluate the impact on medication administration error rates and customer service results following the implementation of a room service meal delivery model at a 326 bed facility.

Methods: Prospective, descriptive inpatient surveys were conducted in March 2008 to set expectations of a room service style meal delivery system. A prospective nursing survey was also conducted to provide insight on timing and administration issues. Implementation of a room service meal delivery process was implemented in September of 2008. A retrospective review of medication error rate for the six months prior to and after the implementation date was collected from our facility's Risk Management department, along with usage data for the amount of 50 percent dextrose and glucagon administered over this time period, which is being used as surrogate markers of appropriate insulin and oral hypoglycemic use. A second, post-implementation, prospective patient satisfaction survey was conducted in March-April of 2009. Results were evaluated with descriptive statistics.

Results: A review of our facility's reported medication error rate was 0.08 percent in the 6-month pre-implementation period compared to 0.06 percent medication error rate during the 6-month post-implementation evaluation period. Total doses of glucagon dispensed per month were 8.5 in the pre-implementation period versus 4.8 in the post-implementation period. Excluding patients receiving glucagon in the emergency department and one patient who received a glucagon infusion for a beta-blocker overdose, the number of glucagon doses dispensed per month was 2.2 +/- 0.98 and 0.5 +/- 0.83, respectively for the pre- and post-implementation periods. The number of doses of 50 percent dextrose used during the pre-evaluation period was 67 +/- 15 for 42 +/- 9 patients per month before the service

change and was 74 +/- 18 doses of 50 percent dextrose for 41 +/- 8 patients per month after the implementation of the new process. The follow-up patient satisfaction survey that was administered in March-April 2009 showed a 15 percent improvement in the highest category, exceeding patient expectations.

Conclusion: Implementation of a room service meal delivery model in a mid-size hospital can be accomplished safely with respect to the impact on medication administration. The implementation of this type of model can potentially impact numerous medications that need to be administered with meals. Surrogate markers for appropriate administration of two of the more important classes of concern, insulin and oral hypoglycemic medications, show a decrease in the amount of glucagon used following the implementation of this meal delivery model. More units of dextrose 50 percent were required post-implementation (74 doses) versus pre-implementation (67 doses) but for a similar number of patients (41 patients and 42 patients, respectively). Combined with a slight decrease in overall medication error rate (0.06 percent versus 0.08 percent pre-implementation), the implementation of our restricted room service delivery model did not negatively impact patient safety in regards to medications requiring to be administered around meal times. We also were able to see an improvement in our patient satisfaction scores in regards for this service as well.

3-224

Category: Quality Assurance / Medication Safety

Title: Hand hygiene testing in a large university teaching hospital

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Purpose: The main goal of the hand hygiene program is to reduce the transmission of pathogenic microorganism from staff to patients in compounded sterile preparations. This process decreases the incidence of health care associated infections. To minimize possible contamination of compounded sterile preparation it is necessary for all staff to be properly trained and tested for strict hand washing technique

Methods: In addition to observing sterile compounding, the staff was required to perform monthly finger culture samples in the intravenous admixture clean rooms. Gloved fingertip, thumb sampling was preformed immediately after garbing and prior to spraying gloves with sterile alcohol. All compounding staff must lightly press each fingertip into a nutrient agar plate. They must use one plate per hand. The plate is labeled and sent to a testing labatory for reading and identification of microorganism. The lab will count any colony forming units that grow on the agar plate. The desired results are zero colony forming units which is considered negative results. A positive result indicates that the employee is non compliant and needs re-education on proper hand hygiene. A report is generated monthly with number of colony forming units and identification of any microorganism.

Results: When this program was first implemented the percent compliance of pharmacy staff with no colony forming units was 30%. After re-education and training the percent of pharmacy staff with no colony growth has remained 95% or above

Conclusion: Ongoing monitoring, training and testing has assured that hand hygeine compliance meets the guidelines of USP 797 and the Joint Commission medication management standards. This process can be very instrumental in improving patient safety and decreasing transmission of pathogenic microorganism within the institution.

3-225

Category: Quality Assurance / Medication Safety

Title: Bridging the gap preparing hospital introductory pharmacy practice experience (IPPE) students to participate in medication safety activities in healthcare systems

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Purpose: Medication safety activities in healthcare systems are important due to the prevalence of medication errors. More than 7,000 deaths each year are related to medications according to the Institute of Medicine (IOM) report, "To Err is Human: Building a Safer Health System. Medication Error Reduction Plan(MERP) Surveys conducted by the California Department of Public Health revealed that 81% of the hospitals surveyed in 2009 were deficient in their medication safety processes (ISMP Mar 25 2010 15(6): 1-3.). Pharmacy schools can play a vital role in bridging the medication safety needs of healthcare practice sites by preparing Hospital IPPE students to work in partnership with their rotation sites. This study describes various ways pharmacy students may participate in medication safety related activities in the acute care setting, and identifies specific needs for medication safety-related curriculum in pharmacy schools.

Methods: All practice sites participating in a Hospital IPPE program for 70 students during the winter 2011 semester were surveyed to determine current medication safety activities of their IPPE students, the types of medication safety activities the site would like the IPPE students to be involved, and the types of training materials the school should provide to better equip students to participate in medication safety activities.

Results: Eleven hospital sites were sent a survey. Sites are located in central and northern California and provided IPPE experience for 70 students. Eight out of 11 (73%) hospital sites responded. Responders are acute care facilities between 220 and 465 beds and were composed of not-for-profit community hospitals (50%), health maintenance organizations (37%) and for-profit community hospitals (13%). The medication safety activities that current Hospital IPPE students are involved include unapproved abbreviation audits (25%), fentanyl patch audits (25%), medication pass observations (25%), warfarin patient education (25%), nursing unit inspections (25%), attendance at medication safety committee meetings (25%), adverse drug reaction reporting (12%), and medication error reporting (12%). The medication safety activities the sites would like the Hospital IPPE students to participate include automated dispensing cabinet refill audits (75%), nursing unit inspections (75%), attendance at medication safety committee meetings (50%), unapproved abbreviation audits (37%), medication pass observation (25%), warfarin patient education (25%), adverse drug reaction reporting (25%), medication

error reporting (25%), and fentanyl patch audits (12%). The responders identified the following skill sets or competencies necessary for the hospital IPPE students to be successful in participating in the above medication safety/quality assurance activities: Competence Assessment Tools for Health-System Pharmacies Medication Safety (75%), ISMP Confused Drug Name List (60%), ISMP Error Prone Abbreviation List (60%), FDA and ISMP List of Drug Names with Tall Man Letters (60%), Competence Assessment Tools for Health-System Pharmacies Adverse Drug Reaction Reporting (50%), and ASHP Guidelines (37%).

Conclusion: Hospital IPPE student involvement in medication safety activities should be incorporated into the overall hospital practice experience. Some medication safety activities are already being conducted by hospital IPPE students. Areas for increased participation in medication safety programs by students should include ongoing audit activities and participation at medication safety meetings. Recommendations for how pharmacy schools can better prepare students for these activities will require additions to the IPPE pharmacy curriculum.

3-226

Category: Quality Assurance / Medication Safety

Title: Assessing contamination rates of medium-risk level sterile compounding with non-sterile and sterile gloves

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Purpose: All hospital sterile compounding is governed by the United States Pharmacopeia (USP) Chapter 797. This chapter dictates the standards, procedures, and requirements of compounding sterile products in all settings. These regulations were created to help decrease the infection rate in patients that received sterile products and to help protect the compounder from unwanted exposure to pharmaceutical products. In December 2007, the USP 797 revision was finalized. One of the major changes to the chapter was mandating that all sterile compounding now needed to be completed with sterile gloves. No longer were compounders able to use non-sterile gloves to make sterile products. Hospitals complying with the new regulations were seeing increases in supply costs due in part to higher cost associated with sterile gloves compared to non-sterile gloves. The purpose of this study was to determine if non-sterile gloves have less than or similar contamination rates set forth by sterile gloves for tryptic-soy broth (TSB) mini-bags and to evaluate if proper aseptic technique and routine sanitization is enough to overcome contamination of TSB mini-bags and agar fingertip plates.

Methods: This study was an institutional review board approved prospective study divided into four arms: new non-sterile gloves with routine disinfection, non-sterile gloves that had been used in compounding for at least an hour with routine disinfection, new sterile gloves with routine disinfection, and sterile gloves that had been used in compounding for at least an hour with routine disinfection. Sterile 70 percent isopropyl alcohol (IPA) was the disinfectant used in all arms as mandated by USP 797. With the exception of the type of gloves used, all other aspects of each trial were performed according to the same guidelines. All compounding and testing was completed by pharmacy technicians who gave informed consent to participate in the study, were trained in aseptic sterile technique, and routinely worked in the IV room compounding sterile products. This study was designed based on the methods from Q.I. Medical Inc. for their medium-risk level Personal Aseptic Technique Test for TSB mini-bags and agar fingertip plates. Once the testing was complete the TSB mini-bags, considered the final product, were stored and incubated at room temperature for fourteen days based on manufacturer guidelines. The agar fingertip plates were stored and incubated at room temperature for three days before being read. Contamination was defined as evidence of microbial growth. The TSB mini-bags were assessed for clarity and for evidence of particulates. The agar fingertip plates were assessed for evidence of microbial

colonies. The primary outcome for the study was detection of contamination in the TSB mini-bags. The secondary outcome of the study was detection of finger tip contamination on the agar fingertip plates.

Results: Contamination was visible in 4.7 percent TSB mini-bag tests completed using non-sterile gloves and in 5.6 percent TSB mini-bag tests completed using sterile gloves (P equals 0.855). There also was not a statistically significant increase in contamination risk based on if the test was completed with unused gloves versus after at least one hour of compounding using the same gloves (P equals 0.293). Bacterial growth was present on 29.1 percent agar fingertip plate samples performed using non-sterile gloves and 6.7 percent agar fingertip plate samples performed using sterile gloves(P equals less than 0.001). The odds ratio of having bacterial growth on the agar fingertip plates is increased 1.3 times with the use of non-sterile gloves versus sterile gloves.

Conclusion: This study concludes that although non-sterile gloves have a higher incidence of bacterial growth in agar growth plates than sterile gloves, these results do not significantly impact the final product in TSB mini-bags. Non-sterile gloves may be an economical and safe alternative to sterile gloves for medium-risk level compounding. Further studies in larger populations are needed to fully validate the results.

3-227

Category: Quality Assurance / Medication Safety

Title: The Effect of Therapeutic Interchanges on Out-patient Medication Regimens

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Purpose: The American College of Clinical Pharmacy advocates for the practice of therapeutic interchange, in which physicians and pharmacists collaborate to develop and implement programs to improve drug utilization. A therapeutic interchange program allows patients to be transitioned to a standard medication within a designated drug class. Upon hospital discharge, patients may be prescribed the therapeutically interchanged agent without reconciliation against the out-patient regimen, introducing a potential duplication of therapy. The primary purpose of this study is to identify the impact of therapeutic interchange on discharge prescriptions.

Methods: All patients admitted to a non-ICU telemetry floor who were prescribed a statin, angiotensin-receptor blocker (ARB), proton pump inhibitor (PPI), H2 antagonist, and/or fibrate were eligible for inclusion. Patients enrolled in the transition of care heart failure program or on the family medicine service were excluded due to proactive pharmacy discharge counseling already in place. The prescribed inpatient drug regimen was compared to the admission medication reconciliation document to identify patients prescribed the therapeutically interchanged agent. In instances where the therapeutically interchanged agent was continued at discharge, the discharge summary was analyzed for instructions to discontinue the out-patient drug. The percentage of therapeutic interchanges converted back to the original out-patient medication regimen at discharge was evaluated.

Results: Fifty patients were included in this study from January 17, 2011 to April 25, 2011. At hospital discharge, 94% of patients (47/50 patients) were properly switched to the original out-patient medication regimen, versus 6% of patients (3/50 patients) discharged on the inpatient therapeutic interchange agent. For those patients discharged on the therapeutic interchange agent, specific instructions to discontinue the original out-patient medication were not included in the discharge summary.

Conclusion: Through proper utilization of a medication reconciliation and discharge database, therapeutic interchange did not routinely alter a patients out-patient regimen upon discharge. Such results may allow for an expansion of the therapeutic interchange process through the Pharmacy and Therapeutics committee.

3-228

Category: Quality Assurance / Medication Safety

Title: Survey of dispensing errors detected prior to the final accuracy check

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Purpose: All prescriptions should be have the correct patient details, be prescribed clearly and legally, correct drugs dispensed, with the correct label and packaging. This project was designed to identify common types of errors and the factors contributing to their occurrence with a view to preventing them.

Methods: During the audit week, staff, working in the dispensaries, compiled a log of the errors made internally but identified and prevented prior to them leaving the department. This data was then analysed, by the pharmacist, to identify the commons themes.

Results: Forty eight errors were detected across the department. These were divided between In-patient (21% rate 0.14%), Out patient (48% rate 1.84%) and Sunderland Eye Infirmary (SEI) (31% rate 0.88%). These results should be considered separately as the 3 areas work in different ways. For example Out patients has a stream of patients waiting for prescriptions, the SEI is similar but part of the volume of transactions includes supplies for the wards and departments. For the In- patient dispensary most of the work is generated via electronic prescribing from the prescribers input, verified by a pharmacist and then dispensed by the robot. Forty percent of the errors which were made by the pharmacist involved quantity calculation errors, all for chemotherapy orders. In Out -patients most common errors were either the wrong drug (22%) or the wrong quantity (22%). The most common error at SEI is selecting the incorrect drug.

Conclusion: The most consistent errors involved selecting the wrong drug. This is resolved by electronic prescribing which means that the robot selects the drug according to what the prescriber has inputted. The exception is where items have to be stored separately, either on the shelves (bulky) or in the fridge. Most errors occur during the traditional method of dispensing from hand written transcribed prescriptions. A key approach to dealing with transcribed prescriptions is to dispense from the prescription not the label. This prevents the wrong drug being selected as when the drug and label are married together there is an opportunity to ensure that they match exactly. This is the opposite of checking an EP generated item where the check is to ensure the label and drug match as the prescription, drug selection and label have all been generated from the prescribers input. Manual drug selection is only required if the item is a fridge item or too bulky for robot storage. The other common error involved the calculation of quantities and applied to all grades of staff. This involves the most basic numeracy skills and great care must be taken with this, as it leads to patients having to return for medication unnecessarily. The error rates between the different dispensaries clearly demonstrates how to Robot virtually eliminates the errors of selecting the wrong drug. However it should be noted that on

rare occasions the shelves in the Robot are disturbed leading the Robot to select the wrong drug. This means all of the items from the Robot must be checked thoroughly and if an error occurs, this needs to be corrected at once. These errors were then used to develop an education programme to remind staff about adopting a systematic approach dispensing and self checking.

3-229

Category: Quality Assurance / Medication Safety

Title: Medication trigger tools: a methodology for measuring medication related harm in a large medical academic center

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Purpose: Adverse drug events continue to have important implications for patient safety. Their identification remains a main target in improving clinical practice errors. Traditional strategies of assessing adverse drug-related events, such as a voluntary incident reporting system, give insights into problematic issues or trends; however, this system only captures a low percentage of the total adverse drug events (ADEs). The primary goal of this quality improvement initiative was to determine the frequency and types of adverse drug events at Cleveland Clinic as defined by IHI Global Trigger Tool methodology. The secondary goal of this study was to compare the frequency and characteristics of ADEs detected by IHI global Trigger Tool and by Cleveland Clinics Safety Event Reporting System (SERS).

Methods: The medication trigger chart review used data from a random sample of patients admitted to the hospital between February 2010 and February 2011. The selection criteria for the charts were: closed and completed record, patient age 18 or older, and length of stay of at least 24 hours. The triggers used for a potential adverse drug event include use of antidotes, abnormal laboratory values, and abrupt medication stop orders. When a trigger was identified, the chart was reviewed to determine whether an adverse drug event has occurred. Level of patient harm was classified using the National Coordinator Council for Medication Error Reporting and Prevention scale (NCC-MERP scale).

Results: A total of 260 charts were reviewed and 367 positive medication triggers were identified. Among these triggers, 33 were deemed to represent true ADEs. The prevalence of adverse drug events observed using Global Trigger Tool was 18 ADE/ 1,000 patient days. However, the prevalence of ADEs voluntarily reported via SERS was significantly lower, 0.2 ADE/1,000 patient days. The majority (90%) of these ADEs were identified as temporary harm (NCC-MERP category E), and a small percentage (10%) included events resulting in prolonged hospitalization (NCC-MERP category F). The voluntary reporting data showed a similar trend. The most common triggers associated with an adverse drug event were: PTT values greater than 100 seconds, glucose levels below 50 mg/dL, rising BUN or serum creatinine two times over baseline, and oversedation/hypotension. These four triggers accounted for 78% of the detected ADEs.

Conclusion: Medication trigger tool methodology is a useful approach to improve detection of adverse events at Cleveland Clinic. Evaluation of these adverse events and subsequently designing specific safety

strategies can be instrumental in improving patient care. Further random chart review will be carried out to evaluate the impact of the change strategies on the occurrence of adverse drug events.

3-230

Category: Quality Assurance / Medication Safety

Title: Point-of-care activated system for amoxiclav-1g infusion is preferred by nurses to both usual syringe-needle and transfer-set methods of reconstitution and administration

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Purpose: Intravenous (i.v.) drug infusions are usually reconstituted in nursing wards using the classic syringe and needle method (SYRNE) or, more recently, the transfer set method (TRASE). However, a third method, the point-of-care activated system (POCAS), enables a safer, more rapid and efficient preparation and administration of infused drugs, including less stable ones. As this alternative is virtually unknown in Europe, we aim to recommend and implement it cost-efficiently within all Belgian hospitals during the European campaign on patient safety. Therefore, the present study was set up to show nurses with no prior experience with this technique could readily adopt it, in replacement of their usual methods.

Methods: This open-design study took place in two Belgian hospitals located 50 miles apart, the former using the SYRNE method and the latter the TRASE method as standardized practices. Two 300-POCAS badges were outsourced from a hospital pharmacy experienced with POCAS and were delivered to the wards. In both hospitals, after a short 10- to 20-minute learning session, 15 registered nurses with more than 5-year experience but ignorant of the POCAS concept were enrolled. Each had to perform 20 infusions of amoxiclav-1g in 50-mL saline bag in their daily routine, alternating their usual and POCAS methods on successive occasions. Immediately after a POCAS administration, each nurse was required to evaluate nine criteria: packaging, activation, reconstitution, deactivation, administration, elimination, safety, ready-to-reconstitute concept usefulness and point-of-care reconstitution usefulness. Each criterion was rated by means of a visual analogue scale where the centre (50 mm) of the 100-mm horizontal line figured the reference value, either attributed to the SYRNE method, the TRASE method or, for activation and deactivation manoeuvres, to a neither bad nor good appreciation. Non-parametric statistics were used and a global comparison was made, for each hospital, between POCAS and SYRNE or TRASE methods using the one-tailed Wilcoxon test for paired samples. In addition, to detect a possible habituation/learning effect throughout the test duration, the 10 POCAS data sets of each hospital were analysed using a Friedman ANOVA for repeated measures, followed by post-hoc comparisons between all pairs of sessions when appropriate.

Results: Data from two nurses were discarded in both hospitals due to non-compliance. All criteria median values were between 80-90 mm with 20-30 mm interquartile intervals. Global comparisons revealed a strong preference for the POCAS method over the SYRNE method or the TRASE method for all criteria (P values less than 0.01). Moreover, statistically significant differences within the 10-administration sequence could be detected for 7 and for 9 criteria in the POCAS-SYRNE and POCAS-TRASE comparisons, respectively (P values less than 0.05). Post-hoc comparisons revealed these differences essentially arose between early and late administrations, evidencing a slight learning process during the first three administrations, followed by a stable performance.

Conclusion: After a short 10- to 20-minute training, nurses ignorant of the POCAS method rapidly considered it as a safer, easier and quicker method than SYRNE and TRASE techniques. Using POCAS thus seems an excellent alternative, especially for labile drugs, in order to cost-efficiently replace them on a broad scale within the frame of Belgian and European campaigns on patients and health workers safety.

3-231

Category: Quality Assurance / Medication Safety

Title: Standardizing regular U-500 insulin ordering, dispensing, and administration in the multidisciplinary inpatient setting

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Purpose: Hyperglycemia is commonly observed in hospitalized patients and has been associated with worse overall prognosis, including increased morbidity, mortality, and length of stay. With the increased incidence of insulin resistance and obesity the use of regular U-500 insulin has expanded its role in the inpatient setting. Lahey Clinic Medical Center, a 317 bed teaching hospital has observed an increase in orders for regular U-500 insulin in the inpatient population. With an increase in these orders an increase in medication errors has been noted. These errors have been associated with unclear dosing information and a deficit in provider knowledge, challenging patient safety. Dosing errors typically occur because of the use of regular U-100 insulin syringes in the outpatient setting. For example, a patient taking 12 units of regular U-500 insulin drawn up in a U-100 insulin syringe is actually receiving 60 units of regular U-500 insulin (0.12 milliliters). Due to the potential confusion and safety risk this concentrated insulin can impose on patients if not ordered, dispensed, or administered correctly it is necessary to develop hospital wide standardization for its use involving the ordering provider, the inpatient pharmacist, and the nurse who will be administering the insulin.

Methods: Over a four month period collaboration between the endocrinology and pharmacy departments led to the development of standard ordering, dispensing, and administration procedures for the use of regular U-500 insulin in the inpatient setting. In April 2011 the procedures were implemented. An inservice was given to nursing by their respective pharmacy liaison to describe the changes.

Results: The following procedures were implemented: When the use of regular U-500 insulin is deemed appropriate, the endocrinology department must be consulted and an order set must be used for ordering it. Regular U-500 insulin must be ordered in milliliters and units. Due to its pharmacokinetic profile it cannot be ordered as a sliding scale and is not allowed as floor stock to avoid any potential administration errors. The pharmacy dispenses the exact dose of regular U-500 insulin in a labeled tuberculin syringe that includes the dose in milliliters and units. It is delivered as a patient specific medication for each dose.

Conclusion: After implementing these procedures the confusion amongst ordering providers, inpatient pharmacists, and nurses has been reduced and patient safety has been optimized.

3-232

Category: Quality Assurance / Medication Safety

Title: Using lean strategies in a repackaging cell to improve staff and equipment utilization, improve inventory management and decrease errors.

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Purpose: Medication shortages and medications not commercially available in unit dose packaging are a part of normal pharmacy routine. There are best practices for patient safety to provide the most unit of use and individual doses as possible. The pharmacy needed to devise a way to meet these demands without compromising safety while increasing efficiency.

Methods: A rapid improvement team used lean techniques and concepts to evaluate the current repackaging operation, repackaging errors and inventory locations. The team identified excess floor stock of repackaged medications as a source of waste and implemented a system to return medication that was not being used to the pharmacy. This served to decrease demand of repackaged products as well as increasing inventory turnover. We standardized operator methodology and record keeping and pharmacist quality control checks to reduce errors. We discovered we were underutilizing our repackaging machines and increased their use. We also considered outsourcing as an additional option to better meet our demand with current staffing.

Results: Our initiatives improved our repackaging operational efficiency while decreasing errors made during the repackaging process. These changes have allowed us to implement the next phase of improving our repackaging operations to include bar coding.

Conclusion: By using lean methodologies the pharmacy was able to devise a way to meet increasing unit dose repackaging and patient safety demands.

3-233

Category: Quality Assurance / Medication Safety

Title: Evaluation of pediatric medication reconciliation discrepancies before and after staff training

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Purpose: Purpose: Research has shown that the potential for adverse drug events within the pediatric inpatient population is about three times as high as among hospitalized adults and experts agree that medication errors have the potential to cause harm within the pediatric population at a higher rate than in the adult population. Therefore, it is very important to research the accuracy and completeness of medication reconciliation in this population as discrepancies can have a large impact. The primary objective of this study is to determine the effectiveness of medication reconciliation training of pediatric nursing staff. Secondary objectives are to determine the frequency and risk factors for discrepancies, assess harm of discrepancies, and also to quantify time for this process.

Methods: Methods: Medication reconciliation was completed on 100 pediatric admissions by a pharmacist following the initial admission medication reconciliation by the nurse. The pharmacist was blinded to all patient health information including medication history and reason for admission. Findings were compared to the medication history obtained by the nurse to evaluate for discrepancies. Training was then provided to the staff and a core team of nurses was assigned primary responsibility for admission medication reconciliation. After training was completed, follow-up discrepancy data was gathered on 25 patients in the same manner as prior to determine effectiveness of training. This study was submitted to the institution review board and determined to be a performance improvement project.

Results: Results: At baseline, a total of 316 discrepancies were discovered for a mean rate of 3.16 (range 0-27) discrepancies per patient and 91 patients (91%) had at least one medication discrepancy. One hundred twenty nine of the discrepancies (41%) involved prescription medications. Mean discrepancies were reduced by 43% to 1.8 per patient post training. Following training, patients with at least one discrepancy was reduced to 76%. On average, patients with 4 or more medications (N=50) had a higher than average rate of discrepancies.

Conclusion: Conclusion: Our findings are consistent with the literature that pharmacist-obtained histories are more accurate and complete than nurse or physician obtained histories. Although it would be ideal, it is highly unlikely that a clinical pharmacist could be involved in gathering every pediatric

admission medication history. For this purpose, we found it reasonable to utilize dedicated, and highly trained nursing staff. This method, in addition to providing training to all bedside nursing staff, proved to be effective at reducing the number of discrepancies on follow-up by 43%. We were able to determine one risk factor for a higher than average rate of discrepancies in pediatric patients to be use of 4 or more medications.

3-234

Category: Quality Assurance / Medication Safety

Title: Evaluating the pharmacist's role in the reduction of human error in the utilization of an automated heparin algorithm

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Purpose: While performing a quality assurance analysis of an automated heparin algorithm, the partial thromboplastin times (PTTs) returned as a function of the program were evaluated. It was discovered that some PTTs were being returned from the laboratory with a value of greater than 400 seconds which were identified as not accurately reflecting the patients anti-coagulation status. When this occurs, the patient may be put at risk of a thrombotic event as the algorithm acts to attempt to correct the false value. The purpose of this study is to evaluate the efficacy of pharmacist-driven education in the reduction of the occurrence of PTTs greater than 400 seconds which are returned as a function of an automated heparin algorithm .

Methods: The institutional review board approved this prospective chart review. The trial consisted of three distinct components: the administration of an educational lecture, a retrospective chart review, and a prospective chart review. The education, administered by a pharmacist to clinical care technicians and phlebotomists focused on instilling the importance of PTTs with regards to the heparin algorithm. The inclusion criterion for the chart reviews was any adult patient who was enrolled in the heparin algorithm during the months which were evaluated. Both chart reviews were performed identically by evaluating all patients enrolled in the heparin algorithm for PTTs which were greater than 400 seconds. In order to further quantify the results, the rate of PTTs greater than 400 seconds was evaluated for every 100 patients enrolled, every 100 labs drawn, and then all patients who experienced an event were further analyzed to identify any potential predisposing factors which lead to these events.

Results: A total of 968 patients were enrolled in the heparin algorithm during the months of March and April of 2010 and 2011. A total of 13 events of PTTs greater than 400 seconds occurred. Following the administration of the education, the occurrence of events, ten events occurring in 2010 and three occurring in 2011, was considerably reduced. The only predisposing factor that could be identified was being male.

Conclusion: Based on the results of this trial, pharmacist-driven education can have a positive impact on the reduction of human errors as a part of an automated heparin algorithm.

3-235

Category: Small and Rural Pharmacy Practice

Title: Establishing guidelines for appropriate and prudent antimicrobial use at a small, rural, community hospital

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Purpose: Many small hospitals are concerned that they do not have the resources available to initiate a traditional antimicrobial stewardship program. Small community hospitals do not have dedicated specially trained infectious disease (ID) pharmacists and ID physicians readily available, but are confronted by the same challenges as large institutions when faced with antibiotic misuse. Prudent and appropriate antimicrobial use at the community hospital level benefits the hospital, the community, and overall patient outcomes. By developing guidelines that ensure appropriate antibiotic use, limit or reduce overuse, and encourage conversion to oral medications, we can reduce the potential development of multiple drug resistant organisms, reduce harmful side effects, maintain antibiotic efficacy, and reduce costs. By sharing what we have learned, our successes are multiplied, and other patients outcomes are affected.

Methods: We wanted to develop a program that could help assure the appropriate use of antimicrobials without requiring additional resources or consuming large amounts of time. Our initial interventions were designed using readily available tools. We began by requesting that the culture and sensitivity (C&S) report print directly to the pharmacy for evaluation and asked laboratory personnel to provide an inservice on accurate interpretation of the culture results. Daily culture results were reviewed for appropriate and effective antibiotic treatment. Was the patient receiving the correct dose of the correct medication by the most efficient route? Focusing on minimizing waste (assuring the minimum number of antibiotic(s) required to effectively treat the infection(s)) and maximizing effects (using the antibiogram and C&S results), we were able to influence prescription adjustments for our patients in just minutes per day. Inspired by results, we looked for other interventions we could implement, still mindful of our minimal resources. Since the laboratory updates the antibiogram, we were able to facilitate an updated version for distribution to the providers and post it in the physician dictation areas. Vancomycin and aminoglycoside dosing and monitoring information was reviewed, updated and posted in physician dictation areas. An antibiotic formulary list was prepared, grouping antimicrobials by class and available injectable and oral dosage forms. This list was reviewed by pharmacists and hospitalists;compared to standards and presented to the Pharmacy and Therapeutics (P&T) committee with recommendations for possible deletions. After approval,this list was posted in dictation areas to aide providers in ordering available medications and present IV to PO options. A proposed review of specific antibiotic usage coupled with antibiogram sensitivity data from the last several years has helped track ordering trends

and identified changes in bacterial resistance. Pocket sized cards with guidelines for empiric inpatient antibiotic usage have been laminated and distributed to hospitalists and attending physicians. A pamphlet titled Diagnosing, Treating and Preventing Spread of Clostridium difficile Infection has been reviewed, customized, and distributed to providers in the hospital and the community. An IV to PO program has been useful in reducing the chance of problems inherent with IV administration of medications, has eased conversion from hospital to home administration and decreased the cost of administration. Medications initially targeted were those with good oral absorption.

Results: From August, 2010 through February, 2011, the pharmacy reviewed 203 days of C&S data. The average time required per day was 8.2 minutes. A total of 737 finalized inpatient cultures were evaluated, along with numerous gram stain results, and partially completed cultures. Interventions or changes were suggested in seven percent of the cultures reviewed. Of those, fifty five percent of the suggested changes were accepted by the providers. Soft cost savings are difficult to capture, but both pharmacists and providers are convinced that the resulting interventions have had a positive effect on patient outcomes and will have long term benefits for the community. In the month of April, 2011, there were a total of 175 orders for antibiotics. Of those, there were 37 requests for pharmacy to dose antibiotics (cefepime[1], levofloxacin [1], pipracillin/tazobactam [1] and vancomycin [34]). Pharmacists checked for appropriate renal dosing and advised a reduction in dose for pipracillin/tazobactam twice, with both doses reduced by the providers. Four different patients needed adjustments to the prescribed dosages of levofloxacin, and all were accepted and adjusted as recommended by the pharmacist. There were eight suggested changes from levofloxacin IV to oral dosing, and all eight were deemed timely and appropriate. A chart outlining suggested outpatient MRSA treatment (CDC, AMA, and IDSA) has been posted in the Emergency Department (ED) physician dictation area. Vancomycin and ceftriaxone use in the ED has been reviewed and evaluated with the medical director of that department to determine if they were ordered properly or if further education is needed.

Conclusion: Non traditional antimicrobial stewardship programs can be customized to any size facility and still provide positive outcomes within the confines of time and resources. An effective stewardship program can begin with guidelines and small interventions using readily available tools, basic antimicrobial knowledge, and a willingness to try. Success from the initial steps provides additional motivation and guidance to continue taking those small steps. The goal of any program is appropriate use of effective antibiotics, reduction of antibiotic resistance, improved patient outcomes and decreased cost of unnecessary and ineffective antibiotics. The time requirements are less than anticipated and physicians and staff have been very supportive of our initiatives. Working with various facilities on collaboratives in New Mexico, our Infection Preventionist has presented information regarding our humble beginnings and sparked the interest of an ID physicians who is an Associate Professor at University of New Mexico. The spark from our small program has resulted in an outreach program, which started in late April, 2011, in which two 2 large hospitals interact with three or four smaller facilities to hone their antimicrobial stewardship programs. As our project has demonstrated, the size of the facility does not determine whether or not patient care can be improved.

3-236

Category: Small and Rural Pharmacy Practice

Title: Nausea associated with vancomycin administration in a patient with gram positive bacteremia and a left knee infection following knee replacement

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Purpose: A seventy-two year old male was admitted to the swing bed unit to receive treatment for gram positive bacteremia (enterococcus) and a left knee prosthetic joint infection. The patient had been treated for four weeks with amoxicillin. This treatment failed, and he was admitted febrile to the hospital where he had the knee replacement. He stayed at this hospital for two weeks receiving intravenous (IV) antibiotic therapy. After improvement, he was transferred to this local hospital to receive IV vancomycin and oral rifampin for six weeks. Anthropometric measurements were a height of 68 inches (172 centimeters) and a weight of 213 pounds (96.8 kilograms). The patient also had a history of diabetes mellitus and hypertension. Redness and puffiness were present in the left knee incision. Metformin 1000 milligrams (mg) twice a day had been used to control his glucose. Insulin detemir 15 units at bedtime (hs) was added on admission. Memantine 20 mg was given daily for memory loss, and diltiazem 300mg hs was used to treat the hypertension. A peripherally inserted central catheter (PICC) was in place for the IV vancomycin. The vancomycin was started on a dose of 15mg/kg IV every 12 hours. This dose was adjusted by the pharmacists in response to the trough levels. Rifampin was also given twice a day. A vocation as a school teacher and coach had kept this patient quite active, so he was resolved to returning to an active status as soon as possible. Nausea associated with administration of the IV vancomycin was the only patient complaint. Rather, he was quite pleased with the patient care. A literature search was conducted but with no findings related to this case was found. It is reported in Micromedex 1 that nausea and vomiting is common with IV vancomycin administration. The package insert2 for vancomycin did not list nausea and vomiting as a side effect. The physicians accepted recommendations from the pharmacists to treat the nausea and vomiting. Initially ondansetron was given IV on an as needed basis. Then it was also ordered before each vancomycin dose. Oral pantoprazole 40mg daily was also given. After continued complaints of nausea, the ondansetron before each dose of vancomycin was changed to 10 mg of IV metoclopropamide. The doctor then separated administration times of the vancomycin and rifampin and gave lorazepam 0.25mg sublingual (SL) prior to each dose. This effort also failed, and oral promethazine 25mg was given prior to each vancomycin dose. Sedation ensued, but the nausea continued. Since the serum creatinine (Scr) was 1.6mg/dL, the metformin was held. The doctor also agreed to change the memantine to 10mg twice a day instead of 20mg daily. Pantoprazole was also discontinued due to lack of effectiveness in controlling the nausea. The patient was discharged home after four weeks of therapy, and the vancomycin and rifampin were continued at home for two more weeks. The nausea and vomiting improved only modestly despite

many attempts to control with medications. Both the patient and his doctor approved submission of this report. Author(s) Disclosure: The authors are employees of Comprehensive Pharmacy Services. This submission was prepared by James Williamson and Ginger Bain.

Methods: N/A

Results: N/A

Conclusion: N/A

3-237

Category: Transplant / Immunology

Title: Association Between Immunosuppressant Therapy Medication Adherence and Depression, Quality of Life and Personality Traits in the Kidney and Liver Transplant Population

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Purpose: To measure the association of transplant patients personality, depression and quality of life with medication adherence in kidney and liver transplant recipients.

Methods: A cross sectional study of liver and kidney transplant recipients > 1 year post transplant was conducted. Demographic, laboratory and psychosocial data was obtained. Patients adherence with medications was assessed by using the Immunosuppressive Therapy Adherence Scale (ITAS). Personality and depression were assessed by using NEO-Five Factor Inventory (NEO-FFI) Scale and PHQ-9, respectively. Quality of life was assessed by using the Short Form 36 (SF-36) These surveys were administered to patients upon their arrival to clinic for their follow up appointments.

Results: A total of 86 kidney and 50 liver transplant patients completed the surveys. In our sample of kidney patient, the mean age was 50.3 (12.4), 58 (67%) were males with a mean time since transplant of 80.8 (86.3) months. In our liver sample the mean age was 57 (9.7), 33 (66%) were males with a mean time since transplant of 57.9 (56.8) months. According to their PHQ-9 scores most patients from the liver and kidney samples had minimal to mild depression, 52 (60%) and 36 (72%) respectively. The mean Karnofsky score for kidney and liver transplant recipients was 88.8 (10.2%) and 83 (9.7%). The mental quality of life was below average in 20 (23.3%) and 10 (20%) of the kidney and liver transplant patients. The physical quality of life was below average for 29 (33.7%) and 25 (50%) for the kidney and liver transplant recipients. By the method of logistic regression analysis, an association was found between depression and adherence with immunosuppressive medications in kidney transplant recipients, (OR=1.51, CI=0.98-2.32, p=0.05). Kidney transplant patients with high scores on PHQ-9 were more likely to be non-adherent. In regard to personality in the kidney sample, one domain, openness, was significantly related to adherence. Kidney transplant patients that exhibited low openness scores were 91 percent more likely to be non-adherent, (OR=0.09 CI=0.01-0.51, p=0.02) compared to patients with moderate to high openness scores. Kidney transplant patients physical functional status was strongly associated with non-adherence and, for each point increase in functionality, the patients adherence increased by 4%, (OR=1.04, CI=1.0-1.08, p=0.02). In the liver sample, the domain age was associated

with non-adherence, for every seven year increase in age the adherence increased (OR=1.07, CI=1.00-1.14, p=0.04)

Conclusion: The presence of depression, personality openness, the patients physical functional status and age were all shown to have an association with adherence to immunosuppressive medications. Recognizing these characteristics, steps can be taken to stratify patients regarding adherence behaviors and focus care resources to improve patient outcome.

3-238

Category: Women's Health

Title: Pharmacist and provider knowledge regarding contraception

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Purpose: Potential for hormonal contraceptives to move to over the counter status exists, which may increase access for patients, while placing pharmacists at the front lines for assisting patients in appropriate method selection. The purpose of this project was to evaluate health care provider perceptions and knowledge regarding contraceptive methods.

Methods: A survey instrument derived of 17 items was developed to assess knowledge and beliefs regarding patient contraceptive use among health care providers at a federally qualified health center. In total, the survey included 11 questions about contraceptive use and 6 sociodemographic questions. Questions relating to contraceptive use evaluated effectiveness of the methods, reasons for selection, patient satisfaction with method, reasons for method failure, influences on method choice, as well as importance of certain co-morbidities and elements of the physical exam when initiating a method of hormonal contraception. The survey was administered to pharmacists, pharmacy technicians, physicians, nurse practitioners, physician assistants, and nurses. Institutional Review Board (IRB) approval was obtained through North Dakota State University. Descriptive statistics were utilized to interpret data.

Results: The overall survey response rate was 68 percent. Participants ranked oral contraceptives as being the most frequently used method of contraception by patients, while natural family planning (NFP) was selected most often as the least likely method to be used by patients. Survey participants believed oral contraceptives were, on average, 97.1 percent effective at preventing a pregnancy, while the injectable, intrauterine device (IUD), and intradermal products were believed to be slightly less efficacious (93.4 percent, 92.9 percent, and 90.7 percent, respectively). Barrier methods were estimated to be 65.4 percent effective. National data would indicate, for a typical contraceptive user, which reflects the average person who does not always use a method consistently or correctly, oral contraceptives are 91 percent effective, the injectable is 94 percent effective, the IUD is 99.8 percent effective, the intradermal implant is 99.95 percent effective, and male condoms are 82 percent effective at preventing a pregnancy. When ranking reasons why providers believe a patient's method of contraception would fail, 85.7 percent of participants selected forget to take on a daily basis as being the most likely reason for method failure, while uncertain of safety ranked as the least likely reason for failure. Seventy three percent of those surveyed believe the patient's provider is the most important influence in aiding in a patient's contraceptive choice, while partner, friend, and pharmacist were

selected less frequently (13.6 percent, 9 percent, and 4.5 percent, respectively). Presence of a blood clotting disorder was selected most frequently by participants as the most important component of the comprehensive health history to consider when initiating hormonal contraception, while presence of gastrointestinal disease was considered the least important of the possible responses. In terms of elements of the physical exam that are considered important when initiating hormonal contraception, the Pap test and pelvic exam were selected most often as being the most important, while weight and blood pressure were selected as least important.

Conclusion: Discrepancies in pharmacist and healthcare provider knowledge on contraceptive products may limit appropriate use in eligible patients. Contraceptive methods that do not require a woman to remember to take a pill on a daily basis, such as depot medroxyprogesterone acetate injections, the IUD, or intradermal implant are generally considered more effective than daily oral products. Unbundling initiation of hormonal contraceptives from the Pap test, pelvic, and breast exam has been recommended by several organizations to prevent unnecessary delays in beginning contraception. On the other hand, measurement of blood pressure and a complete medical history, both of which most pharmacists are qualified to perform, are considered valuable pieces of information to obtain prior to initiation of a hormonal contraceptive. Provision of educational topics to pharmacists and providers on misconceptions regarding contraceptives is necessary to optimize patient care and minimize the risk of unintended pregnancy.

3-239

Category: Women's Health

Title: Predictors of infection with Trichomonas vaginalis in women at an urban community health clinic

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Purpose: Trichomonas vaginalis (T. vaginalis) is the most common non-viral sexually transmitted infection (STI) in the US. Despite the fact that the Centers for Disease Control and Prevention (CDC) does not track reports of this disease, it poses significant risks for women, including premature and low-birth weight infants, pelvic inflammatory disease (PID), infertility, and increased risk of acquiring and transmitting human immunodeficiency virus (HIV). The objective of this study was to measure occurrence and predictors of T. vaginalis infection in women at an urban health care clinic that provides affordable health care to underserved populations.

Methods: A retrospective chart review of women tested for trichomoniasis was conducted at the clinic between 2004 and 2008. Subjects were identified through a list of patients that underwent wet mount testing and/or urine DNA amplification testing. Data collected included age, race, prior STI history and treatment, ability to bear children, number of children, and smoking status.

Results: Fifty-five women underwent testing and 10 women (18.2%) were positive for trichomoniasis. Eighty percent were African-American, 50% had a history of prior STI, 50% were of childbearing potential, and 40% were smokers. Of those testing positive for trichomoniasis the mean age was 44.2 +/- 11.3 years, the average number of sexual partners was 0.9 +/- 0.57, and the average number of children was 1.2 +/- 1.14. Multiple logistic regression analysis revealed trends towards a positive association between trichomoniasis infection and African-American race (OR 7.43, 95% CI 0.68-80.99), age greater than 30 years (OR 7.43, 95% CI 0.63-31.85), and smoking status (OR 2.47, 95% CI 0.45-13.53).

Conclusion: These data verify previously reported predictors of trichomoniasis, including older age (greater than 35 years), African-American race, and smoking status. Providers, including pharmacists, must be aware of the risk factors for trichomoniasis in symptomatic patients and direct patients for appropriate STI testing.

3-240

Category: Women's Health

Title: Impact of standing orders on postpartum rates of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis adsorbed (Tdap) vaccination

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Purpose: Since 2008, the recommendations of the Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices have included that postpartum women (who were not previously vaccinated with Tdap) should receive Tdap before hospital discharge. A decrease in the rate of Tdap ordered and administered to postpartum patients was observed in a teaching hospital. An investigation revealed that the design of Computerized Prescriber Order Entry (CPOE) postpartum order sets may have contributed to the decline. Further analysis revealed an opportunity to improve vaccine availability on postpartum units. This project was designed to reverse the decline in Tdap ordering and administration.

Methods: Subsequent to feedback from healthcare team members and discussion at the Medication Event Review Team meeting, a decrease in the rate of postpartum Tdap immunizations was confirmed: (1) the number of orders had declined and (2) administration of a significant number of ordered doses was omitted. A hospital team was formed to investigate current Tdap vaccine processes and included clinical pharmacists, an Infectious Diseases physician, pharmacy management and postpartum unit directors. Current processes were defined, identifying the methodology, people, communication and technology involved in these processes. The hospital team planned changes by obtaining feedback, identifying barriers, evaluating the computerized prescriber order entry set and examining vaccine availability on the nursing units. The team implemented change by: revising the computerized order set with physician input, forwarding the order set changes to Information Technology for revision, implementing unit based storage of Tdap in automated dispensing unit refrigerators and scheduling a go-live date for all changes. All process changes were communicated to healthcare team members through various medical staff and patient care services committees.

Results: Since implementing the changes, rates of Tdap immunization ordering and administration have consistently exceeded prior rates in our postpartum patient population. A 51.6% increase in Tdap vaccine ordering was achieved by defaulting the Tdap order within the postpartum order set to a pre checked order. An 84% increase in Tdap vaccine administration was achieved as a result of the order set enhancement as well as the change in storage to a unit based model utilizing automated dispensing

cabinets. The increases were accomplished through changes in both technology, specifically the order set, and process, specifically drug storage. Valuable input from key stakeholders was instrumental in identifying changes necessary for process improvement.

Conclusion: Unit based storage of Tdap vaccine and redesigning the CPOE postpartum order set increased the administration of Tdap vaccine resulting in safeguarding infants from pertussis, meeting a vaccine recommendation of the Centers for Disease Control and Prevention and supporting patient safety goals of the hospital.

3-241

Category: Women's Health

Title: Assessment of hospital readiness in prevention of perinatal HIV transmission

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Purpose: The National Institutes of Health (NIH), Centers for Disease Control (CDC), and American Congress of Obstetricians and Gynecologists (ACOG) have guidelines that emphasize the components necessary to prevent perinatal HIV transmission; these components include rapid screening and use of IV zidovudine. Optimal zidovudine therapy before, during, and after delivery can reduce the risk of vertical HIV transmission from mother to newborn to near zero. Although few, there have been perinatal HIV transmissions in our state. In conjunction with the state department of health, we conducted a survey of all birthing hospitals in the state to assess the awareness of and adherence to the prevention guidelines, to determine readiness of our state birthing hospitals to intervene to reduce the transmission of HIV from mother to newborn, and to identify barriers to compliance with the prevention guidelines.

Methods: All birthing hospitals in the state were surveyed on several parameters related to HIV testing and availability of IV zidovudine for women presenting to labor and delivery. Pharmacists were contacted about IV zidovudine availability and protocols for its use via a phone survey administered by our team. Nurse Managers for the labor and delivery areas of the birthing hospitals were contacted via an online survey.

Results: Survey results were received from nurse respondents at 45% of the state's birthing hospitals. Respondents revealed that approximately 50% of the time most women presenting to labor and delivery have a documented HIV test result. Most commonly reported barriers to having the test result available at the time of labor and delivery included inefficient prenatal records transfer and lack of prenatal testing. Although the NIH recommends rapid HIV testing for all women whose HIV status is unknown at the time of delivery, only 23% of respondents indicated that a rapid HIV test would automatically be ordered when HIV status is unknown and only half of the hospitals who responded have rapid HIV testing available. Survey results from 60% of the state's birthing hospitals were analyzed in regards to availability of IV zidovudine. Only 10% of pharmacists reported having a protocol for administration of prophylactic zidovudine therapy to HIV positive mothers during labor and delivery and only 20% of hospital pharmacies routinely stock IV zidovudine. Larger hospitals are more likely to have the medication available and to have protocols surrounding HIV testing and prophylaxis. Several additional barriers to optimal compliance with the prevention guidelines were identified.

Conclusion: Although few perinatal HIV transmissions have occurred in the state, perinatal HIV transmission is unacceptable given the availability of rapid HIV testing and given the effectiveness of IV zidovudine for prevention of perinatal HIV transmission. Results from our survey indicate that attention should be focused on enforcement of perinatal HIV testing and, for mothers with positive HIV results; IV zidovudine should always be available for emergency use during labor and delivery. Education, development of protocols, and possibly legislation and/or incorporation of prevention guidelines into accreditation standards may be necessary.

5-001

Category: Administrative practice / Financial Management / Human Resources

Title: Strategies for use of compounding services to deal with critical medication shortages

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Purpose: Ensuring a reliable source of critical medications, even when faced with manufacturer shortages, was the goal of the purchasing, clean room, and drug information functions of the pharmacy. Although often an alternative can be identified, there are some drugs for which there are no alternatives. In these cases, the various functional areas of pharmacy collaborated on implementing an action plan to make drug available through the institution's clean room conservation efforts, use of outsourced pharmacy admixture or compounding providers, or through compounding medications from USP-grade chemical in the institution's clean room. Thus, availability of critical medications was ensured.

Methods: From June, 2010 through May, 2011, the health system considered 69 drug shortages to be critical. When a drug shortage is considered critical, users are notified and surveyed regarding alternatives for use during the shortage. When no alternative can be identified, the pharmacy department's purchasers, representatives from the clean room, and drug information pharmacists discuss what can be done to conserve medication. For example, multi-dose vials can be spiked in the clean room and labeled as pharmacy bulk packages, extending the dating up to 14 days compared to the standard 12 hours when spiked in a standard horizontal flow hood. Medications have also been repackaged into smaller units (ie, repackage a 10-ml vial into 5 x 2 ml syringes) to conserve supply. When it is still apparent that supply will be exhausted before resolution of the shortage, pharmacy purchasing contacts licensed outsourced pharmacies capable of providing sterile admixtures or licensed compounding pharmacies. If the compounding pharmacy expects to be able to meet demand, they are used to supply drug during the shortage. Simultaneously, drug information consults chemical companies who have available for purchase USP-grade chemical to make the medication. If a recipe is found, chemical is obtained and the clean room compounds the medication. Compounding medication in the clean room also involves a 14-day incubation period where sterility and pyrogen testing are performed, translating into a 14-day lag for availability of compounded medication.

Results: Of the 69 drug shortages, spiking the multi-dose vial or repackaging into smaller units has been done for 11 of the shortages. Examples include arginine 10%, 300 ml vials and lipids. Obtaining drug from compounding pharmacies has been done for three of the shortages; amikacin, dexamethasone injection and tromethamine. Drugs obtained by an admixture service included, succinylcholine and vecuronium syringes. Obtaining recipes for the clean room to compound drug from USP-grade chemical

has been done in three of the shortages; ammonium chloride, sodium chloride, and magnesium sulfate 50% injection. For some of the shortages, such as arginine, prescribers were aware of the continued shortage and were frequently informed of the institutions inventory. For others, such as dexamethasone injection, use of oral medication when possible and obtaining drug from a compounding pharmacy with a manufacturers license was sufficient to ensure continued supply.

Conclusion: Various functional areas of the department of pharmacy were able to use alternative strategies for ensuring supply of certain medications during a shortage. Spiking vials or repackaging in the clean room, obtaining drug through alternative sources such as licensed outsourced admixture or compounding pharmacies, or by compounding in the institutions clean room was effective to conserve the drug supply of critical medications.

5-002

Category: Administrative practice / Financial Management / Human Resources

Title: Utilization of a weekly purchasing report (WPR) to track invoices and monitor budget goals on a daily, weekly, and monthly basis

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Purpose: Tough economic times have forced health care providers to become actively involved in monitoring and controlling pharmaceutical costs. In most cases, the accounting department is responsible for these activities and only reports this information on a monthly basis. The WPR is an electronic tool that can be used to monitor and control cost. The WPR ensures transparency, accountability, and a forum for communication by diligently tracking invoices and providing accurate, up-to-date purchasing data to compare to budget.

Methods: The purchasing management team, pharmacy directors, and pharmaceutical buyers at each site were all trained on how to use the WPR effectively. Education consisted of group lectures, specific site training, and individual one-on-one sessions. Additional modifications to the WPR were made based on feedback and comments that would improve its function. The WPR process is pretty simple. A pharmaceutical buyer enters invoices daily in WPR. The invoice entries include invoice date, PO number, invoice number, vendor, and invoice amount. The buyer has the ability to mark an invoice as a department charge if the product is going to another department; this removes the invoice amount from the current pharmaceutical spend. The buyer also enters the total pharmaceutical spend to date. This information is reviewed daily, weekly, and monthly and compared to budget goals. If there are numbers that are unfavorable to goals, the pharmaceutical buyer is able to alert the necessary individuals to investigate the discrepancy on a proactive basis. Actions are then taken by the appropriate individuals to get pharmaceutical spending on track to meet goals and to ensure patients are treated appropriately.

Results: The WPR was successful in reducing pharmaceutical spending and achieving financial goals. The WPR tool was implemented at three hospital sites in 2010. The drug spend in 2009 was approximately $27.8 million dollars. For 2010, the system was able to reduce its pharmaceutical spend by approximately 5%, spending approximately $26.5 million. The system was also successful in achieving favorable pharmaceutical spending costs in comparison to budget goals. The variance in 2009 was approximately $1.9 million dollars over budget. The system was able to reduce its variance in 2010 by approximately 121%, completing the year under budget by approximately $389,000.

Conclusion: Prior to implementation of the WPR, the system was having difficulty in managing and controlling pharmaceutical costs. The WPR was successful in providing a tool to help achieve these goals. By diligently tracking invoices, providing a tool to communicate, and enabling the staff to be proactive, the WPR is a great way to manage and control drug costs.

5-003

Category: Administrative practice / Financial Management / Human Resources

Title: Budget Impact of IV Iron Utilization in a Pharmacy Managed Office-Based Infusion Clinic

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Purpose: Patients with iron deficiency anemia (IDA) associated with a number of underlying clinical conditions often require intravenous (IV) iron to correct the iron deficiency. Oral iron is often intolerable and ineffective, and many of the currently available IV iron formulations are limited by cumbersome dosing paradigms; often requiring 5 to 10 doses and/or administrations, encompassing up to several hours. These dosing regimens are often a burden to both patients and the infusion clinics administering the IV irons, tying up chair-time as well as the administering clinicians time. Ferumoxytol (Feraheme; approved by the FDA in June 2009 for the treatment of IDA in adult patients with CKD) is a newer IV iron with a more convenient dosing paradigm than many other IV irons. The purpose of this retrospective analysis is to examine the efficiency and economic impact associated with the introduction of ferumoxytol into the current IV iron mix at an office-based oncology infusion clinic.

Methods: Data from January 2008 through December 2010 were obtained from an office-based oncology infusion clinic affiliated with Gundersen Lutheran Hospital. The pharmacy department at Gundersen Lutheran was responsible for drug management at the oncology infusion clinic. Data collected over the three-year period included total IV iron utilization, IV iron administration time (hours to administer 1 g of iron therapy), drug and administration reimbursement rates (based on Medicare, Medicaid, and private payers), drug acquisition cost (per mg), and other costs collected and reported per year. These data were then analyzed to calculate percent contribution, revenue and margin output, and efficiency outcome realized with each IV iron per-year at the infusion clinic. The results were exclusive of patient observation time that follows the administration of IV iron formulations.

Results: Over the three-year period (2008-2010), the oncology infusion clinic utilized four different IV irons. Iron dextran (administration time 4.5 hrs per gram) was the most frequently administered IV iron over this period, and comprised between 67% and 74% of the clinics total IV iron use. Sodium ferric gluconate (administration time 12 hrs per gram) was the second most utilized IV iron in 2008 (22%) and 2009 (20%), but its use fell steeply in 2010 (3%). Iron sucrose (administration time 7.5 hrs per gram) was the least utilized IV iron over the period, garnering approximately 2% of the clinics total IV iron use each of the three years examined. Ferumoxytol (administration time 1 hr per gram) was introduced into the clinics IV iron mix in 2009, and accounted for approximately 9% of total IV iron use in 2009; utilization of ferumoxytol rose in 2010 to 23% of total IV iron use. This increased utilization of ferumoxytol, with its

more efficient dosing paradigm of two 510 mg IV administrations to provide 1 gram of elemental iron, resulted in a 39% decrease in the total chair hours per gram across the clinic from 2008 to 2010. Due in part to this increased efficiency, ferumoxytol presented the clinic with the highest medication margin per hour (reimbursement revenue minus cost) and highest administrative margin per hour relative to the other IV irons employed.

Conclusion: At an office-based oncology infusion clinic, the increased utilization of ferumoxytol resulted in an increase in clinic efficiency, medication margin, and administration margin relative to the other IV iron employed. These results were similar to a separate analysis conducted at the Gundersen Lutheran outpatient infusion clinic, where increased ferumoxytol utilization resulted in an increase in patient, clinic and staff efficiencies and an increase in the overall IV iron revenue and margin.

5-004

Category: Administrative practice / Financial Management / Human Resources

Title: Efficiency Outcomes Associated with Increased Ferumoxytol Use in an Infusion Clinic

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Purpose: Patients with iron deficiency anemia (IDA) may require intravenous (IV) iron supplementation in an outpatient infusion clinic setting. Such infusions require multiple visits and several hours of patient time. Ferumoxytol (Feraheme) is a newer IV iron approved for IDA in patients with reduced kidney function (CKD stages 1-5). Ferumoxytol requires fewer visits and fewer hours per treatment than other IV iron treatments. For instance, iron sucrose must be given in 200 mg doses infused in five separate 1 hour visits while ferumoxytol may be given in 510 mg doses given as a rapid injection in 2 visits. The purpose of this analysis is to understand the impact of increased ferumoxytol utilization on patient, staff and financial efficiency metrics for an outpatient infusion clinic.

Methods: Data on IV iron and other procedure mix, payer mix, length of clinic visit, medication and administration costs, and treatment revenue were collected from hospital financial data, staff interviews and pharmacy records for the 10-chair outpatient infusion clinic of a 325-bed academically-affiliated, non-profit hospital from January 2008 through December 2010. Cost of medication and administration used in each procedure came from the hospitals cost accounting system, revenue was captured as the amounts reimbursed by payers and margin was calculated as the difference between costs and revenue. Cost, revenue, margin and chair time required per IV iron treatment were analyzed for each year. Per hour efficiency metrics were calculated as the total revenue divided by total hours for each procedure. Revenue and margin per hour for the clinics other administered therapies was also analyzed and was modeled to quantify the projected financial impact of allocating freed IV iron chair time to these therapies.

Results: Ferumoxytol treatment became available in 2009 and its share of the clinics administered IV iron increased from 0% in 2008, to 25% in 2009, and to 38% in 2010. From 2008 to 2010, the clinics use of iron sucrose dropped from 12% to 4%, sodium ferric gluconate decreased from 65% to 5% and iron dextran increased from 23% to 53%. Because ferumoxytol requires 30 minutes per visit vs. 1.5-4.5 hours for other IV iron treatments, the average number of patient hours required to infuse a gram of IV iron in the clinic dropped 63% from 10.4 hours in 2008 to 3.8 hours in 2010. Furthermore, our study estimates that the clinic saved 196 hours of chair time in 2009 and 104 hours during 2010. Staff interviews suggested that ferumoxytol IV iron procedures were associated with improved clinic efficiencies such as

reduced pharmacy preparation time (10-15 minutes less time) and improved availability of high demand equipment such as IV smart pumps. While total IV iron medication cost increased from 2008 to 2010, decreased chair time resulted in increased revenue per hour for IV iron medication and IV iron administration. IV iron medication and administration margins per hour also increased, moving the clinics overall IV iron treatment margin per hour in line with their higher margin therapeutics, such as chemotherapy agents, erythropoietin, and monoclonal antibodies. Given the clinics average revenue and margin per hour for the current mix of other (non-IV iron) infusion therapies, reallocation of freed chair hours to other infusion therapies represents an additional clinic revenue and margin opportunity of $213,919 and $34,126, respectively.

Conclusion: Increasing ferumoxytol use in an outpatient infusion clinic was associated with patient, staff and clinic efficiencies including fewer IV iron patient visits, decreased IV iron procedure time, the opportunity for increased clinic throughput and a substantial increase in overall IV iron revenue and margin per hour.

5-005

Category: Administrative practice / Financial Management / Human Resources

Title: Have i got a job for you! how to address pharmacy succession planning and encourage employee development and advancement

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Purpose: It has been reported that by 2014, 53% of the federal workforce will be eligible to retire with little to no experienced replacements ready to step up and fill their shoes. Of those expected to retire, many will be in some type of leadership position. It is safe to assume that the Pharmacy numbers reflect the same trend. In 2010, there were 239 pharmacists on board throughout the Veterans Integrated Service Network (VISN) which encompasses the five Veterans Affairs (VA) facilities in Ohio. Of these pharmacists between 26 and 40 will be eligible to retire each year through 2017. As these positions are vacated the recruitment process can be long. Facilities can be left without essential leaders for long periods of time, often exceeding greater than year. In October 2009, VISN pharmacy leadership met to develop a strategic plan for the upcoming year. This included the development of a plan to address succession planning. A VISN Pharmacy Succession Planning work group was established to develop this plan and enhance the skills of potential future pharmacy leaders to fill these soon-to-be vacant positions.

Methods: The work group conducted conference calls twice a month to achieve their objectives. After review of the VISN retirement eligibility statistics and of all pharmacy positions, the work group decided to focus on identifying and developing highly motivated pharmacy staff at the five VISN facilities. With the assistance of the VA Employee Education Service and Workforce Development organizations, a one day Introduction to Pharmacy Leadership program was developed. The objectives of the program were to provide exposure to various leadership opportunities and challenges and to provide a glimpse into a day in the life of a pharmacy leader. The workgroup felt that very few pharmacy staff had sufficient exposure to the day to day functions of a pharmacy leader to make a decision regarding a leadership role in their future. The following topics were incorporated into the program: Overview of Veterans Health Administration (VHA) Succession Planning; Completion of a Personal Development Plan; VHA Training Opportunities; Round Table Discussion; Case Based Scenarios; and Putting Skills into Practice. Attendees were selected through an application process which included a recommendation from the immediate supervisor. Attendance was limited to 20 to allow the program to be interactive and so that any questions or concerns could be addressed. Various materials were provided to supplement the training including but not limited to two leadership books, a recommended reading list, and worksheet

to document a plan for personal development. Following the completion of the program, an online evaluation was provided to assess the effectiveness of the program.

Results: The program was conducted on June 11, 2010, with 18 participants from four of the five VISN 10 facilities. All facets of Pharmacy Service were represented including clinical and staff pharmacists, pharmacy residents, pharmacy technicians, and administrative staff. A majority of the workgroup members were also in attendance and played a vital role in the delivery of the program. The evaluation was voluntarily completed by 84% of the attendees providing confirmation that the content compared favorably to other VA personal development programs and was considered a worthwhile investment in both time and effort. Comments from the attendees provided insight for future training opportunities such as another leadership program and a pharmacy shadow program to provide a one on one approach to experience pharmacy leadership. A year after the program, the work group followed up with the attendees to find out what leadership activities they have become involved in. These activities include participation in other VA leadership programs, serving in a key position for work groups or committees, and completing additional residency programs.

Conclusion: The program evaluations and work group findings were shared with the VISN Pharmacy Leadership. It was requested that the pharmacy leaders provide leadership opportunities to the attendees while the attendees were encouraged to proactively seek out those opportunities. The workgroup was chartered for a second year to continue with VISN pharmacy succession planning initiatives. Recruitment is underway for participation in the pharmacy shadow program. There are also plans to repeat the Leadership Program in the near future.

5-006

Category: Administrative practice / Financial Management / Human Resources

Title: Improving quality and consistency of bedside pharmaceutical care through competency-based continuing professional development

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Purpose: Compliance with Meaningful Use Regulations and computerized prescriber order entry transform staff pharmacists (SP) accustomed to order entry and verification to staff clinical pharmacists (SCP) who verify orders and deliver point of service pharmaceutical care. This paradigm shift redefines traditional roles and demands higher level terminal behavioral outcomes (i.e., delivering and documenting patient-centered care in multidisciplinary settings; applying evidence-based practices and quality improvement measures; and utilizing new informatics systems). To achieve and maintain these behavioral outcomes so that they become measurable standards against which pharmacists can assess their own level of competence, we developed and implemented a competency-based continuing professional development (CPD) program.

Methods: We conducted a GAPs analysis to identify skill deficiencies and knowledge gaps. We reviewed existing policies and procedures; evidence-based guidelines, and Best Practices; consulted leaders from Nursing, Medicine, and Quality and Performance Improvement; and interviewed pharmacists with advanced clinical skills. We shared information gathered and CPD objectives with SPs and solicited feedback. Six competency-based modules with corresponding summative assessments were created and placed on the intranet. Each module topic was reviewed with all SPs and formative assessments were employed to promote learning. SPs were required to complete all six on-line modules and score 100% on the summative assessments. Two attempts were permitted before requiring remediation. Post-assessment feedback was elicited to determine the educational value of the CPD.

Results: Twenty three SPs completed the on-line training assessments for the six modules over four months. Compliance was 100%. Approximately 6% of the questions were found to be ambiguous or invalid and were deleted. The first time successful completion rate was 95.6%. Only 2 SPs required remediation. All participants gave the CPD a positive mark for educational value. Increased level of confidence and improved knowledge of pharmacology were the most common attributes given to the CPD program.

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5-007

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of prospective pharmacy review and automated dispensing cabinet profiling in the emergency department

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Purpose: The emergency department (ED) is a challenging environment to implement Computerized Prescriber Order Entry (CPOE) and Automated Dispensing Cabinet (ADC) profiling due to the rate of patient throughput, variability in patient population, and urgency of decision making. However, these same factors create a high risk environment for patients. Retrospective order review and subsequent physician and nurse education are commonly used to optimize the quality of medication orders, accuracy of administration, and compliance with quality metrics. These methods can often reduce long term trends in medication errors, but they do not address the day to day risks in patient safety. Prospective pharmacist review and ADC profiling are generally considered unfeasible in this environment due to physicians and nursing concerns with delay in patient care. The purpose of this project was to review of the rate of order verification, the quantity and quality of documented pharmacists interventions, and the rate of ADC overrides following implementation CPOE, prospective pharmacy order review, and profile activation in the ADC system.

Methods: CPOE and ADC profiling were implemented in December 2010. Orders were reviewed by a central pharmacy location 24 hours a day, 7 days a week. Order verification times and clinical interventions were extracted from the CPOE system. Override information was reported through the ADC software. Prior to go-live, order sets were created in the CPOE specific for the ED and the ADC override list was reviewed and optimized for this location.

Results: From December 2010 May 2011, ~90,000 orders were verified by the inpatient pharmacy. The average verification time was 4 minutes with 80% verified in 5 minutes or less. During this time period, there were 1,169 documented interventions in CPOE. The most common interventions were: order clarification, non-formulary drug/restricted drug, and duplicate therapy. The override rate in the ED was 20.5% for this period. During the comparative time period, the average override percentage in the ICUs was 19.5%.

Conclusion: Implementation of prospective pharmacy review of emergency department medication orders had minimal impact on the timeliness of patient care in the ED and resulted in prospective interventions on orders. In addition, ADC profiling helped facilitate interventions could be made prior to medication administration. In the ED there is a delicate balance between quality and efficiency. Efforts that increase quality and have minimal impact efficiency should be implemented as we continue to improve patient safety in this environment.

5-008

Category: Administrative practice / Financial Management / Human Resources

Title: Activity based costing: the ABC's of pharmacy funding

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Purpose: Establishing a funding plan that allocates resources based, in part, on type and volume of activities, facilitates cost effective performance and optimal levels of service provision for pharmacy operations within a hospital. The provincial pharmacy program within Alberta Health Services (AHS) services 107 hospitals, across a large and varied geographical area. Given this service mandate over such a large and diverse range of hospitals, Pharmacy Services developed a funding model using Activity Based Costing as the foundation. Creating a funding model that could be applied to all hospitals, irrespective of location, size or patient population was crucial. The model was developed to address two key issues: funding related to changes in the bed base, and the ability to quantify pharmacy costs in relation to service growth (due to either increases in workload or service expansion).

Methods: Pharmacy Services identified patient admissions and patient days as the driving factors that influence activity. The costing model is intended to address the two main types of pharmacy activity, drug production/distribution functions and clinical functions. In order to establish costing, it was necessary to identify specific distribution and clinical activities occurring due to patient admissions and/or patient days. Distribution activity costs were determined to have two components: staffing and supply costs. Clinical activity costs were determined using provincial workload measurement data collected daily by frontline pharmacists. Costs associated with staff that do not contribute directly to patient driven activity but provide administrative support were also identified and included as fixed costs. Using this methodology, a cost for a patient admission and a cost for a patient day was established.

Results: Funding requirements related to changes in the bed base can be determined by applying the cost for admission and patient day events to anticipated rates of each per bed. Based on desired bed to staff ratios, the funding model can facilitate proper staffing and service levels for acute or critical care beds. Further assessment within the acute care bed category has not been addressed at this stage. Quantification of pharmacy costs in relation to service growth will be determined using workload statistics that are collected annually.

Conclusion: Pharmacy Services has developed a funding model to establish consistent planning for new beds. This enables pharmacy to accurately identify resources required for distributive and clinical services for new beds. This funding model also enables pharmacy to accurately quantify costs associated

with changes to service provision, due to increased workload or service expansion and align budget requests accordingly.

5-009

Category: Administrative practice / Financial Management / Human Resources

Title: Internalizing a patient assistance program in a county hospital system

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Purpose: The Harris County Hospital District (HCHD) is an integrated public health care system for Harris County, Texas which is the nation's third most populous county. Over 27% of Harris county residents are uninsured and Texas state law requires counties to serve the indigent, therefore most of these patients receive care at HCHD.2 HCHD is comprised of three hospitals, 14 community health centers, 13 satellite homeless shelter clinics, eight school-based clinics, four mobile health clinics, and a free-standing dental center. The hospital district operates 975 licensed hospital beds, and provides more than 1 million outpatient visits each year. The pharmacy department hired a drug replacement program vendor that handled all patient assistance programs for patients that receive care at the county. Data showed that collections from the 3rd party vendor had a steady decline over the years of up to 40%. Reasons identified for the decline included decrease in the branded medications dispensed, inability to effectively coordinate with other HCHD departments, poor physician/analyst relationships, contract compliance issues, and a lack of aggression in maximizing the full potential of reimbursement. The county decided to pursue an internal program with the goal of increasing cost savings by $2 million more than the previous year with the 3rd party vendor. The purpose of this study was to evaluate the efficacy of the internal drug replacement/patient assistant program.

Methods: Thirteen full time equivalents were hired under the Pharmacoeconomics and Formulary Management group for the program including one pharmacy services manager, one senior drug replacement analyst and eleven drug replacement analysts. The staff receives a bi-weekly report of all drugs approved on institutional patient assistance program (IPAP) and patient assistant programs (PAP) dispensed in the pharmacies. The analysts check patients charts for program qualifications including citizenship status, financial information and ensuring no third party coverage. Patient and physician signatures are obtained as needed and the required paperwork is submitted to the manufacturers vendor. The pharmacies either receive a bulk shipment in the cases of IPAPs or individual replacements for PAPs. Some manufacturers may also ship drugs directly to the patients home.

Results: The internal drug replacement program began in December of 2010 where the new internal team began to work on delinquent prescriptions. Since the inception of the internal program, HCHD has been reinstated into three major manufacturers IPAP. These changes have resulted in an increase of $2,575,670 in cost savings in three months since the inception of the program (March May 2011,

$3,667,798 compared with March May 2010 - $1,094,128). IPAPs resulted in 60% of the recoveries while PAPs accounted for 40% of all recoveries. Of the 40% that is received in paper claims, 10% of the medication is sent directly to the patients home so the initial drug expense is never passed on to the district.

Conclusion: The decision to internalize the drug replacement/patient assistance program was an excellent one as financial goals for one year where achieved in less than three months.

5-010

Category: Administrative practice / Financial Management / Human Resources

Title: Evolution of the Ongoing Professional Practice Evaluation (OPPE) Program in a Rural VA Health Care System Pharmacy

Primary Author: Shelly Pulscher, VA Black Hills Health Care System, 500 N 5th Street , Hot Springs, SD, 57747; Email: shelly.pulscher@va.gov

Purpose: Developed an Ongoing Professional Practice Evaluation (OPPE) Program for pharmacists to confirm the quality of care delivered and ensure patient safety. Pharmacists with direct patient care responsibility may be provided prescribing privileges with a scope of practice in accordance with VHA (Veteranfs Health Administration) Directive, which includes medication prescribing privileges of non]controlled substances based on a locally]defined scope of practice. Each pharmacist with a scope of practice must participate in a peer review program, such as Ongoing Professional Practice Evaluation (OPPE).

Methods: Utilize the OPPE process for pharmacy leadership to identify professional practice trends that affect quality of care and patient safety which may require intervention. The results of OPPE are used at the time of reappraisal and renewal of the pharmacistfs scope of practice. OPPE needs to include the following elements: (1) Definition of the practice areas to be reviewed (i.e. medication management, pharmacokinetics, anticoagulation). (2) Timeframe of when reviews will occur (annually and quarterly for new hires); (3) Sample size for review; (4) Focus on patient outcomes; (5) Rotation of reviews to eliminate sources of personal bias. The OPPE reviewer is given a random patient name, note title, and date of note of the assigned OPPE to review. For each note being reviewed, the reviewer uses the clinical aspects to evaluate quality issues related to the care given by the individual pharmacist, including but not limited to: (1) Appropriateness of plan of action; (2) Ordering of appropriate labs; (3) Appropriate documentation; (4) Other relevant aspects of care.

Results: After completing an OPPE review, the reviewer assigns a level A, B, C, or D depending upon the level of discrepancies in care found. Pharmacists with C or D ratings are asked to submit written comments on issues raised during the review process and to provide additional substantive documentation if desired. The Pharmacy Practice Quality Management Committee reviews all Level C-D ratings and determines a final rating level. Data is evaluated based on the number of reviews, the outcome by level, and the number of changes from one level to another during the review process. Based on this initial review, we were able to assess the pharmacistfs abilities to provide quality care.

Conclusion: In the search for providing optimal patient care, a process was developed for ongoing monitoring of pharmacists to confirm the quality of care delivered and ensure patient safety. This also gives us an opportunity to identify best practices to share across the organization.

5-011

Category: Administrative practice / Financial Management / Human Resources

Title: Multidisplinary Approach for Implementing A Vaccine Prescription Workflow: from processing the Medicare Part D claim through the Outpatient Pharmacy to the Administration of the Vaccine at the Clinic

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Purpose: In an era of decreasing reimbursement from all payers and decreasing margins, organizations need to make sure they get compensated for all services they provide to their patients. With Medicare shifting coverage of most vaccines from a medical benefit to a pharmacy benefit (Medicare Part D Drug Plan), organizations have struggled to figure out how to get paid for these vaccines. Lahey Clinic designed a workflow and collaborated with many different levels of the organization to assure payment for these services. This project aimed to find an easy process to obtain reimbursement for vaccines under the Medicare Part D program while avoiding any adverse impact on patient satisfaction.

Methods: Meetings were arranged with the key people involved in the vaccine prescription work-flow. These include nurse managers from the clinics, pharmacy management with pharmacy staff responsible for this process, and patient financial services. The nursing staff, in collaboration with the patient financial services, identifies patients who are enrolled in a Medicare Part D Drug Benefit Plan. Once identified, for the Medicare patient who requires vaccine administration, the prescriber sends the prescriptions electronically to the outpatient pharmacy. The pharmacy staff determines the patients co-pay via adjudication to the pharmacy benefit manager. The patient is then instructed to go to the outpatient pharmacy. At the pharmacy counter the patient pays the applicable co-pay and receives appropriate counseling. The patient then returns to the clinic with the pharmacy receipt, whereupon the patient receives the vaccine.

Results: Over a one-year period (6/1/10 to 5/31/11), the outpatient pharmacy processed 939 vaccine prescriptions totaling $99,681 in revenue that would have otherwise been lost if this process was not in place. Additionally, we experience a patient care benefit that was positive. Very few patients expressed any displeasure in the process when learning Medicare Part D changes and requirements.

Conclusion: This solution proved to be effective by being both financially favorable and client-friendly in adapting to changes in the Medicare benefit of vaccines. It also prepares us for managing other Medicare coverages as they shift to pharmacy benefit in the future.

5-012

Category: Administrative practice / Financial Management / Human Resources

Title: Student perceptions of a pilot medical writing elective in a new college of pharmacy

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Purpose: Pharmacists are continuously asked to write in their chosen areas of pharmaceutical care. The drug information skills learned in prior coursework will serve to lay a foundation of writing skills. This course provides an introduction to medical writing and will aid students in improving their written communication skills. Students will learn the practical applications of technical writing and also gain an in-depth understanding that medical writing extends to a broad array of healthcare issues from advocacy on pharmaceutical legislation to health literacy and disparities. A one-month concentrated elective was offered to third year students to provide an understanding of medical writing concepts and to stimulate an interest on the integration of writing into their careers. The objectives of this study were to document students response to this course for continuous quality improvement and to assess their intent on applying newly acquired skills towards future practice.

Methods: A 13-item survey, consisting of Likert-type scales was developed to gather information pertaining to establishing a pilot course. It included items addressing the following: overall satisfaction with content, ability to apply medical writing concepts in future practice, and an interest in writing and publishing materials. After explaining study objectives and that participation was voluntary, anonymous, and independent of course grade, the questionnaire was administered in hardcopy format at the end of the last class to eleven students. Survey responses were manually entered in a spreadsheet for tabulation.

Results: Ten students completed the survey instrument. Most students (N=7) were strongly satisfied with course content and several (N=3) were satisfied with course content. Nearly all students (N=9) were interested in writing and publishing in the future. All students (N=10) intended to apply the medical writing concepts and principles learned in future practice when they will be pharmacists. Student comments were positive and believed the course aided them in professional development and would highly recommend the course to other classmates. The survey was helpful in identifying student perceptions on the course and whether the course should be offered in the future.

Conclusion: The role of pharmacists is continuously evolving and pharmacy education must advance and progress to meet the needs of the changing field. Writing and publishing in the pharmacy field is an acquired skill that will enable sharing of clinical information with colleagues, other healthcare professionals, and patients. Students indicated strong positive perceptions of their learning, acquisition of skills, and an interest in publishing. The results of the course will be used to enhance future iterations of the program.

5-013

Category: Administrative practice / Financial Management / Human Resources

Title: Reducing intravenous filgrastim waste by modifying administration time at an academic medical center

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Purpose: Traditionally, departments of pharmacy have reduced drug expense by requiring orders for costly medications be reviewed by a specialist prior to dispensing. This project sought to reduce the expense associated with wasting high cost medications. The default time of administration for a medication scheduled to be given once daily is 0800. Due to numerous medication administration times at 0800, intravenous (IV) filgrastim was scheduled to be given at 1000 when the patient's intravenous lines were more accessible. The labels for IV products scheduled to be given at 0800 or 1000 print in the pharmacy the evening before at 2100. If a decision to stop or modify therapy is made during rounds it is nearly impossible to prevent the dose from being prepared and sent. Filgrastim accounted for two of the department of pharmacy's ten most expensive wasted medications based on total dollar amount. Intravenous as opposed to subcutaneous filgrastim is primarily utilized on the bone marrow transplant and leukemia units in patients with low platelet counts and for ease of administration. This project was designed to determine if a change in administration time could decrease filgrastim waste.

Methods: Data was collected retrospectively during two time periods (July 1, 2010 to January 2, 2011) and (January 3, 2011 to April 30, 2011) to determine how much intravenous filgrastim was wasted. The Pharmacy Information System was used to generate a report of wasted IV filgrastim. The administration time of filgrastim was changed from 1000 to 2000. The labels for IV products scheduled to be given at 2000 print in the pharmacy at 1300. This would allow the physicians ample time to determine need of IV filgrastim and to either continue or discontinue the order.

Results: A total of 186 days and 118 days of retrospective data was collected prior to the change in administration and after the change in administration time respectively. Changing the administration time of filgrastim accounted for an 82% reduction in total wasted filgrastim doses (pre=226 mcg/day, post=40 mcg/day; $p<0.001$). There was a 72% reduction in wasted 300 mcg doses (pre=71 mcg/day, post=15 mcg/day; $p<0.001$) and an 85% reduction in wasted 480 mcg doses (pre=155 mcg/day, post=24 mcg/day; $p<0.001$).

Conclusion: Changing the administration time from the morning to the evening had a significant impact on the number of wasted IV filgrastim doses. This allowed for the clinicians to determine whether a patient should continue on IV filgrastim on rounds. Then the clinicians had sufficient time to discontinue

the order in the computer order entry system. This prevented doses from being made ahead of rounds and potentially wasted.

5-014

Category: Automation / Informatics

Title: Post implementation assessment of a smart pump library

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Purpose: Prior to implementation of Symbiq smart pumps at UAB Hospital the medication library was built with multidisciplinary input. Limits were determined for each medication entry within the individual clinical care areas (CCAs). This post implementation project was designed to identify and implement improvements within the library in order to enhance patient safety related to medication infusion with smart pumps.

Methods: From October 14th to November 14th, 2010 all edits and overrides of upper soft limits were reviewed through Hospira MedNet reports. Medication entries meeting defined criteria for review were evaluated to determine the reason for infusion rate entries exceeding the upper soft limit. Medication entries with changes were evaluated between February 10th and March 13th, 2011

Results: During the initial evaluation period 5,376 edits and overrides of soft upper limits involving 92 medication entries were documented. Review of the edits/overrides identified 23 medication entries which met criteria for further review. Changes to 15 medication entry limits were made to enhance pump programming safety. Eight medications required the addition of an upper hard limit and 7 required modification of the upper soft limit. Upper hard limit additions prevented 715 inappropriate infusions and alert frequency was reduced for 86% (6/7) of the medications with modified upper soft limits.

Conclusion: Dosing errors were prevented and alert frequency was reduced through a smart pump library assessment.

5-015

Category: Automation / Informatics

Title: Development of an electronic medication titration process to optimize statin use

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Purpose: Compelling evidence indicates that patients with cardiovascular disease (CVD) and/or diabetes mellitus (DM) will reduce their risk of heart attack and stroke by achieving an LDL less than 100 mg/dL. However, many patients with CVD and/or DM who are taking statins have suboptimal LDL levels; these patients require up-titration to optimize their statin use. Conventional methods of individual dose titrations for large populations is typically lengthy and resource intensive. This task was streamlined in an integrated health care system through the development of an electronic medication titration process called the eApproval Project.

Methods: Patients are identified based on inclusion and exclusion criteria to be eligible for statin titration. Inclusion criteria is defined as patients with CVD and/or DM who have filled a statin prescription within the last six months and whose last LDL measured within the last 24 months is greater than 99 mg/dL. The LDL must have been measured at least four weeks after the initial statin dose or last statin dose change. Patients are excluded based on various criteria, including age, recent lab levels, history of statin intolerance, or concurrent use of interacting medications. The identified patients are populated into eApproval, an intranet application that sends an email to primary care providers (PCPs) directing them to their customized eApproval page to view and approve dose titrations based on an approved algorithm for their eligible patients. For approved titrations, the new prescription data is pre-populated into a barcoded file, and pharmacy technicians scan each component of the prescription into the outpatient dispensing system prior to pharmacist verification. Outreach to the patients, in the form of secure telephone messaging and postal letters, describes prescription changes and any other important information about their care. All patients are requested to return for follow-up labs four weeks after picking up their new prescription to assess outcomes. Reminder calls are sent out for patients who have not picked up newly titrated prescriptions or patients who have not returned for labs within four weeks.

Results: The initial campaign of the eApproval Project was launched for twelve Southern California service areas. The average time between the first titration request date to the last titration performed date was 2.69 months across all service areas. Overall, PCPs approved 12,192 titration requests. Pharmacists successfully titrated 10,953 prescriptions (89.8%), and patients picked up 7,243 of these prescriptions (66.1%). Of the patients who picked up their prescriptions, 5,795 patients (80.0%) re-checked their LDL level at least four weeks later, at a mean of 20.8 weeks after prescription pick-up.

These patients had a mean LDL of 115 mg/dL prior to prescription pick-up and a mean LDL of 89 mg/dL after prescription pick-up, resulting in a mean LDL reduction of 26 mg/dL (22.6%).

Conclusion: The eApproval Project streamlines statin titrations for patients with CVD and/or DM with suboptimal LDL levels. It decreases the need for office visits and requires minimal physician involvement and time, improving physician operational efficiency. Pharmacy operational efficiency is also improved through the use of barcoding to minimize time spent on order entry. Additionally, these improvements in efficiency have cost saving implications for both patients and the organization. eApproval is an example of effective and efficient utilization of available technology to effect positive change in medication use for large populations of patients.

5-016

Category: Automation / Informatics

Title: Implementation of Computerized Physician Order Entry and Pharmacist Education at a Community Hospital

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Purpose: Beginning in 2010, the UAB Hospital Pharmacy Department began to prepare for the integration of UAB Hospital, a large academic medical center, and UAB Highlands, a small community hospital. In April of 2010, pharmacists from UAB Hospital provided education to the Highlands pharmacists on clinical responsibilities and documentation systems. Cerner Millennium, the Health Systems version of CPOE was eventually implemented at UAB Highlands. The purpose of the project is to improve pharmacists reporting of medication misadventures and clinical interventions at UAB Highlands.

Methods: Retrospective Data Collection was conducted six months prior to CPOE implementation from April to September of 2010. Concurrent data collection began October of 2010 after CPOE implementation and was continued for six months. Educational efforts began by the Drug Information Resident in October on a longitudinal basis for medication misadventure and clinical intervention reporting. Stars Web, Microsoft Access, and Cerner Millennium were utilized for data collection for medication misadventures, clinical interventions, and pharmacy consults respectively.

Results: Six months prior to CPOE, UAB Highlands reported 83 total medication errors compared to six months after CPOE in which there were 98 reported errors. No adverse drug reactions were reported. Six months prior to CPOE implementation there were 22 reported clinical interventions compared to 75 interventions after CPOE implementation. During the six months after CPOE, each month, there were 270 antibiotic pharmacokinetic, 86 renal dosage and 68 intravenous to oral (IV to PO) conversion consults.

Conclusion: CPOE and educational efforts were associated with an increase in the number medication errors reported and documented clinical interventions. Additionally, CPOE was also effective in expanding the types of pharmacy consults to include medication reconciliation, IV to PO, and renal dosing.

5-017

Category: Automation / Informatics

Title: Evaluation of nursing responses to a medication related computerized physician order entry (CPOE) survey to determine future education requirements

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Purpose: Due to errors occurring during computerized physician order entry (CPOE), nursing staff is often unable to access medications from the automated dispensing cabinets (Pyxis). Medications are available through Pyxis one-half hour before and after the scheduled administration time. In the past, nurses had been encouraged to contact the Clinical Information Services (Cerner) department for assistance with order entry issues. However, six years after CPOE was implemented, nursing personnel are continuing to contact the pharmacy staff for aid when timing issues prevent removal of medications from the Pyxis cabinet. The purpose of this study was to determine whether or not nursing personnel are being adequately trained in the ordering of medications through the CPOE system to facilitate medication removal.

Methods: A completely anonymous, non-punitive data collection survey was developed to address order entry issues that created medication retrieval difficulties. The survey was administered to nurses in the medical-surgical unit during their scheduled annual nursing competencies. Each question on the survey had six choices as possible answers. Response options included for every question included calling the pharmacy for help, calling Cerner for help, placing a communication order, and other. The remaining two options provided a course of action specific to each question. Nurses were instructed to select how they would currently handle each of the situations presented in the questionnaire rather than what they perceived to be the correct answer. Topics covered included entering medications with appropriate start dates, using care sets to properly enter multiple order sentences at one time, appropriate dosage entry, routine order medication rescheduling, total parenteral nutrition order modifications, frequency changes, and appropriate one time order entry rescheduling. In addition to the survey, the education department was contacted to verify the current procedure for training nurses on the CPOE system.

Results: Forty-six surveys were returned to pharmacy. Each response was individually reviewed and determined to be ideal, acceptable, or unsatisfactory. Evaluation of the resulting information revealed that 16 percent of answers were considered ideal, 32 percent were deemed acceptable, and the remaining 52 percent of responses were unsatisfactory. Four of the topics covered had less than 5 percent ideal responses. Calling the pharmacy for assistance was the option chosen in 19 percent of total responses received. Critical in the findings was the discovery that there was not a single incidence of a nurse choosing the option of calling Cerner for help. Also, conversations with the education department revealed that most clinical hospital employees involved in using the Cerner system receive the same training. An "Introduction to the Cerner System" group training segment is included in the

clinical employee orientation. This generic four hour segment (taught by the education, not Cerner, staff) includes CPOE along with all other Cerner components, and is the only formal training provided on the system. The only other additional training is provided on the job by personnel who are currently using the system, but who also received no more than the four hour formal training course.

Conclusion: The results were representative of the extent of the problem related to deficiencies in order entry training. The formal education provided is inadequate to appropriately prepare nursing staff for the intricacies involved in safe medication practices. It is imperative that the education, Cerner, and pharmacy departments work in conjunction to provide ongoing medication order entry training which will ensure patient safety in the facility.

5-018

Category: Automation / Informatics

Title: Determining bacterial contamination and particle matter count with the use of injectable compounding robotics

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Purpose: Compounding robotics can assist pharmacy compounding by reducing errors, decreasing dispensing turnaround times, reducing inventory, and reducing manual dispensing workload. National and local pharmacy organizations along with the accrediting boards have set standards for error rates and safety guidelines for the appropriate use of compounding robotics. There are two areas that still need to be evaluated to determine if the solutions are appropriately prepared. These include bacterial contamination and the number of particulate contaminates from multiple injections in the same injector port. The purpose of this study is to determine the bacterial and particulate contamination rate with the use of robotics and manual compounding.

Methods: In order to determine the bacterial contamination rate typtic soy broth media was pumped into ten containers by the compounding robot each day at the end of the compounding workload from October 2009 through April 2011. A total of 5,770 tests were incubated during the time period studied. The tests were examined daily for the length of the testing period to determine if any of the tests were positive. Positive tests were sent to microbiology for plating and bacterial determination. Particulate matter count was determined by repetitively injecting through the injector port of a vial and withdrawing 2.5 milliliters of solution after each injection. This was performed with compounding robotics and manual compounding for comparison. One hundred compounded syringes of normal saline and 40 syringes of cefazolin were tested using both robotic and manual compounding. Each sample was filtered through a 0.45 micron filter disc and analyzed quantitatively for particulate matter under 100 x magnification. According to the USP standards, solutions are considered physically compatible if there are less than 12 particles/ml measuring greater than or equal to 10 micrograms and less than 2 particles/ml measuring greater than or equal to 25 micrograms in diameter. The robotic and manual solutions were also evaluated to determine if the number of particles was increasing with each injection. This was accomplished by dividing the 100 normal saline solutions and 40 cefazolin solutions in half and comparing the first half to the second half for particulate matter count. Statistical analysis was calculated by using descriptive analysis and Mann-Whitney for nonparametric data.

Results: In 5,770 bacterial contamination tests there were no contaminated samples. The median number of particles greater than or equal to 10 micrograms in the robotic and manual normal saline was

5 particles/2.5ml (p> 0.05). The median number of particles greater than or equal to 25 micrograms in the robotic normal saline was 0 particles/2.5ml and the manual was 1 particle/2.5ml (p< 0.05). The manual normal saline syringes were found to have 14% more particulate contamination than the robotic. The median number of particles greater than or equal to 10 micrograms in the robotic cefazolin was 7 particles/2.5ml and the manual was 9 particles/2.5ml (p< 0.05). The median number of particles greater than or equal to 25 micrograms in the robotic cefazolin was 0 particles/2.5ml and the manual was 1 particle/2.5ml (p<0.05). The manual cefazolin syringes were found to have 33% more particulate contamination. All the syringes in the normal saline and cefazolin met the USP requirements for particulate matter count. Particulate containers from the normal saline and cefazolin samples were further evaluated by comparing the first and last half of the prepared solutions for both robotics and manual compounding to determine if the amount of particulate matter in each sample increased with the number of injections into the vial. The median robotic number of particles greater than or equal to 10 micrograms in the first 50 injections of normal saline was 6.5 particles/2.5ml and the last 50 was 3 particles/2.5ml (p<0.05) . In the manual process the first 50 injections had a median of 6 particles/2.5mls and last fifty had 4 particles/2.5ml (p>0.05). The median robotic number of particles greater than or equal to 25 micrograms in the first 50 robotic injections and the last 50 injections of normal saline was 0 particles/2.5ml (p> 0.05). In the manual process the first 50 injections and the last 50 injections had a median of 1 particle/2.5mls (p>0.05). The median robotic number of particles greater than or equal to 10 micrograms in the first 20 robotic injections of cefazolin was 7 particles/2.5ml and the last 20 was 7.5 particles/2.5ml (p>0.05) . In the manual process the first 20 injections had a median of 9 particles/2.5mls and last fifty had 11 particles/2.5ml (p>0.05). The median robotic number of particles greater than or equal to 25 micrograms in the first and last 20 robotic injections was 0 particles/2.5ml (p>0.05). In the manual process the count of particles greater than or equal to 25 micrograms in the first and last 20 injections had an median of 1 particle/2.5ml (p>0.05).

Conclusion: Using robotic compounding eliminates bacterial contamination. Robotic and manual compounding meet USP standards for particulate matter count. The use of robotics decreases the number of particulate contamination compared to manual compounding. Repeated injecting through an injector port does not necessarily increase particulate count under the number of injections studied.

5-019

Category: Automation / Informatics

Title: COST SAVINGS ASSOCIATED WITH THE IMPLEMENTATION OF AN AUTOMATED INVENTORY MANAGEMENT TOOL FOR MEDICATION DISPENSING CABINETS

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Purpose: An inventory management tool is a value-added service which helps engineer a safe, efficient, and cost effective decentralized pharmaceutical supply chain. Gundersen Lutheran Medical Center implemented an automated inventory management tool in November 2010. The inventory management tool works in conjunction with the health systems medication dispensing cabinet to automate the ordering and fill process. Prior to inventory tool implementation, medication dispensing cabinet replenishment required a manual process involving various steps and personnel to accomplish. The objectives of this project are to optimize inventory management of the medication dispensing cabinets, reduce pharmacy logistics, and improve patient safety.

Methods: To serve as a baseline, the manual pharmacy distribution model was evaluated with standard performance metrics. The three focus areas used for the evaluation include pharmacy logistics, inventory management, and patient safety. The metrics were then applied to the new inventory management tool. These metrics include processing time in the pharmacy for ordering, receipt, restocking, picking, sorting, and the refill time. Utilizing measured times, approximate wages of the pharmacy staff, average daily ordering, and inventory management, the labor costs were able to quantify both with and without the inventory management tool. Compliance in patient safety initiatives were tracked in the inventory management tool by reviewing the percentage of items being scanned while refilling the medication dispensing cabinets as opposed to manual refills.

Results: Based on time-motion observations, data inputs, and cost projections, the inventory management tool will garner a $20,000 net savings and 0.63 full-time equivalents. The majority of the cost savings is realized in reduced ordering time, manual check-in/put away time, and number of doses needing to be manually picked for dispensing cabinet restocking.

Conclusion: The inventory management tool is providing value at Gundersen Lutheran. The tool has allowed the decentralized pharmacy distribution model to become more efficient, safer, and cost effective.

5-020

Category: Automation / Informatics

Title: Prescriber compliance with intravenous immunoglobulin guidelines

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Purpose: At the University of Michigan Hospitals and Healthcare System (UMHHS), it is important that intravenous immunoglobulin (IVIG) use is closely monitored in order to maintain fiscal accountability and preserve occasionally scarce supplies for patients who truly benefit from therapy. Prescribers are required to document the condition for which the patient is receiving IVIG. For certain indications, verbal approval from a key clinical leader is required prior to use. Documentation of this approval occurs when IVIG is ordered, either electronically in the computerized physician order entry (CPOE) system used for hospital inpatients or manually on the paper order form used for outpatients in the Cancer Center. Since an order form is used to guide prescribers, the dispensing pharmacist presumes that the documented indication is valid. To assess the validity of this presumption, a study was conducted to assess physician compliance with IVIG prescribing guidelines.

Methods: This study consisted of retrospective and concurrent evaluations. For both evaluations, compliant order sets were defined as having matching conditions listed on the IVIG order form with documented patient care problems in CareWeb, the electronic heath record system. For the concurrent evaluation, an assessment of the validity of physician approvals for new IVIG orders was completed by contacting the listed IVIG approvers and confirming their consent. A total of 150 new IVIG order sets for initiation of treatment were reviewed, 100 retrospective orders and 50 concurrent orders.

Results: For the order sets in the retrospective portion 91% were compliant with prescribing criteria. In the prospective portion of the study, 82% of the order sets were compliant with appropriate indication criteria. Overall, 132/150 (88%) of IVIG new start orders had a matching indication listed in CareWeb. These differences in prescriber compliance were not significant (P = 0.0683, Fisher's exact test). An approving clinician was named on 44 of 50 prospective IVIG new start order sets. Of these, 61% received approval from the listed approving clinician. None of the orders from the outpatient setting received appropriate approval while 64% of the inpatient orders were approved by the physician listed.

Conclusion: Our findings are consistent with other studies that have shown a high rate of order completeness occurs with standardized ordering processes for restricted drugs, but inaccurate documentation of approval persists whether or not prescribing is conducted using a paper-based or computerized ordering system.

5-021

Category: Automation / Informatics

Title: Reducing medication errors by incorporating weight-based dosing into computerized order entry systems

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Purpose: Computerized physician order entry (cPOE) with clinical decision support provides a platform for dosage recommendations directly to the prescribers at the point of order entry, potentially decreasing the frequency of dosing errors. Medications that have weight-based dosing recommendations introduce a new variable into the decision support intelligence. However, many software programs only utilize total body weight for dosing recommendations. Beth Israel Deaconess Medical Center recently integrated screening for obesity and utilizing total, ideal or dosing weights for dosing recommendations. This was a before-after study designed to quantify the improvement in drug dosing when correct weights were used.

Methods: The institutional review board approved this retrospective chart review. Intravenous (IV) acyclovir was chosen as a representative medication, since it is recommended to use ideal body weight when dosing obese patients, defined as >120% of their ideal body weight. Patients who received IV acyclovir during a one month period prior to the programming change were compared to patients who received IV acyclovir during a second one month period after the change. Only the initial IV acyclovir dose was assessed. Patients receiving IV acyclovir as part of their hematologic/oncologic prophylaxis were excluded. Orders were categorized as being appropriate, higher than recommended or lower than recommended.

Results: Thirty-two patients had IV acyclovir orders written in the pre-programming period. Eleven patients were obese. Eleven patients (34.4%) received appropriate doses; 15 (46.9%) received higher than recommended doses and 6 (18.8%) received lower than recommended doses. Four patients (12.5%) did not have any dosing recommendations. All 11 obese patients received higher than recommended doses. Eight patients had IV acyclovir orders written in the post-programming period. Two patients were obese. Six patients (75%) received appropriate doses; 1 (12.5%) received a higher than recommended dose and 1 (12.5%) received a lower than recommended dose. Dosing recommendations were provided for all patients. One of the two obese patients received a higher than recommended dose.

Conclusion: Although the number of patients was small, incorporating multiple weights into cPOE for the purpose of drug dosing seemed to improve overall prescribing of IV acyclovir. More patients

received appropriate doses, and fewer patients received higher than recommended and lower than recommended doses in the post-programming period.

5-022

Category: Automation / Informatics

Title: The design and implementation of a formulary management and drug information website in a multi-hospital health system

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Purpose: Communication is essential to providing optimal patient care. The care of patients involves many different health-care services, all needing access to medication information. Health systems are faced with the challenge of providing effective communication and implementation of drug policy initiatives across all practice sites. Institution specific information on the drug formulary, drug policies, drug shortages, medication safety, and Joint Commission initiatives need to be readily accessible to health care providers in order for them to make appropriate, point of care decisions. An online drug information repository was identified as a tool our health system could utilize to bridge the communication gap between pharmacy and health care practitioners. This project discusses the processes through which our health system implemented a multi-disciplinary,formulary management and drug information website.

Methods: Access to the health systems' drug formulary and clinical drug information was fragmented at our health system. This information could be found in several different places within our institutions: the health system's intranet, on a department's share-drive, on an employee's personal drive, and in the individual minds of our health-care professionals. Pharmacy administrators envisioned a multi-disciplinary, one-stop-shop for drug formulary and clinical information as a solution to this problem. Subsequently, the pharmacy department was authorized to purchase formulary management software that allows the health system to create a drug database that mirrors the health system's drug formulary. In addition, the software provides our health care providers a place to communicate critical drug information to all employees of the heath system. Once the health system purchased the software, a multi-disciplinary team comprised of pharmacists, pharmacy technicians, student interns, physicians, and nurses was formed to determine the content of the website. The website currently includes the heath system's drug formulary (with drug specific links to REMS and black-box warnings), approved therapeutic interchanges, drug policies, current drug shortages, medication safety information, links to the FDA, ISMP, ASHP and other agencies, along with additional clinical information pertaining to the drug formulary. Each type of health care professional (nursing, pharmacy, physician) has a link specifically designed for their profession embedded in the website. For example, the pharmacy department's orientation/training manual, annual competency and current drug shortages were posted on the website, encouraging pharmacy staff members to incorporate the website into their daily work

activities. In addition, suggestions and updates to the website can be submitted to the team via a comments/suggestions link in the website. The website was initially introduced to the staff of our largest hospital through an ice-cream social. There, staff familiarized themselves with the contents of the website through a slide presentation, interactive training, and a quiz. In addition, the website was demonstrated to clinicians at a staff meeting.

Results: The health system's formulary management and drug information website has had over 4,500 hits in the first month of operation. The results of a staff survey indicate the staff believes that the online repository is beneficial and supports their daily clinical efforts. Prior to this system, staff members indicated they had trouble locating drug related information and the process of locating information was very time consuming. Survey results also indicate the staff feels this site improves patient care through the ability to efficiently locate drug related information. In addition, this website has resulted in fewer calls to pharmacy. Suggestions for improving the site were minor and included designing some of the web pages to look "less busy" and adding some additional content to the site. Overall, the survey results indicate that the staff feels the online formulary management site improves communication of drug related information within the health system.

Conclusion: The implementation of a formulary management and drug information website has improved communication and implementation of drug policy initiatives within our health system. Based on the successes of the current formulary management and drug information website, our health system plans to expand the website to all practice areas within the health system.

5-023

Category: Cardiology / Anticoagulation

Title: Case report: Probable interaction between warfarin and marijuana smoking

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Purpose: This case report indicates the probable interaction between warfarin and marijuana smoking. A 56-year-old Caucasian male was admitted to the hospital with a diagnosis of upper gastrointestinal bleed. He was receiving chronic warfarin therapy for his mechanical heart valve replacement. Due to a large melenic bowel movement, he was admitted to the hospital. His INR value was supratherapeutic at 10.41, and his hemoglobin level was 6.6 g/dL at that point. He received four units of fresh frozen plasma and one dose of oral vitamin K 10 mg. His INR value decreased to 1.8 the next day. He was discharged 7 days after this hospitalization. Fifteen days after the first hospital discharge, he was re-admitted to the hospital with a constant nose bleed and increased bruising. His INR value was supratherapeutic at 11.55 at that point. After treatment, he was discharged with an INR value of 1.14. It appeared that he smoked marijuana more frequently throughout the period of these two hospitalizations due to his depression. He was instructed by the pharmacist about the potential interaction of warfarin and marijuana. The patient decided to stop smoking marijuana after three instruction sessions. His INR values ranged from 1.08 to 4.40 throughout the 9-month period without marijuana smoking. Marijuana might have increased warfarin anticoagulant effect in our patient by inhibiting its metabolism and transiently increasing its free plasma concentrations by plasma protein-binding displacement. Using the Drug Interaction Probability Scale, the warfarin and marijuana interaction in our patient appeared to be probable (a total score of 5 on the scale). To our knowledge, there have been no reported cases concerning the interaction between warfarin and marijuana smoking. Further research or studies are required to confirm this interaction; however, clinicians should be aware of its probability. It is important for pharmacists to carefully review the prescription/non-prescription drugs, and other substances that the patient is receiving or using.

Methods: N/A

Results: N/A

Conclusion: N/A

5-024

Category: Cardiology / Anticoagulation

Title: Prospective comparison of an inpatient pharmacist managed anticoagulation service versus usual medical care

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Purpose: Warfarin is known to be effective in both the inpatient and outpatient setting for the prevention and treatment of venous thromboembolism, systemic embolism, and to reduce the risk of recurrent myocardial infarction. Outpatient anticoagulation clinics have been using established pharmacist managed protocols for warfarin and numerous studies have been conducted in the outpatient setting to validate these protocols. However, with only a handful of published studies, the data is limited on warfarin dosing protocols in the inpatient setting. The purpose of this study was to compare anticoagulation control in hospital patients treated with a pharmacist managed protocol-based anticoagulation service with that of usual medical care.

Methods: This is a prospective study, approved by the Morton Plant Hospital (MPH) institutional review board that evaluated a pharmacist managed inpatient anticoagulation dosing protocol compared to physician managed dosing at MPH between November 1, 2010 and April 30, 2011. Patients greater than age 18 years and initiated on warfarin while hospitalized during the study period were included. Warfarin dosing in the study group was determined using an initial dosing algorithm based off of patient specific factors and changes in dose were based on a dose adjustment algorithm. A prothrombin time (PT), international normalized ratio (INR), and complete blood count (CBC) were ordered at baseline, then a PT/INR was obtained daily while a CBC was obtained at a minimum of every three days. The primary outcome measure was anticoagulation control, defined as the percent of INR values within a clinical target range. Secondary outcomes included incidence of supratherapeutic INR values, length of stay, number of INRs ordered, bleeding events, and thromboembolic events. A two-sample percent defective test was utilized to analyze all nominal data, while a two-sample t-test was utilized on all numeric data.

Results: Overall, patients in the protocol group had 38.8 percent (85/219) of their INR values within the clinical target range versus 23.5 percent (71/302) in the control group, which was a difference of 15.3 percent (odds ratio 2.06, 95 percent CI: 1.41 3.02, P less than 0.05). Protocol group patients had 2.74 percent (6/219) of their INR values deemed supratherapeutic versus 6.62 percent (20/302) in the control group, which was a difference of 3.88 percent (odds ratio 2.52, 95 percent CI: 0.99 6.38, P less than 0.05). Patients in the control group had a length of stay 2.39 days longer (90 percent CI: 1.39 3.39, P less

than 0.05) and 0.79 more INRs ordered (90 percent CI: 0.33 1.25, P less than 0.05) than patients in the protocol group. Adverse events were similar between the two groups.

Conclusion: Hospitalized patients who were initiated on warfarin therapy and were dosed by utilizing a pharmacist managed protocol-based anticoagulation service achieved more INR values within a clinical target range, had fewer supratherapeutic INR values, required a shorter length of hospitalization, and were not at an increased risk for adverse events when compared to usual medical care.

5-025

Category: Cardiology / Anticoagulation

Title: Evaluation of appropriate enoxaparin venous thromboembolism prophylaxis dose adjustments in hospitalized obese populations

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Purpose: Venous thromboembolism (VTE) has been recognized as a major cause of morbidity and mortality among hospitalized patients. In the United States, obesity is on the rise and has been identified as one of the risk factors involved in the development of a VTE. One study by Samama et al. found that there was a relationship between thrombosis rate and BMI. This risk was significantly higher in those patients with a BMI greater than or equal to 32 kg/m2. Therefore, utilizing appropriate dosing strategies in obese patients is necessary to provide optimal prophylaxis. To address concerns regarding insufficient prophylactic doses, various studies have suggested the use of higher than standard doses to attain adequate prophylaxis. Limited data currently exists about the appropriate enoxaparin prophylaxis dosing in morbidly obese hospitalized patients with acute medical illness as well as the recommended dose adjustments based on anti-Xa level monitoring. The purpose of this study was to evaluate the appropriate enoxaparin prophylactic dosing in obese hospitalized patients (BMI >=32 kg/m2) with acute medical illness through the attainment of target anti-Xa levels (0.2-0.4 units/mL +/- 10%).

Methods: This was an IRB approved, quality assurance, retrospective chart review of anti-Xa levels in obese patients admitted to Methodist Dallas Medical Center who received VTE prophylaxis with enoxaparin 40 mg subcutaneously twice daily between December 1, 2010 and February 28, 2011. The primary endpoint was to evaluate the number of patients who attained target anti-Xa levels with enoxaparin 40 mg subcutaneously twice daily. Patients have been evaluated for target anti-Xa levels within the range of 0.2-0.4 units/mL +/- 10%. Any level above or below this range was classified as within, below or above target, respectively. Baseline data collection included serum creatinine, creatinine clearance, hemoglobin, hematocrit, and platelet count. In addition, VTE risk factors, nonpharmacological forms of VTE prophylaxis, bleeding events, and VTE development were also collected. Bleeding events were categorized into major and minor bleeding. Major bleeding was defined as a decrease in hemoglobin by greater than or equal to 2 g/dL over 24 hours, a blood transfusion, or surgical intervention needed to prevent further bleeding. All other bleeding was considered minor.

Results: Twelve patients with a BMI greater than or equal to 32 kg/m2 on twice daily enoxaparin 40 mg had anti-Xa levels attained. Four patients were excluded due to the timing of the laboratory draw. Sixty-seven percent (N=6) of patient's levels were within the target range (0.2-0.4 units/mL +/- 10%) and the

remaining 33% (N=3) were below the target range. There did not appear to be a coorelation between anti-Xa levels and BMI or renal function. One patient did have a decrease in hemoglobin by 3 g/dL over 24 hours but without any clinical signs of bleeding. No VTE events were noted in any of the patients during the hospital stay.

Conclusion: Patients with BMI greater than or equal to 32 kg/m2 receiving enoxaparin 40 mg twice daily (versus standard 40 mg daily) attained target anti-Xa levels without an obvious significant increase risk of bleeding. The clinical significance of these dose adjustments must be determined in larger, more diverse, longer-term clinical trials.

5-026

Category: Cardiology / Anticoagulation

Title: Safety and efficacy of inhaled epoprostenol-arginine in critical care patients

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Purpose: Intravenous epoprostenol is an FDA-approved treatment for pulmonary arterial hypertension. Inhaled epoprostenol is not an approved route of administration but has been used for the treatment of pulmonary hypertension and may be preferred due to its lack of systemic hypotension in critically ill patients. Currently there are two formulations of intravenous epoprostenol marketed in the United States that have been utilized via inhalation therapy. One formulation of epoprostenol contains 50 mg of arginine and is diluted with normal saline. The other formulation of epoprostenol is formulated with a glycine diluent. Small studies have evaluated epoprostenol-glycine administered via inhalation and have demonstrated improved efficacy and decreased systemic hypotension. No published literature exists evaluating the safety or efficacy of inhaled epoprostenol-arginine. There are theoretical clinical concerns that the change in amino acid from glycine to arginine may be associated with undesirable adverse drug reactions. Limited data suggests that inhaled arginine may be associated with bronchospasm in asthmatic patients. The purpose of this study was to evaluate the safety and efficacy of inhaled epoprostenol-arginine administered in intensive care patients.

Methods: An institutional review board approved retrospective evaluation of 42 intensive care unit patients who received inhaled epoprostenol-arginine was conducted to determine efficacy and safety outcomes. Safety was assessed by evaluating the use of any newly prescribed or increased use of a bronchodilator within 24 hours of initiation. Efficacy was determined by evaluating the changes in systolic and diastolic pulmonary artery pressures at 8 and 24 hours after initiation of inhaled epoprostenol-arginine compared to baseline values.

Results: The use of inhaled epoprostenol-arginine in intensive care unit patients resulted in a reduction in systolic and diastolic pulmonary artery pressures at 8 and 24 hours compared to baseline values. Only one patient experienced an increase in the use of a bronchodilator (2 doses) within 24 hours after initiation of inhaled epoprostenol-arginine. Due to the patient's concomitant diseases, correlation of a temporal relationship with the bronchodilator use and initiation of inhaled epoprostenol-arginine was unable to be determined.

Conclusion: Epoprostenol-arginine administered via inhalation in critical care patients reduced systolic and diastolic pulmonary artery pressures with no evidence supporting a negative effect in regards to safety.

5-027

Category: Cardiology / Anticoagulation

Title: Evaluation of the Use of Phytonadione (Vitamin K) for INR Reversal

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Purpose: The management of patients with a supra-therapeutic INR is a common problem in clinical practice. Phytonadione (vitamin K) is indicated for prevention and treatment of hypoprothrombinemia caused by anticoagulant-induced vitamin K deficiency. As a result of medication use evaluation data generated in 2007, pharmacists of the St. Josephs/Candler Health System designed a phytonadione protocol that optimizes the ordering practices for clotting factors, blood, and phytonadione for patients who experience warfarin-induced coagulopathy. This protocol would be able to guide physicians for appropriate dosing of phytonadione based on INR and whether or not a patient is bleeding. It will also guide physicians in choosing the appropriate route of administration, which at our facility is preferred to be oral or intravenous. A follow-up medication use evaluation (MUE) was conducted to determine if the protocol was being utilized by physicians.

Methods: A retrospective chart review was conducted between 11/15/10-12/31/10. Eighty-three patients met inclusion criteria of having received phytonadione during that time period. Patients were evaluated based upon meeting appropriate indication, appropriate dose, and appropriate route of administration according to the CHEST Guidelines. Patients were also evaluated to see if the protocol was used, and whether or not the patient showed signs/symptoms of improvement.

Results: The 83 patients being evaluated received a total of 101 doses of phytonadione. The MUE revealed 80/101 (79%) patients had an appropriate indication for therapy, 34/101 (34%) patients had an appropriate route of administration documented, and 44/101 (44%) patients had the appropriate dose based on INR. Only one patient had the protocol for phytonadione used. All patients showed signs/symptoms of improvement by having a decrease in bleeding or a decrease in INR.

Conclusion: Appropriate indication for use showed the best results; however, all 21 patients who were inappropriately treated came from the same INR range of < 5. Appropriate route of administration and dose were both suboptimal at 34% and 44%, respectively. The phytonadione protocol that was created is not being used by physicians, with most still choosing to write free hand. From the results of this project a multidisciplinary anticoagulation team is being created to address this issue, as well as others concerning anticoagulation. The P&T committee is currently working on an automatic switch that would allow orders for inappropriate route of administration to be changed automatically by pharmacists. Improving pharmacist and physician knowledge is a beneficial and necessary step to better the care of patients.

5-028

Category: Cardiology / Anticoagulation

Title: Optimizing anticoagulation protection at the time of patient discharge

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Purpose: Prevention of venous Thromboembolism (VTE) with anticoagulation therapy (AT) is of paramount importance for hospitalized patients when risk factors are present. Failure to provide such protection can result in catastrophic untoward events. Fortunately, there is a wide body of scientific evidence by which care providers can develop evidence-based practice models (EBP) for prevention of VTE. These may be best summarized by the American College of Chest Physicians Conference on thrombolytic therapy (2008). Their recommendations are commonly known as the CHEST guidelines and they provide an excellent framework for care providers to build related EBPs. We set out to develop an EBP for the purpose of optimizing AT during a patient's hospitalization and also at the time of their discharge to the ambulatory setting. After the EBP was developed, the natural question of How are we doing was raised. The primary purpose of our study was to determine if our AT was compliant with our EBP. Research questions were, 1) AT provided when indicated, 2) target INR goal reached; 3) when the target INR was sub therapeutic, was unfractionated heparin or low-molecular-weight heparin added as a bridging agent. A secondary purpose to our study was to provide feedback for prescribing doctors.

Methods: The design of our study was prospective, observational, non-randomization and non-blinded. The sample size is 200 patients.

Results: Results showed that at the time of patient discharge, therapeutic INR was reached in (38%) of patients, bridging agent not required was (24%), discharged with warfarin and a bridging agent was (12.5%), not falling under the EBP criteria was (12.5%), and discharged with a sub therapeutic INR, without a bridging agent, when recommended (13%) .

Conclusion: Our conclusion was that too many patients were being sent home with sub therapeutic INR levels and not being prescribed a bridging agent. Therefore, they were being put at risk for serious adverse events. For example, a patient with the diagnosis of atrial fibrillation (A.Fib.)and having a CHADS2 score of >2 is at a five fold greater risk for stroke if AT is not optimized . Other examples of non-compliant cases to the EBP included patients with deep vein thrombosis and pulmonary embolism. We developed a mechanism to provide feedback to prescribing doctors and also provide them with education regarding the availability of the EBP. During the time of our study, a new anticoagulant drug dabigatran, a direct thrombin inhibitor, was released for the indication of stroke prevention in patients with A.fib. Modifications to our EBP were made and will be described. Information from our study

looking closely at anticoagulation treatment strategies at the time of patient discharge from a hospitalized setting to an ambulatory one should be of interest to care providers concerned about continuity of care for the prevention of VTE.

5-029

Category: Cardiology / Anticoagulation

Title: Evaluation of the incidence of peripheral neuropathy symptoms associated with the use of intravenous epoprostenol and treprostinil in patients with pulmonary hypertension

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Purpose: Prostacylin-induced peripheral neuropathy is thought by many health care professionals to be a common adverse reaction. The currently available literature indicates limited or no incidence of peripheral neuropathy with these medications. The object of this study was to determine the incidence of symptoms of peripheral neuropathy associated with the use of intravenous epoprostenol or intravenous treprostinil.

Methods: Patients who were at least 18 years of age and who were being treated with either intravenous epoprostenol or intravenous treprostinil and were followed by the University of Iowa Pulmonary Arterial Hypertension Treatment Program were included in the survey. IRB approval was obtained, and data was collected by questionnaire provided via telephone. The primary outcome measure was the incidence of patients developing symptoms of peripheral neuropathy after initiation of intravenous prostacyclin therapy. The secondary outcome is the temporal relationship between the onset of symptoms of peripheral neuropathy and the administration of the intravenous prostacyclin.

Results: Fourteen subjects were enrolled in the study. Nine subjects (64%) developed at least one symptom of peripheral neuropathy, and eight subjects (57%) developed at least five symptoms of peripheral neuropathy. All symptoms of peripheral neuropathy developed after initiation of therapy with an intravenous prostacyclin. Sixty-seven percent of subjects developed symptoms within 6 months.

Conclusion: The use of the intravenous prostacyclins, epoprostenol and treprostinil, appears to be associated with the development of symptoms of peripheral neuropathy, with most symptoms of peripheral neuropathy developing within 6 months after the initiation of therapy. Patients may benefit by being counseled on the incidence of this previously undocumented side effect prior to the initiation of therapy.

5-030

Category: Cardiology / Anticoagulation

Title: Performance of venous thromboemoblism (VTE) risk assessment algorithms in medical patients VTE risk stratification and prophylaxis: a comparative study

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Purpose: Venous thromboembolism (VTE) is one of the most preventable causes of deaths among hospitalized medical patients in the US. Quality improvement (QI) interventions have demonstrated a significant reduction in the incidence of in-hospital VTE. An integral component of any QI strategy is to comprehensively evaluate patient-related and admission-related VTE risk factors and base the VTE prophylaxis approach on the VTE risk level. Multiple VTE risk assessment algorithms are published and vary considerably in their length and the number of risk factors included. The Caprini risk assessment model (Caprini JM. Dis Mon 2005;51:70-78) is a comprehensive tool with more than 40 differentially-weighted risk factors and 4 risk levels (low, moderate, high and highest). No prophylaxis is recommended in the low-risk category; mechanical or pharmacologic thromboprophylaxis for moderate risk and pharmacologic thromboprophylaxis alone or in combination with mechanical prophylaxis for high and highest categories. An abbreviated VTE risk assessment tool (Galanter WL, et al. Am J Health-Syst Pharm 2010;67:1265-1273) includes 15 equally-weighted risk factors and 2 risk levels (lowest with no risk factors and no recommendations and intermediate-high with one or more risk factors and pharmacologic prophylaxis). The aim of this study is to retrospectively apply the two VTE risk assessment tools to a cohort of hospitalized medical patients at our institution and compare the risk stratification and the percentage of patients receiving pharmacologic thromboprophylaxis between the two tools. We hypothesized that by using an abbreviated VTE risk assessment tool, we can properly classify patients according to their VTE risk compared to a comprehensive VTE risk assessment tool.

Methods: A retrospective cohort was identified. Inclusion criteria included hospitalization between January 1st and June 30th, 2008, age more than 40 years old at hospitalization and length of stay for 5-7 days. Exclusion criteria included patients admitted for surgical procedure or required full anticoagulation on admission. A random sample of patients who fit the inclusion criteria (n=175) was selected and retrospective chart reviews were conducted. For each patient, the two VTE risk assessment tools were applied using data available on admission date. Following completion of the two VTE risk assessment tools for each patient, patients were placed in the appropriate risk category based on each risk assessment approach and the associated prophylaxis strategy was documented. The main outcomes measure was the percentage of patients receiving pharmacologic thromboprophylaxis using each assessment tools. Additionally, the percentage of patients receiving pharmacologic thromboprophylaxis using the abbreviated tool who also should receive pharmacologic thromboprophylaxis using the

comprehensive tool was calculated. Significant differences were determined by using Fisher exact test with and level = 0.05. This study was approved by the Institutional Review Board at Rhode Island Hospital.

Results: Using the comprehensive VTE risk assessment tool, 13 patients (7%) were classified as low-risk with no specific recommendations. A total of 53 patients (30%) were classified into the highest risk categories compared to 92 (53%) in the high-risk category and 17 in the intermediate-risk category (10%). Using the Caprini risk assessment tool, 162 (93%) patients receive a form of VTE prophylaxis and a total of 145 patients (83%) require pharmacologic thromboprophylaxis. Using the abbreviated risk assessment tool, a total of 127 (72%) had 1 or more risk factors requiring pharmacologic thromboprophylaxis. The percentage of patients receiving any form of VTE prophylaxis is significantly higher ($p<0.001$) using the comprehensive VTE risk assessment compared to the abbreviated risk assessment tool. The percentage of patients receiving pharmacologic thromboprophylaxis using the comprehensive risk assessment was significantly higher ($p=0.028$) compared to the abbreviated risk assessment. All of the patients receiving pharmacologic thromboprophylaxis in the abbreviated VTE risk assessment tool would have received pharmacologic thromboprophylaxis using the comprehensive VTE risk assessment tool.

Conclusion: Proper VTE risk assessment is an essential component of any successful QI strategy. In this investigation, a comprehensive VTE risk assessment tool resulted in a significantly higher VTE prophylaxis recommendation compared to an abbreviated VTE risk assessment tool. This increase in VTE prophylaxis should be weighed against prescriber burden and the likelihood of compliance with the risk assessment tool utilization. These two VTE risk assessment tool should be compared prospectively to identify the likelihood of adoption among admitting physicians.

5-031

Category: Cardiology / Anticoagulation

Title: Evaluation of incorporating decentralized pharmacists into an anticoagulation monitoring program in a community teaching medical center

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Purpose: In 2008, the Joint Commission national patient safety goal 3E required that by 2009, all hospitals implement standardized systems to reduce the likelihood of patient harm associated with the use of anticoagulation. To meet this requirement, our pharmacy department initiated and established standardized practices to ensure proper anticoagulation prescribing and monitoring. Initially, monitoring was primarily done by one clinical pharmacist with the support of centralized pharmacists during order verification. In 2010, all pharmacists received revised competency training and decentralized pharmacists started anticoagulation monitoring on their respective patient floors. The purpose of this evaluation is to assess the quality of this decentralized program as measured by monthly audits and documentation of pharmacist interventions on patients receiving warfarin, heparin and enoxaparin.

Methods: Monthly audits and documentation of pharmacist interventions were collected before and after decentralization of the anticoagulation monitoring program. Data in the monthly audits included the following: percentage baseline international normalized ratios (INRS) before first warfarin dose, INRs more than 5, physician completion of standardized order forms for all prescribed warfarin and heparin, baseline serum creatinine (SCR) and creatinine clearance (CRCL) before first enoxaparin dose, appropriate renal dosing of enoxaparin, baseline platelets before enoxaparin and heparin initiation, three consecutive activated partial thrombin times (aPTTs) over 150 while on heparin drip and nursing shift-checks, double-checks and documentation of heparin drip rates and adjustments. Pharmacist interventions were also collected and included the following; monitoring of patients on anticoagulation for appropriate dosing, laboratory monitoring, drug interactions, adverse drug reactions, heparin induced thrombocytopenia, monitoring of aPTT, and nursing adherence to the heparin dosing nomogram.

Results: Audits on twenty patients per month before and after decentralization of pharmacists demonstrated consistent results of 100 percent compliance in the following areas: baseline INR prior to warfarin dosing, baseline SCR and CRCL prior to enoxaparin dosing, baseline platelets prior to heparin and enoxaparin dosing, appropriate renal dosing of enoxaparin and completion of standardized order forms. INRS more than 5 and aPPTs over 150 also showed consistency. Prior to decentralization 1 out of 153 INRs was over 5 (0.65 percent) while results after showed 3 out of 146 INRs over 5 (2 percent). Similarly, three consecutive aPPTs over 150 were found in 1 of 20 patients (5 percent) before and none

after. Nursing adherence to the heparin dosing nomogram was appropriately documented in 11 of 20 patients (55 percent) prior and in 20 out of 20 patients (100 percent) after decentralization. During the 5 months prior to decentralization, pharmacists documented 741 interventions related to anticoagulation while in the 5 months after decentralization documentation of interventions increased to 6,079. The average number of documented pharmacist interventions per month increased from 148 (range 114 to 178) to 1,216 (range 708 to 1,422).

Conclusion: The decentralized pharmacist program contributed to increased documentation of nursing adherence to heparin dosing nomogram including shift checks, double checks, and heparin drip rate adjustments. Audits resulted in similar monitoring outcomes before and after decentralization. This program resulted in expanded pharmacist monitoring as shown by the remarkable increase in documented interventions. Incorporation of the decentralized pharmacists into the anticoagulation monitoring program has demonstrated consistent quality while improving the documentation of both nursing and pharmacists.

5-032

Category: Cardiology / Anticoagulation

Title: Post-operative venous thromboembolism (VTE) chemoprophylaxis after cardiac surgery: a single-center prospective study

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Purpose: Venous thromboembolism (VTE) and pulmonary embolism (PE) are known complications of cardiac surgery. The reported postoperative incidence of pulmonary embolism in cardiac surgical patients has ranged widely from 0.75 to 10%, and the reported incidence of DVT has ranged from 0.7 to 48%. VTE and PE are associated with increased morbidity, length of stay, utilization costs, and mortality. Extrapolated data suggests that VTE in this population may result in up to 1,300 avoidable deaths on an annual basis. Consensus guidelines support the use of VTE chemoprophylaxis for post-operative cardiac surgery patients. Despite this knowledge, concern over bleeding-related complications has limited the adoption of standard VTE prophylaxis protocols at many institutions. Our review of the published literature suggests that a combination of mechanical and pharmacological prophylaxis is the most effective method available in clinical practice for prevention of VTE. Our objective was to evaluate the safety and efficacy of implementation of a standardized protocol incorporating mechanical and pharmacologic VTE prophylaxis to reduce the incidence of VTE/PE in our large community cardiac surgery program.

Methods: A multidisciplinary team, consisting of a data manager, a critical care nurse specialist, a clinical pharmacist, and a pulmonary/critical care specialist, organized a task force to review available literature on VTE chemoprophylaxis in cardiac surgical patients and design an evidence-based protocol to be adopted at our institution for all CABG, CABG+ valve, and valve surgery patients. We prospectively followed patients to determine the incidence of VTE/PE, bleeding complications, HIT, readmission rates for VTE/PE, and other postoperative morbidity and mortality, using data from the University Health System Consortium (UHC) database. Our evidence-based VTE protocol included mechanical prophylaxis using intermittent pneumatic compression devices (IPCs) and pharmacologic prophylaxis using Heparin 5000 units SQ BID starting post-operative day 1 for all patients meeting inclusion criteria. This protocol was approved by the cardiac surgeons at our institution. Surgeon clinical judgment was allowed to supersede the protocol on a case-by-case basis for patients deemed high risk for bleeding complications. VTE prophylaxis was continued throughout inpatient and rehabilitation stay until the day of discharge home. Our protocol was instituted February 2011. Pre-protocol data from January 2010 through January

2011 served as a historical control group (Group I) and was compared to patient data after protocol adoption from February 2011 through April 2011 (Group II).

Results: Group I comprised 1217 patients, and Group II comprised 285 patients. In Group I, the average incidence of VTE/PE was 1%. The 30-day readmission rate was 11.4%. Readmission secondary to VTE/PE was 6%. The postoperative re-exploration rate for bleeding for Group I was 6.4% and the incidence of HIT was 1.5%. In Group II, there has been 1 case (0.4 %) of post-operative VTE since the institution of our protocol. There have been 42 readmissions, with 2 cases (5%) of DVT and 1 case (2.3%) of PE. The rate of re-exploration for bleeding is 7.2% in Group II, with an incidence of HIT of 0.9%. The difference in readmission rates between the two groups was not statistically significant ($p = 0.12$ by Chi-square test). The difference in re-exploration rate was also not statistically significant $p = 0.56$ by chi square test.

Conclusion: Our preliminary retrospective data analysis suggests that VTE prophylaxis consisting of a dual strategy of using mechanical and pharmacologic agents appears to be safe and effective in reducing the incidence of post-operative DVT/PE. The incidence of post-operative re-bleeding and HIT have not significantly increased since the institution of our protocol. Data on the reduction in readmission rates associated with VTE is trending in a postive direction. To date the institution of our protocol is safe and effective.

5-033

Category: Cardiology / Anticoagulation

Title: Assessing venous thromboembolism (VTE) prophylaxis in post-operative vascular and general surgery patients

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Purpose: The primary purpose of this study was to assess the appropriateness of providers' prescribing of post-operative VTE prophylaxis in patients undergoing vascular and general surgery as compared to current American College of Chest Physician (ACCP) guidelines. Secondarily, this study evaluated how many VTE events occurred within 30 days after surgery and assessed whether those events were associated with inappropriate prescribing of VTE prophylaxis. Lastly, this study determined whether better compliance with VTE prophylaxis guidelines was attained at this institution in this study or the study done in the previous year.

Methods: Retrospective analysis of VTE prophylaxis was conducted in 291 patients who underwent general or vascular surgery between July 1, 2010 and December 31, 2010. This study was approved by the institutional review board.

Results: Twenty-nine vascular surgery patients and 65 general surgery patients met inclusion criteria and were analyzed in this study. Seventeen vascular surgery patients (59 percent) and 31 general surgery patients (48 percent) received appropriate VTE prophylaxis (as compared to 33 percent and 47 percent from the 2009 VTE study, respectively). None of the patients indicated to receive extended, 28 day post discharge anticoagulation actually received it. Three patients (3 percent) developed a VTE within 30 days of their surgical procedure as compared to twelve patients (6 percent) in the previous 2009 VTE study.

Conclusion: More vascular surgery patients received appropriate VTE prophylaxis in this year's VTE study as compared to the 2009 VTE study. The amount of appropriate VTE prophylaxis in general surgery patients was comparable between this year's VTE study and the prior VTE study. Less VTE events occurred in this year's study, with no apparent correlation to inappropriate prophylaxis. Lastly, patients undergoing cancer surgery or those with a history of VTE did not receive appropriate extended duration prophylaxis post discharge.

5-034

Category: Cardiology / Anticoagulation

Title: Impact of dabigatran on a hospital pharmacist-managed anticoagulation service

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Purpose: Since the introduction of dabigatran to the anticoagulation arena, there have been concerns related to the pharmacoeconomics of this new medication. These concerns have been with regard to patient drug costs, as well as volume and reimbursement effects on anticoagulation clinics. For hospitals with inpatient anticoagulation services, the concerns have mostly centered around pharmacist resources and direct drug costs. In addition, questions have arisen about the safety of dabigatran in atrial fibrillation patients as the RE-LY trial demonstrated an increase in gastrointestinal bleeding. The purpose of this review is to describe the impact of dabigatran on an inpatient, pharmacist-managed anticoagulation service.

Methods: Patients receiving dabigatran between December 2010 and May 2011 with an indication for anticoagulation of atrial fibrillation were screened for inclusion in this retrospective review. Patients with mitral or aortic valves, or other non-FDA approved indications were excluded from the analysis. Dabigatran patients were matched with warfarin patients during the same time period using a random number generation table to select from a database containing all warfarin atrial fibrillation patients. Information was collected on patients including age, gender, indication of anticoagulation, drug interactions, length of stay, doses and duration of anticoagulant dispensed, laboratory markers of bleeding or recorded bleeding, interruptions in therapy, international normalized ratio for warfarin patients, creatinine clearance for dabigatran patients, and pharmacist therapeutic interventions. The institutional review board waived the need for informed consent.

Results: A total of 55 dabigatran patients were identified during the study period; 53 of these patients met inclusion criteria (mean age 73.4 years) and were matched to 53 warfarin patients (mean age 74.7 years). In the dabigatran group, 28.3% of patients were initiated on dabigatran prior to admission, with 22.6% of dabigatran patients previously receiving warfarin. The need for pharmacist interventions were similar between the dabigatran (13) and warfarin (14) groups; however, the dabigatran patients required pharmacist dose adjustments in 8 patients. Bleeding events occurred more often in the dabigatran group with 1 minor and 1 major event, with no bleeding events reported in the warfarin group. In the warfarin group, 25 patients required heparin bridging, with a mean duration in this subgroup of 3.52 days of heparin therapy. The length of stay was shorter in the dabigatran group, 3.9 days, versus the warfarin group, 4.9 days. Overall, the total cost of anticoagulation therapy was different

between the dabigatran and warfarin groups, with the average cost of therapy in the dabigatran group of $36.00 per patient as compared to $86.98 per patient in the warfarin group.

Conclusion: Although there is a significant difference in the acquisition cost of dabigatran compared to warfarin, dabigatran is associated with a lower total cost to use the agent, and was associated with a shorter length of stay. The length of stay difference may be partially explained by the need for heparin bridging in warfarin patients. Despite the lack of daily lab monitoring, it remains important for pharmacists to actively follow dabigatran patients to monitor for correctness of dose based upon renal function, identify drug interactions, and otherwise minimize bleeding risk.

5-035

Category: Cardiology / Anticoagulation

Title: Heparin Protocol: The Impact of Computerized Order Processing and Evaluation of Monitoring Parameters

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Purpose: Heparin is on the list of the top 5 drugs reported as a medication error and causing patient harm. To reduce the risk of errors and patient harm The Joint Commission requires the use of approved protocols for the initiation and maintenance of anticoagulation therapy. The Valley Hospital has utilized standardized heparin protocols for over ten years, however when revising the protocol based on the recent American College of Cardiology (ACC) guidelines the tandem development of computerized heparin order processing presented many unique challenges. The revised heparin protocol reduced the dose of the low dose protocol based on the ACC guideline and added the choice of no bolus for initial and subsequent dosing. At the time the protocol was approved the use of computerized provider order entry (CPOE) was rapidly expanding. The objective of this study was to evaluate the safety and efficacy of using (CPOE) when ordering the heparin protocol and evaluate the clinical target monitoring parameters for the protocol.

Methods: All patients on heparin for greater than 24 hours were included in the study. All aPTT values for these patients were collected for the first twenty four hours and compared to the protocol requirements and target monitoring parameters. Anecdotal variances from the protocol other than aPTT values were also collected and reviewed.

Results: As per the protocol, an aPTT should be ordered at baseline then every 6 hours until the aPTT is therapeutic. Results demonstrated baseline aPTT and subsequent results were not consistently ordered showing a break in policy. A revision of the CPOE ordering process was completed to address this problem. The clinical target for patients on the heparin weight dose protocol is to reach a therapeutic aPTT within 24 hours. Patients receiving the high or low dose protocol with bolus reached a therapeutic aPTT within 24 hours, but in both groups more than 50% of the patients had at least one supratherpeutic level. The no initial bolus group had fewer patients reach the therapeutic target within 24 hours, but a higher percentage were in the therapeutic range at 24hours with only 9% of patients having at least one supratherapeutic aPTT. Anecdotal problems included variance in nursing documentation and dosing verification.

Conclusion: Computerization of the heparin protocol requires multiple components including laboratory orders, medication orders and nursing directions. The implementation of this process can result in unexpected breaks in policy potentially leading to an increased risk of error. Utilization of a

multidisciplinary approach and continuous monitoring helps identify and resolve potential problems, providing a safe processing system. The use of a low dose no initial bolus protocol results in fewer supratherapeutic aPTT levels in the first 24 hours possibly leading to a reduced risk of bleeding.

5-036

Category: Cardiology / Anticoagulation

Title: Evaluation of the adequacy of dosage of antithrombotic therapy in acute coronary syndrome in a general hospital: First step in a multidisciplanry program for reducing risk of bleeding

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Purpose: Bleeding events in patients with acute coronary syndrome (ACS) have become as important a target as the prevention of ischemic events. A main side effect is the need to discontinue antithrombotic therapy, which can lead to increased ischemic risk by a rebound mechanism. There are several independent predictors of bleeding, such as advanced age, female sex, history of renal failure, percutaneous coronary intervention, use of glycoprotein IIb/IIIa receptor inhibitors but also excessive drug doses. The purpose of this study is to characterize antithrombotic therapy prescribing practices in patients with an ACS, based on dosing recommendations provided by clinical guidelines and to identify areas of improvement.

Methods: A retrospective chart review was performed in all patients hospitalized between January and July 2010 at an academic teaching hospital. Inclusion criteria were: patients older or equal to 18 years of age, diagnosed with non-ST-segment elevation myocardial infarction (NSTEMI) or ST-segment elevation myocardial infarction (STEMI) and treated with antithrombotic drugs during their hospitalization. The exclusion criteria were: patients less than 18 years old, pregnant or breastfeeding. A database was designed to record patient demographics as well as information necessary for evaluation of antithrombotic drug use, such as age, sex, weight, risk factors for developing bleeding events, loading dose, maintenance dose and duration of antithrombotic agents prescribed from the ACS onset. Evidence based guidelines from the American Heart Association and the European Society of Cardiology were used to determine whether the dose was the optimal one for each patient. The study was approved by the Regional Ethics Committee for Clinical Research.

Results: 330 patients were included. The median age was 69 (57-79) years old and 73.3% male. 56.9% of patients suffered from NSTEMI, 31.5% from STEMI and 12.1% from an unclassifiable ACS. 36.8% had suffered from a previous ACS, 3.3% of patients had had a previous bleeding event, 6.4% had chronic renal failure and 80.3% underwent percutaneous coronary intervention. 57.3% of patients were treated with enoxaparin, 57.0% with unfractionated heparin (UFH) and 20.0% with abciximab. Only 43.9% of patients were weighed during hospitalization. The antithrombotic therapy was judged as not optimal in 130 patients (39.4%), due to overdose. An excess dose was administered to 79 patients (24.0%) treated

with enoxaparin, 63 (19.1%) treated with UFH and 10 (3.0%) treated with abciximab. The most common causes of overdose were: - 17.6% of patients suffered from NSTEMI and were treated with a loading dose of UFH greater than 4000 U.I. - 5.8% suffered from NSTEMI and had been treated with a loading dose of 30 mg i.v of enoxaparin (This use has not been approved by the European Medicines Agency). - 3.0% of patients received an overdose of abciximab because, instead of using body weight, a standard dose was administered. - 1.5% were treated with a continuous IV infusion of UFH greater than 1000 U.I. per hour.

Conclusion: We identified opportunities to improve the use of antithrombotic therapy in ACS in our institution. In a high proportion of patients the dose prescribed exceeded the recommended one. Designing multidisciplinary interventions is imperative to improve healthcare quality and safety. Such interventions could include the implementation of under-bed weighing systems, and the development of a Clinical Decision Support tool in the computerized prescription order entry which would guide the clinician in the selection of the correct dose of the antithrombotic drug.

5-037

Category: Cardiology / Anticoagulation

Title: Pharmacist **impact on discharge medication reconciliation in heart failure patients**

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Purpose: Pharmacist participation in discharge medication reconciliation reduces medication discrepancies and preventable adverse drug events and pharmacist involvement in the care of heart failure patients improves outcomes. However, the impact of pharmacist involvement in discharge medication reconciliation of heart failure patients is unknown, and assessing this was the purpose of our study.

Methods: The institutional review board approved this retrospective, quasi-experimental cohort study. This study evaluated a random sampling of three groups of heart failure patients identified from the quality core measure database and pharmacist discharge medication reconciliation data. The institution includes patients in the quality core measure database if they have a primary diagnosis code of heart failure. The three groups were 1) a control group from the core measure database, 2) pharmacist intervention group from the core measure database, and 3) a pharmacist intervention group not included in the core measure database, but had a secondary diagnosis of heart failure. Control group patients were discharged one year before pharmacist-assisted discharge medication reconciliation began. The pharmacist intervention groups included patients discharged during the first year of pharmacist-assisted discharge medication reconciliation from November 2009 to October 2010. Patients admitted with comfort cares only, a history of heart transplant, a left ventricular assisted device, participation in a clinical trial, and a length of stay greater than 120 days were excluded. A pharmacy-specific discharge medication reconciliation form was utilized to collect the number of home and discharge medications, ejection fraction (EF) < 40%, and number of medication discrepancies at discharge. The core measure database was used to determine patient fallouts pertaining to medication discharge instructions (HF-1), use of angiotensin converting enzyme inhibitor or angiotensin receptor blocker for EF < 40% (HF-3), and post-discharge hospital and emergency room visits to any institutions within the hospital health system. The primary objective of the study was to compare the number and type of medication discrepancies found at discharge between the three groups. The secondary objectives were to evaluate the number of HF-1 and HF-3 fallouts among the two groups included in the core measure database and evaluate 30-day readmission rates and 72-hour post-discharge emergency room visits among all patient groups.

Results: A total of 300 heart failure patients were evaluated, with 100 patients in each study group. Staff clinical pharmacists identified 0.9 + 1.2 medication discrepancies at discharge for the intervention group and 1.5 + 2.7 discrepancies at discharge for the intervention, non-core measure group (p=0.034 for intervention, non-core measure versus intervention group). The investigators identified 1.8 + 2.3 (p= 0.001 compared to intervention group) medication discrepancies at discharge in the control group. The most common discrepancies found were incorrect drug frequency, incorrect dose or incomplete discharge instructions. Despite the reduction of discharge medication errors due to the pharmacist intervention, there was no significant reduction in HF-1 fallouts in the pharmacist intervention group compared to the control group (8 versus 11, p=0.315) and there were no HF-3 fallouts for either group. There was no difference in 30-day readmission or 72-hour post-discharge emergency room visits between the control group and both intervention groups.

Conclusion: Pharmacist review of discharge medication reconciliation reduced discharge medication discrepancies. We saw fewer core measure fallouts related to medication discharge instructions in our pharmacist intervention group but our results were not statistically significant. Pharmacist involvement in discharge medication reconciliation of heart failure patients is beneficial; however, further studies are needed to determine their effect on readmission rates.

5-038

Category: Cardiology / Anticoagulation

Title: Evaluation of fondaparinux for the treatment of heparin-induced thrombocytopenia

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Purpose: To evaluate the clinical outcomes of fondaparinux therapy in patients with heparin-induced thrombocytopenia

Methods: The Beth Israel Deaconess Medical Center Institutional Review Board (IRB) approved this evaluation prior to initiation. Pharmacy and hospital databases were used to identify patients who received fondaparinux for a minimum of 24 hours between January 2005 and January 2011. Data collection included patient demographics, admitting diagnosis, admitting medical or surgical service, comorbidities associated with elevated intrinsic coagulant activity (malignancy, hepatic diseases), recent surgical procedures, previous anticoagulant treatment, baseline platelet count, INR, hematocrit, hemoglobin, serum creatinine and calculated creatinine clearance(CLcr), and results of platelet-factor 4 (PF4)-Heparin dependent antibody and serotonin release assay (SRA)tests. Medical charts and medication administration records were reviewed for dose and duration of fondaparinux therapy, time to platelet count recovery (i.e. Platelet count >100,000 mm3, or return to patient baseline), day of warfarin initiation, warfarin doses administered, duration of dual fondaparinux and warfarin therapy, and incidence of recurrent venous thromboembolism (VTE) and major bleeding.

Results: Thirteen patients were identified and evaluated. Mean age was 63 years old and 57% were female, and the mean CLcr was 72mL/min. The most common admitting services were surgical, followed by medical. PF4 Antibody and SRA testing were performed in all patients. Fondaparinux was consistently dosed at 7.5mg once daily, and the mean duration of therapy was 6 days. Patients were transitioned to warfarin, with therapy usually beginning on day 2. There were no cases of thrombotic complications, recurrent VTE, or major bleeding.

Conclusion: Fondaparinux was safe and effective in the management of heparin-induced thrombocytopenia. Further studies with larger patient populations are needed to confirm these findings.

5-039

Category: Cardiology / Anticoagulation

Title: Evaluation of gastrointestinal prophylaxis usage in veterans receiving clopidogrel in response to FDA communications

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Purpose: Patients receiving dual antiplatelet therapy (DAPT) with clopidogrel and aspirin (ASA) are at a high risk of upper gastrointestinal bleeding (UGIB). Therefore, guidelines recommend proton pump inhibitors (PPIs) over other classes of drugs including histamine2 receptor antagonists (H2RAs) for GI prophylaxis in patients taking clopidogrel and ASA. There is growing yet controversial concern that PPIs may decrease the effectiveness of clopidogrel and increase the risk of adverse cardiovascular (CV) events. The U.S. Food and Drug Administration (FDA) released two communications in January and November of 2009 addressing the potential PPI-clopidogrel interaction. The purpose of this study was to characterize the choice of GI prophylaxis used in patients at Jesse Brown VA Medical Center receiving clopidogrel for acute coronary syndromes (ACS) and/or percutaneous coronary interventions (PCI) before and after the FDA communications.

Methods: The study was conducted in compliance with the IRB/Human Subjects Research Committee requirements and was a retrospective, electronic chart review of veteran patients aged 18 years and older, who had an approved clopidogrel consult at JBVAMC for 12 months or longer during one of two enrollment periods: January 25, 2007 to January 25, 2008 and July 15, 2009 to April 15, 2010. Criteria for exclusion were three-fold: (1) clopidogrel approvals for less than 12 months, (2) non-cardiac clopidogrel approvals, and (3) lack of documentation. Primary endpoints were the percent (%) change in the choice of GI prophylaxis and PPIs used between the two groups and the % change in the choice of GI prophylaxis and PPIs used within group two before and after the November 2009 FDA communication. Secondary endpoints included major adverse cardiovascular events (MACE), UGIB, and the change in GI prophylaxis in patients from group one receiving indefinite clopidogrel therapy and concurrent omeprazole after both FDA communications.

Results: The usage of PPIs as GI prophylaxis in patients receiving clopidogrel for ACS and/or PCI at JBVAMC decreased significantly by 33%, while the usage of H2RAs increased by 36%. Omeprazole remained the most used PPI for GI prophylaxis at JBVAMC. The occurrence of MACE was marginally higher in patients enrolled before the release of early FDA communication. There was no significant difference in the occurrence of UGIB between the two groups before and after the release of early FDA communication.

Conclusion: The usage pattern of GI prophylaxis in patients receiving clopidogrel for ACS and/or PCI at JBVAMC was influenced by FDA communications. Greater change was noted after the release of the first FDA communication in January 2009 compared with the second communication. Further prospective head-to-head trials are needed to investigate the impact of different GI prophylaxis on clopidogrel efficacy in patients with major UGIB risk factors.

5-040

Category: Cardiology / Anticoagulation

Title: Implementation of an annual anticoagulation education and competency assessment for medical residents, pharmacists, and nurses

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Purpose: Anticoagulation therapy is considered a high alert category of medications by the Institute for Safe Medication Practices. Warfarin, unfractionated heparin, low molecular weight heparin, direct thrombin inhibitors, and factor Xa inhibitors are associated with significant patient harm if they are used or administered incorrectly. One of the Joint Commission's National Patient Safety Goals is to reduce the likelihood of patient harm associated with the use of anticoagulant therapy. Providing education to providers and staff is an element of performance for the goal. This project was designed to implement an annual anticoagulation education and competency assessment for all medical residents, pharmacists, and nursing staff.

Methods: Two Internal Medicine Pharmacists developed computer-based education modules and multiple choice competency assessments. One module and assessment was developed for nursing staff and a second was developed for medical residents and pharmacists. The modules covered topics such as indication for use, mechanism of action, dosing regimens, monitoring parameters, standardized hospital protocols, medication safety, and medication administration techniques. The module for physicians and pharmacists was also presented live over sixty minutes during the medical residents morning conference. A computer-based competency assessment consisting of ten to fifteen questions was required at the end of the module. A score of eighty percent was required to pass the competency.

Results: Three hundred and eighty-seven individual nurses completed the education module and assessment. Two hundred and thirty-six nurses (sixty-one percent) passed the assessment on the first attempt. Forty-nine medical residents and sixteen pharmacists completed the module and passed the assessment.

Conclusion: A computer-based review of anticoagulant medications with an associated competency assessment is an effective method to provide annual education to medical staff. Pharmacists play an integral role in the implementation of annual education.

5-041

Category: Cardiology / Anticoagulation

Title: Implementation of a pharmacist-monitored heparin protocol

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Purpose: Hospital performance improvement auditors identified several problems with patients receiving continuous intravenous heparin therapy during quality assurance surveys. The problems identified included inappropriate dose adjustments, omitted documentation and subsequent timing of activated partial thromboplastin time (aPTT) ordered for patients receiving intravenous heparin therapy. In an effort to improve anticoagulation patient safety practices, pharmacy-monitored heparin weight-based protocols were implemented at Cleveland Clinic Florida in May 2010. The pharmacy-monitored heparin protocol allows the pharmacist to direct heparin dose adjustments and order the subsequent aPTTs following a weight-based protocol to achieve therapeutic goals. Our objective was to evaluate whether adherence would improve with pharmacy-monitored heparin weight-based protocols in reaching timely therapeutic aPTT values to prevent thromboembolism, and whether there was an efficacy and safety benefit in regards to major bleeds with such improvement.

Methods: A retrospective chart review was performed to evaluate the outcomes before and after the implementation of pharmacy-monitored heparin weight-based protocols from January 2009 to May 2010, and June 2010 to March 2011 at CCF, respectively. A total of 52 patients were included for evaluation. Times to therapeutic aPTT, percentage of therapeutic aPTTs, length of stay and bleeding rates were assessed.

Results: The mean time to achieve a therapeutic aPTT decreased from 44.3 hours to 12.5 hours ($p< 0.001$). Of the measured aPTT values, percentage of therapeutic aPTTs increased from 34% to 49% ($p=0.007$) and supratherapeutic values decreased from 22% to 13% ($p=0.036$). The number of aPTT tests per patient decreased by 50% ($p=0.0012$). Length of stay was not significantly changed between groups (15.7 vs 15.1, $p=0.867$). Five patients had evidence of a bleed surrounding heparin therapy before protocol.

Conclusion: Improved outcomes were attributed to improvement in overall adherence to pharmacy-monitored heparin weight-based protocols. Multidisciplinary healthcare teams of physicians, nurses, laboratory technician and pharmacy-monitored heparin weight-based protocols have a profound effect on improving overall efficacy and safety in patients requiring heparin therapy.

5-042

Category: Cardiology / Anticoagulation

Title: Evaluation of treatment strategies for prevention of venous thromboembolism in elective orthopedic surgery at a tertiary academic medical center

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Purpose: Venous thromboembolism (VTE) is a prevalent adverse event in postoperative orthopedic surgery patients. Both the American Academy of Orthopedic Surgeons (AAOS) and the American College of Chest Physicians (ACCP) recommend low molecular weight heparins (LMWH) or vitamin K antagonists (VKA). However, only AAOS recognizes aspirin as an option for VTE prophylaxis. The purpose of this study was to evaluate different treatment strategies for VTE prophylaxis following orthopedic surgery at our institution.

Methods: This retrospective study was approved by the pharmacy peer review committee and the institutional review board. Chart review was performed on consecutive subjects who had elective total knee and total hip replacement surgery from January 1, 2010 to June 30, 2010 and received pharmacologic VTE prophylaxis. Warfarin dose adjusted to an international normalized ratio (INR) goal of 1.5 to 2.5 (warfarin group 1) was compared to warfarin dose adjusted to an INR goal of 1.8 to 2.3 (warfarin group 2), LMWH, and aspirin. Data was collected for 30 days starting on the day of procedure. All patients on chronic anticoagulation for any indication were excluded. The primary outcome measured was the composite endpoint of VTE, stroke, and transient ischemic attack (TIA). Secondary outcomes included major and minor bleeding, time to target INR range, and percentage of critical INR values, defined as less than 1.5 or greater than 4. Fishers exact testing was used to evaluate the primary outcome.

Results: Out of 511 subjects evaluated, 49 patients were excluded because they were on chronic anticoagulation. Rates of the primary outcomes were 1.6 percent in warfarin group 1 and 1.4 percent in warfarin group 2 (p equals 0.31). There were no primary outcome events in the LMWH or aspirin groups. Rates of bleeding were 4.2 percent in warfarin group 1, 4.7 percent in warfarin group 2 (p equals 0.19), 20 percent in the LMWH arm (p equals 0.07), and 4.2 percent in the aspirin arm (p equals 0.29). Patients in warfarin group 1 achieved time to target INR range 2.9 days sooner than those in warfarin group 2 (95 percent confidence interval, 1.5 to 4.3, p <0.001). Subjects experienced a 0.9 percent lower rate of critical INR values in warfarin group 2 compared to warfarin group 1 (p equals 0.83).

Conclusion: There was no difference in the incidence of VTE, stroke, or TIA events in any of the treatment strategies. Although not significant, a tighter INR range led to similar outcomes and lower rates of critical INR values. However, the time to target INR range was significantly decreased in warfarin group 1 compared to warfarin group 2. There was no statistically significant difference in bleeding events among treatment strategies, although, there was a high rate of bleeding in the LMWH arm.

5-043

Category: Cardiology / Anticoagulation

Title: Assessment of therapeutic goals for unfractionated heparin before and after change from non-weight-based to weight-based protocols in a physician group practice hospital

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Purpose: Clinical outcomes are improved in patients receiving intravenous unfractionated heparin (UFH) when therapeutic levels of activated partial thromboplastin time (aPTT) are achieved within 24 hours and maintained, and use of standardized heparin dosing protocols have been shown to be an effective way to achieve this goal. The purpose of this study was to monitor and compare the efficiency at reaching therapeutic goals before and after hospital-wide conversion to use of weight-based heparin protocols.

Methods: A multidisciplinary group planned and implemented the use of weight-based heparin dosing protocols for inpatients in April 2009. Heparin dosing and laboratory results were monitored prospectively for all patients treated with therapeutic doses of intravenous UFH for a 30 day period prior to implementation during which non weight based protocols were used (February 2009) and for a 30 day period two months after implementation of weight-based protocols (June 2009). Heparin dose, time to reach aPTT of 1.5-2.5 times mean control, percent of patients therapeutic at 24 hours, and dose to achieve therapeutic goals were calculated. A subsequent analysis of a 30 day period was performed after weight based heparin protocols had been implemented for 21 months (January 2011). The IRB approved presentation of aggregate results as an exempt quality improvement study.

Results: 148 patients received non weight-based heparin protocol dosing and 134 received weight-based dosing. The non weight-based group had a mean time to therapeutic aPTT of 31.1 hours compared to 17.0 hours in the weight-based group ($p = .0001$). In the non weight-based group, 34.5 percent of patients were in therapeutic range, 11.8 percent supratherapeutic and 53.6 percent subtherapeutic at 24 hours compared to the weight-based group in which 65 percent were in the therapeutic range, 20 percent supratherapeutic, and 15 percent subtherapeutic. For patients treated for acute venous thromboembolism, mean time to therapeutic range was 33.2 hours in the non weight-based group and 12.9 hours in the weight-based group. Mean heparin dose required to achieve therapeutic range in the weight-based group was 14.5 units/kilogram/hour overall and 16.4 units/kilogram/hour in patients with venous thromboembolism. An analysis of 85 patients performed 21 months after weight based heparin protocols had been implemented had a mean time to therapeutic aPTT of 20 hours with 65 percent in the therapeutic range, 20 percent in the supratherapeutic range,

and 15 percent in the subtherapeutic range at 24 hours. For patients treated for acute venous thromboembolism, mean time to therapeutic range was 18.4 hours.

Conclusion: Implementation of weight-based heparin dosing was shown to reduce time to achieve adequate anticoagulation compared to a non weight-based protocol.

5-044

Category: Cardiology / Anticoagulation

Title: A retrospective evaluation of patient self testing compared with laboratory testing of patients in an anticoagulation management service at a tertiary academic medical center

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Purpose: Patient self testing (PST) of the international normalized ratio (INR) may improve time in therapeutic range (TTR) and decrease adverse events, such as thrombosis and bleeding, in patients on warfarin therapy. We performed a retrospective evaluation to determine whether patients who use PST achieve a greater TTR and experience less thrombotic and bleeding events compared with testing in a laboratory setting.

Methods: This retrospective analysis was approved by the pharmacy peer review committee and the institutional review board. We collected data from January 2004 to May 2011. Patients served as their own self control and were included if they were enrolled in our institution's anticoagulation management service and used PST to monitor their INRs. Patients were excluded if they had antiphospholipid antibody syndrome, tested at a laboratory for less than 3 months prior to PST implementation, or had laboratory INR to PST INR correlation of greater than 0.4. The primary outcomes measured were TTR and occurrence of thromboembolic complications, defined as venous thromboembolism (VTE), stroke, or arterial embolism. Secondary outcomes were number of critical INRs, defined as less than or equal to 1.5 or greater than or equal to 4, and minor or major bleeding, defined by the Italian Study on Complications of Anticoagulant Therapy parameters, and hospital or emergency department (ED) visits. Outcomes were evaluated using the paired student t test and McNemars test as applicable.

Results: One hundred and thirteen patients were included in our analysis. With PST, patients maintained an average TTR of 73.9 percent, which provided an improvement of 10 percent compared to laboratory testing (95 percent CI, 0.1 percent to 19.9 percent, p less than 0.05). Patients experienced 3 VTE events with PST compared to 9 with laboratory testing (p equals 0.15). PST led to a 5 percent decrease in critical INRs compared to laboratory testing (p less than 0.05). There were 16 minor bleeding events in the PST period and 33 in the laboratory period (p equals 0.58). One major bleeding event was observed in the PST period compared to 8 in the laboratory period (p equals 0.05). There were 16 hospital and ED visits in the PST period and 37 in the laboratory period (p less than 0.05).

Conclusion: PST significantly improved TTR and was associated with fewer thromboembolic complications. PST was associated with significantly decreased rates of critical INRs. Although the difference in the number of minor bleeding events was not significant, we observed significant differences in the number of major bleeding events and number of hospital and ED visits.

5-045

Category: Cardiology / Anticoagulation

Title: Implementation of a novel bivalirudin aliquot process to minimize surplus and promote cost savings

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Purpose: Bivalirudin is the most commonly used anticoagulant during percutaneous coronary intervention (PCI) procedures at our institution. Currently, bivalirudin is supplied from the manufacturer as a single-use, 250mg vial. Using FDA-approved adult doses and infusion durations for bivalirudin, institutions with short procedure times may have a significant volume of drug remaining at the end of each case. Using stability data from the manufacturer, we implemented a process in which the contents of each reconstituted and diluted vial would be divided into two equivalent aliquots using aseptic technique in a laminar flow hood. The objective of this study was to quantify the amount of bivalirudin remaining at the end of the case before and after implementation of this novel aliquot process and to calculate potential annualized cost savings.

Methods: Adult patients receiving bivalirudin during PCI in May 2010 were identified retrospectively. Baseline demographics were obtained for all study patients. The initial bolus of bivalirudin and the infusion rate and duration were collected in order to calculate the total number of milliliters required to complete each case. Surplus bivalirudin was calculated as the difference between the initial admixture volume (50mL) and the number of milliliters required for the intervention. The cost of each milliliter of bivalirudin excess was calculated by dividing the average wholesale price (AWP) of a bivalirudin vial by the number of milliliters each vial provides once reconstituted and diluted. Based on the average amount of bivalirudin used per case in May 2010, an aliquot size of 25 milliliters was chosen. In November 2010, the new aliquot process was implemented. Baseline demographics and doses for all adult patients receiving bivalirudin were collected as described above. Patients were excluded if they did not receive the aliquot. The primary endpoint was to compare bivalirudin excess before and after implementation of the new aliquot process. The secondary endpoint was to assess potential annualized cost savings realized with the aliquot. Descriptive statistics were used to assess baseline variables. Students t-tests analyzed continuous data. If the normality test failed, a Mann-Whitney Rank Sum Test was used.

Results: Baseline demographics were similar between pre- and post-aliquot treatment groups. There were no significant differences in patient weight, initial bivalirudin bolus doses or infusion rates or durations. After implementation of the novel aliquot process, there was a statistically significant reduction in the amount of bivalirudin remaining at the end of the PCI procedure. The median excess of

bivalirudin in the pre-aliquot cohort was 24mL, while median excess in the post-aliquot group was 18mL. This translated to a potential savings of approximately 85 dollars per case. Based on current PCI volume and bivalirudin usage, the potential annualized cost savings may exceed 150,000 dollars.

Conclusion: Use of bivalirudin aliquots significantly reduced the quantity of bivalirudin remaining at the end of the procedure and may represent a potential opportunity for cost savings.

5-046

Category: Cardiology / Anticoagulation

Title: A comparison of past and current data on the effects of implementing a heparin anti-factor Xa protocol and how a change in heparin potency has affected these results

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Purpose: Heparin works by directly inhibiting factor Xa and inactivating thrombin, or factor IIa. Until recently activated thromboplastin time (aPTT) has been the standard laboratory test to monitor the anticoagulation of patients. In recent years, the reagents and instruments used to measure aPTT have changed and there is significant variability between individual patients and institutions. The anti-factor Xa level is a more effective way of standardizing and measuring the anticoagulation of a patient. On September 1, 2009 our institution converted from using the aPTT to an anti-factor Xa level to monitor patients being anticoagulated with heparin. Subsequently, in response to the 2007/2008 heparin contamination problem, there was a new USP reference standard and test method implemented to determine the purity and potency of current heparin products being manufactured that old methods were not able to detect. In October 2009, the FDA released a public health alert that warned of a decrease in the potency of heparin by as much as ten percent. It is unclear how the decrease in potency will affect the current heparin monitoring and doses used. We will be analyzing and comparing the outcomes of patients on an unfractionated heparin infusion before and after the decrease in heparin potency was implemented.

Methods: The retrospective electronic chart review was approved by the hospitals institutional review board. Data was collected for all inpatients prescribed a heparin infusion from September 22nd 2009 to October 5th and June 23rd to July 7, 2010. Dates were randomly selected but included patients that received both formulations of heparin. Data collected included sub-therapeutic and supra-therapeutic anti-factor Xa levels in the first 24 hours, and critical first anti-factor Xa levels (>1). The study also looked at the initial rate of the unfractionated heparin infusion, and what the average rate was per patient. In addition, baseline hemoglobin and hematocrit, bleeding based on if dropping hemoglobin levels by 5g/dL, 4g/dL, 3g/dL or positive fecal occult blood, and death from the unfractionated heparin infusion was evaluated. Data was collected for patients receiving both formulations of heparin and were compared.

Results: A total of fifty-six patients were reviewed in the pre-potency change group. Fifty patients were reviewed in the lower potency heparin group. Sixty-seven percent of patients in the pre-potency change group had a supratherapeutic anti-factor Xa level in the first 24 hours after drip initiation compared to 55 percent in the lower potency group. There was a decrease in the average heparin drip rate between

the pre-heparin potency change group and the post heparin potency change group (15.5 units/kg/hr vs. 14 units/kg/hr). This appears to be an appropriate decrease in heparin potency of about 10 percent. The number of patients that had a critical anti-factor Xa level (greater than 1) decreased from 43 percent in the pre-potency change group to 25 percent in the post heparin potency change group. There was a decrease in the total number of positive fecal occult blood tests between the pre-potency change group compared to the post potency change group (12% vs 4%) although there were no clinically significant diffences in hemoglobin levels between the two groups. There were no deaths in either study group.

Conclusion: In conclusion, changes in the manufacturing of heparin do appear to have effects on lab data and the associated dosing of the infusion. Critical values decreased in the low potency group, however, 55 percent of patients still had anti-factor Xa levels greater than 1 in the first 24 hours. This suggests that perhaps bolus doses or the inital infusion rate on our heparin protocol is too high. While it is unclear of what the clinical significance of these differences are, it is important to note that these differences should not go ignored. While this study looked at heparin infusions, it would be logical to assume that these differences would also be seen in bolus doses and prophylactic doses of unfractionated heparin. Areas that frequently use heparin infusions or give heparin during procedures should be aware of this change and watch for any adverse effects that could be associated with under dosing a patient with heparin.

5-047

Category: Cardiology / Anticoagulation

Title: Development of an Institutional Cost of Care Model for Anticoagulation Management of Patients with Warfarin versus Novel Oral Anticoagulants

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Purpose: The antithrombotic service (AS) at our large, urban, tertiary health system (Thomas Jefferson University Hospitals; TJUH) encompasses a multi-disciplinary team of clinical pharmacy specialists, nurse practitioners and physicians. Recent challenges our practitioners have faced include increased accountability for performance, an increased need for fiscal responsibility, and an institutional focus on improved transitions of patient care. The advent of a novel oral antithrombotic, with more new agents in the FDA approval pipeline, has challenged the institution to examine its AS practices to improve the efficiency of the discharge process and insure seamless transitions in care from the inpatient to outpatient setting. The purpose of this project was to develop an economic model to estimate the resources, time and cost required to educate and coordinate discharge for patients receiving the current antithrombotic standard of care, warfarin +/- a heparin product, such as subcutaneously administered low molecular weight heparin (LMWH). Secondarily, we then adapted the model to predict the potential impact of a hypothetical new oral anticoagulant which requires less counseling than warfarin. We focused the project on inpatients receiving anticoagulation via the AS.

Methods: Data for the model were obtained from 2010 TJUH aggregate metrics on AS resource requirements: patient volume, major diagnosis categories (for example, orthopedic surgery, atrial fibrillation), and resource requirements (time and cost of personnel involved in providing antithrombotic discharge counseling, as well as the time and cost of management, including INR-related discharge delays). Resource requirements were coded as inputs in a MS Excel model in order to estimate the potential time and cost impact of changes in anticoagulation patient volume, changes in the personnel providing counseling, or addition of novel oral anticoagulants to the formulary. It was assumed that 80% of warfarin patients would receive novel antithrombotic, and that these drugs would reduce discharge counseling time by 70%, and would not require INR testing. The cost per day of the new anticoagulant was assumed to be $7 vs. $0.82 for warfarin, and the bed of discharged patients was assumed to be refilled with a new patient 100% of the time at a reimbursement rate of $1500/day.

Results: Results are presented as the financial and time impact of the warfarin discharge process per 1000 anticoagulation patients with an average LOS of 4 days. Efficiency impacts of the new oral agent

were estimated as follows: 4000 hours through avoidance of INR-related delays, 400 hours through elimination of delays caused by the AS team not arriving to the patient in a timely manner, 284 hours in reduced AS time to administer discharge counseling. The estimated total number of patient days saved by introduction of the new oral anticoagulant was 142 per year, translating to $213,000 in revenue opportunity by improving the efficiency of the discharge process. The additional annual drug cost to the facility for oral anticoagulants was estimated to be $19,776 assuming prices remained constant.

Conclusion: Anticoagulation discharge counseling is a team effort requiring extensive time and institutional investment. The financial model allows TJUH to quantify the opportunity of improved discharge efficiency for patients receiving warfarin monotherapy or a regimen consisting of warfarin with a LMWH. The potential impact of new oral antithrombotic on personnel and facility resources can be tested by modifying model inputs to account for the counseling and monitoring requirements, the acquisition costs of these new drugs in comparison to currently utilized agents, as well as the percentage of patients eligible for management. Further validation of the model using additional data will enhance the value of this tool to administrators.

5-048

Category: Cardiology / Anticoagulation

Title: Pharmacoeconomic evaluation of dabigatran compared to warfarin for stroke prophylaxis in atrial fibrillation

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Purpose: Atrial fibrillation (AF) is the second most common form of sustained arrhythmia and presents with a variety of complications. Affecting 2.3 million Americans, the incidence of AF increases with age to 10% of adults over 80 years of age and accounts for 105,000 strokes annually. The $57.9 billion resulting from AF each year1 is expected to increase as the baby boomer generation ages. AF as a source of thromboembolic events, particularly stroke, combined with its growing prevalence, is associated with excess mortality. The current standard of care warfarin, a vitamin K antagonist, has long been used to prevent the incidence of thromboembolic events; however, it is associated with monitoring burdens and a high risk of bleeding events. Although the recently developed direct thrombin inhibitor dabigatran etexilate (Pradaxa) is more expensive than generic warfarin, we hypothesize that its use in stroke prevention in patients with atrial fibrillation is still more cost-effective due to its clinical benefits. What dabigatran lacks in generic availability and pricing, it recovers in lack of mandatory monitoring, fewer major adverse events, and superior stroke prevention. To evaluate length of stay in patients admitted to a community teaching hospital with a primary diagnosis of atrial fibrillation when treated with dabigatran etexilate compared to warfarin sodium.

Methods: Observed and expected length of stay in patients admitted to Morristown Medical Center with a primary diagnosis of atrial fibrillation and medically managed with either warfarin or dabigatran during the first quarter of 2011 was obtained from the University Healthsystem Consortium (UHC) database. Patients were grouped according treatment with either dabigatran or warfarin and mean length of stay and standard deviation were calculated for each group. Length of stay outliers, as defined by UHC, were excluded. Statistical analysis was done using the chi-square fit test and t-test. Secondary analysis was done to estimate possible cost avoidance due to reduced length of stay when patients are treated with dabigatran compared to warfarin

Results: Eighteen patients admitted with a primary diagnosis of atrial fibrillation received dabigatran compared to 88 patients who received warfarin from January 1, 2011 through March 31, 2011. The mean LOS for the patients receiving dabigatran was 2.93 days + 1.77 days. The mean LOS for patients receiving warfarin was 3.73 + 2.37 days, resulting in a mean difference in LOS of 0.80 days. Our

calculated Yates chi square was 0.063 and t-test P-value was 0.12. The average total cost per day for patients on a telemetry unit at Morristown Medical Center is $957. An estimated cost-avoidance of $766 per patient was calculated based on reduced length of stay seen in patients receiving dabigatran compared to warfarin. Based on first quarter data, an estimated annual cost-avoidance of $269,632 due to decreased hospital days, may be possible by treating patients with dabigatran compared to warfarin in patients admitted with a primary diagnosis of atrial fibrillation..

Conclusion: The use of dabigatran compared to warfarin in patients with a primary diagnosis of atrial fibrillation may reduce patient length of stay. Although utilization of dabigatran may increase direct cost drug expenditure compared to warfarin, total hospital cost-avoidance can be realized when using dabigatran based on reduced length of stay.

5-049

Category: Cardiology / Anticoagulation

Title: Analysis of the effect of intravenous labetalol continuous infusions on systemic blood pressure in critically ill hypertensive patients

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Purpose: Labetalol is a treatment option used to emergently reduce blood pressure in patients with severe hypertension. Labetalol can accumulate in patients administered intravenous continuous infusions (CI) due to its approximate five-hour half-life. Labetalol CI can be detrimental if the patient develops severe hypotension during the infusion. Hypotensive effects can occur hours after infusions are discontinued due to the continued blood pressure lowering effects. Abrupt discontinuation of labetalol CI secondary to hypotension may lead to increased patient care resources utilized, which may include intravenous fluids and/or vasopressor support. Case reports and six small studies have described life-threatening hypotension, bradycardia, or discontinuation of labetalol CI due to rapidly declining blood pressure requiring emergent treatment to reverse these adverse effects.

Methods: A retrospective evaluation of severely hypertensive patients receiving labetalol CI was conducted after institutional review board approval. Included patients were admitted to the medical or cardiovascular intensive care units over a 19-month period. Patients were identified through a retrospective analysis of electronic medical records and had a medication order for labetalol continuous infusion. The primary outcomes evaluated were the incidence of hypotension associated with labetalol continuous infusions and the incidence of discontinuation secondary to hypotension associated with labetalol continuous infusions. Secondary outcomes assessed were: duration of labetalol continuous infusion, hypotensive treatments, if required, and the associated length of stay increase due to the adverse reaction.

Results: Thirty-seven patients received labetalol CI during the study period. Nine patients were excluded due to other beta-blocker use. Twenty-eight patients were included for analysis. The average systolic blood pressure (SBP) and diastolic blood pressure after 1 hour of treatment dropped to 144/79 mmHg, respectively, representing a 21% drop. Thirty-one percent of patients had a SBP decline of greater than 25% within the first hour. Upon discontinuation of treatment, 52% of patients had a SBP less than goal. SBP was less than 100 mmHg upon discontinuation of treatment in 28% of patients. The average dose of labetalol used was 1575 mg. Forty-eight percent of patients used less than 500 mg, or less than one institutional standard bag, the average dose used in these patients was 248 mg. Sixty-five percent of patients received labetalol CI for less than 12 hours with 82 % of patients receiving therapy for 24 hours or less. One patient required a 500 mL bolus of normal saline, secondary to hypotension, 10 minutes

after the discontinuation of labetalol CI. No patients required the use of vasopressors after the discontinuation of labetalol.

Conclusion: Labetalol continuous infusions were associated with significant detrimental declines in blood pressure in 31% of patients and were discontinued in approximately 66-82 % of patients prior to achieving steady-state effects. Labetalol CI is not an optimal dosing strategy for critically ill patients with severe hypertension due to the potential for hypotensive end organ ischemia and life-threatening hypotension.

5-050

Category: Cardiology / Anticoagulation

Title: Cost-Effectiveness Analysis of Implantable Cardioverter Defibrillator compared to Ventricular Tachycardia Ablation in Population with Left Ventricular Ejection Fraction less than .30 and History of Myocardial Infarction

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Purpose: Evaluate the cost-effectiveness of ICD compared to ventricular tachycardia ablation (VTA) in population with depressed left ventricular ejection fraction (LVEF) and history of myocardial infarction (MI) Background: The major risks associated with coronary disease are angina, acute myocardial infarction, depressed left ventricular ejection fraction and congestive heart failure, and sudden arrhythmogenic cardiac death. During the past three decades, considerable advances have been made in the management of patients with coronary heart disease with beta blockers, calcium-channel blockers, angiotensin converting-enzyme (ACE) inhibitors, angiotensin receptor blockers, thrombolytics, balloon-stent angioplasty, and coronary artery bypass graft surgery. The clinical course of patients with coronary disease has been meaningfully improved by these therapies, but sudden cardiac death remains a major problem and has not been impacted by these therapeutic interventions.

Methods: A model was built using Decision Maker. The model compares two choices: (1) ICD and (2) EPS + possible VTA. The probabilities of the different side effects were taken from literature. Different death rates were considered for post-VTA patients with and without long-term side effects (strokes or heart attacks), and for post-ICD patients with appropriate shocks, inappropriate shocks, and no shocks at all. Cross-over between both treatments was allowed and modeled based on published data. All costs and utilities were taken from published literature. A Markov model was used to track the costs and utilities of patients. The study is based in the whole patient life after the treatment is made, that is, all utilities and costs will be considered until the death of the patient. Due to the lack of data with more than 8 years of patient follow-up, some assumptions were made in order to forecast the death rates of patients in each category after 8 years of treatment. The study was made considering that the age of the patient when the initial treatment was made was 50 years.

Results: The overall cost of ICD ($176,000) is less than half the cost of the EPS+VTA alternative ($426,000). In addition, the ICD treatment achieves an average of 17.51 QUALYs while the EPS+VTA treatment achieves only 16.66 QUALYs

Conclusion: The ICD treatment is dominant over the EPS+VTA treatment for the population considered in this study (50-year old patients with LVEF less than .30 and history of MI).

5-051

Category: Cardiology / Anticoagulation

Title: Optimizing weight-based heparin protocol therapy: Post NPSG 3E (NPSG 03.05.01) implementation

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Purpose: In 2008, The Joint Commission implemented National Patient Safety Goal 03.05.01 to reduce the likelihood of harm associated with the use of anticoagulation therapy. A key element of performance of this goal is that hospitals use approved protocols for the initiation and maintenance of anticoagulant therapy. Harris County Hospital District (HCHD) established heparin weight-based protocol in 2005 with nurses are the primary drivers however compliance was still a working progress as there were discrepancies in protocol adherence which continued to impact ADEs rates. The purpose of this program was to improve patient outcomes by optimizing the use of established protocol; educate healthcare providers on protocol compliance; and identify and reduce costs associated with non-compliance to protocol.

Methods: Prospective data was collected from patients charts over a 9-month period. In this time frame, 316 patients were reviewed. Inclusion criteria was patients who the weight-based heparin protocol was used. All other heparin orders were excluded. The data was collected and analyzed for form completion and accuracy including weights, laboratory draw frequency and pertinent laboratory parameter monitoring

Results: The following discrepancies were found in order of frequency: incorrectly filled protocol form; wrong dosing weight; unnecessary heparin drip order; inappropriate lab draw time (frequency); unnecessary/unordered PT/INR; and wrong heparin protocol form (version 2005 vs version 2009). Based on these discoveries, immediate interventions were implemented. The former version of the heparin weight-based protocol forms (version 2005) were removed from all units and was removed from the reorder list with the Forms department. Nurses, physicians and pharmacists were in-serviced along with memos and flyers addressing this issue were placed in strategic locations throughout the hospital. The estimated cost savings associated with the reduction of unnecessary PT/INR labs, veno-puncture related infections, and adverse drug events are approximated to have saved the county approximately $300,000.

Conclusion: This program was worthwhile and needs to be revisited annually to re-evaluate opportunities for improvement.

5-052

Category: Cardiology / Anticoagulation

Title: Evaluation of Warfarin Education Prior to Hospital Discharge

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Purpose: The Joint Commission Elements of Performance to reduce harm associated with anticoagulation includes provisions for warfarin education. Effective January 2011, this includes providing warfarin education highlighting the importance of monitoring, adherence, drug-food interactions, and the potential for adverse drug reactions. The purpose of this evaluation is to determine the effectiveness of current hospital practices on warfarin education and the ability of inpatients to successfully recall key safety information regarding warfarin prior to hospital discharge. Current practice includes an automatic patient warfarin education handout printed upon the first administered dose of warfarin which is reviewed with the patient by a nursing or pharmacy representative.

Methods: Over a 3 month period, any inpatient who was receiving warfarin was evaluated. If the patient was newly initiated on warfarin during the current hospitalization, the patient was interviewed by a clinical pharmacist or pharmacy student using a predefined set of literacy appropriate questions based on a 6th grade reading comprehension level. Each patient was asked six questions regarding warfarin: indication, how to monitor for side effects (signs or symptoms of bleeding), what effect diet has on treatment, duration, goal INR level, and time to follow-up (to determine efficacy). Patients who were interviewed the day before or the day of discharge were included in the evaluation.

Results: A total of 41 patients newly started on warfarin were interviewed using the warfarin education assessment questionnaire. The most common indication for warfarin was prevention of venous thromboembolism following joint replacement surgery (58.5% or 24/41) followed by treatment of deep venous thrombosis or pulmonary embolism (29% or 12/41), atrial fibrillation (7% or 3/41), and cardiovascular disease (5% or 2/41). Most patients (80%) were interviewed the day of discharge. Out of 41 patients, only 12% or 5/41 were able to accurately recall and answer all 6 questions. Appropriate indication was stated 22% (9/41) of the time. The ability to identify monitoring parameters for bleeding, duration of therapy, and goal INR was 15% (6/41) for each of the 3 questions. Most patients were able to state that vitamin k foods interfere with the effect of warfarin (70% or 29/41). During the interview process, the pharmacist identified drug related problems in 22% (9/41) of patients that were unknown to the inpatient team. These included drug interactions (herbals, vitamins) and missing home medications while inpatient and on the discharge summary. Patients were also asked permission to be contacted by a pharmacist or pharmacy student over the phone within 7 days of discharge to verify that a follow-up INR was obtained. Out of 20 patients contacted, 10 patients were able to be reached. Two

patients did not have a follow-up INR checked after being discharged for 7 days including one patient who failed to make a follow-up appointment with their primary care giver. After discussing with the pharmacist, both patients had a follow-up INR drawn within the next 2 days.

Conclusion: The current practice around warfarin education during the first dose of warfarin administration is not adequate. Warfarin education review around the time of discharge may better prepare patients to be safely discharged on warfarin and have the ability to recall important facts regarding warfarin therapy. Additional follow-up at home and/or immediately post-discharge would only enhance warfarin-related knowledge.

5-053

Category: Clinical Service Management

Title: Implementation and impact of an inpatient pharmacist and physician co-managed anticoagulation service

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Purpose: Anticoagulants are commonly used for the prevention and treatment of venous thromboembolism and are high risk medications that require careful dosing and monitoring. National Patient Safety Goal 03.05.01 was implemented by the Joint Commission to reduce patient harm associated with the use of anticoagulant therapy. An inpatient anticoagulation co-management service was established at Overlook Medical Center to promote the safe and effective management of warfarin therapy.

Methods: Clinical pharmacists collaborated with a hospitalist group to manage patients on warfarin who met eligibility criteria for the warfarin co-management protocol. A comprehensive evidence based protocol was developed which included the purpose and goals of the service, the responsibilities of the physician and pharmacist, and evidence based practices for management of warfarin therapy. The Pharmacy and Therapeutics and Medical Executive Committees approved implementation of the warfarin co-management service.

Results: The warfarin co-management service was implemented in May 2011 and is a continuous pharmacy service that is maintained seven days a week. All clinical pharmacists have been trained to manage this service. The physicians order the initial dose of warfarin along with baseline laboratory values. Subsequent doses of warfarin are ordered by the pharmacist using evidence based dosing guidelines. Pharmacists continue to manage the patients daily and directly communicate with the physicians when indicated. On a daily basis pharmacists document notes in the consult section, write progress notes, and order daily warfarin doses and labs.

Conclusion: This evidence based inpatient warfarin co-management service has increased pharmacist involvement with direct patient care in the management of warfarin therapy. Patient care has been optimized by the interventions that pharmacists have made and positive feedback has been received regarding the warfarin co-management service.

5-054

Category: Clinical Service Management

Title: Use of oral doxercalciferol in place of intravenous therapy for secondary hyperparathyroidism at a 140 patient urban out patient dialysis unit

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Purpose: Treatment of secondary hyperparathyroidism is a common indication for use of injectable doxercalciferol at our institution. Previously, our institution used injectable doxercalciferol exclusively for treatment of secondary hyperparathyroidism. Oral doxercalciferol is also FDA approved to treat secondary hyperparathyroidism though oral doxercalciferol is not widely utilized to treat secondary hyperparathyroidism in dialysis. Recently, reimbursement for out patient dialysis treatment has changed to a bundled method of payment encouraging exploration of more cost effective strategies. Our institution is a disproportionate share hospital (DSH) which participates in Public Health Service (PHS) contracts. Oral doxercalciferol can be purchased at nominal pricing versus the injectable form on PHS contracts. Additionally, by administering via the oral route one point of possible intravenous complications is removed.

Methods: The dialysis unit doxercalciferol protocol was updated to incorporate the differences in bioavailability of the oral product (42%) versus the injectable (100%) with each injectable doxercalciferol 1 mcg dose replaced with an oral dose of 2.5 mcg. Response to doxercalciferol therapy is monitored quarterly via measurement of intact parathyroid hormone (PTH) levels. The target PTH level for a patient receiving dialysis is 130-580 pg/ml corresponding to Renal Association guidelines

Results: The updated doxercalciferol / intact parathyroid hormone protocol utilizing oral doxercalciferol was instituted on Feb 1, 2011. A minimal difference in the percentage of patients having intact parathyroid hormone levels between 130-580 pg/dl was observed between the pre-intervention period (55%) and the post intervention period (51%). Additionally, cost savings by the institution were realized. Previous to the doxercalciferol intervention, cost per dialysis treatment for injectable doxercalciferol treatment was more than $8.00 per dialysis treatment and after the intervention the cost per oral doxercalciferol treatment was less than $1.00 per dialysis treatment. There were no reports of serious adverse effects and doses were well tolerated

Conclusion: Oral doxercalciferol was a viable therapeutic option for the treatment of secondary hyperparathyroidism at our institution. Oral doxercalciferol can yield significant savings to DSH hospitals that participate in the PHS program.

5-055

Category: Clinical Service Management

Title: Implementation of an oral inhaler therapeutic interchange and common canister program in a multi hospital health care system

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Purpose: Respiratory medications are the single greatest expense in the treatment of hospitalized chronic obstructive pulmonary disease patients. In this four hospital acute care system, annual expenditures for oral inhalers were greater than one million dollars. The goal of this initiative was to reduce respiratory medication expenditures by instituting an oral inhaler therapeutic interchange and common canister program.

Methods: A multi-disciplinary committee, which included pulmonologists, hospital medical directors, hospitalists, pharmacy, respiratory, and quality management, was formed to develop a therapeutic interchange and common canister program. An analysis of total expenditures, cost per puff, cost per day, and cost per admission was performed. Equivalent dosing charts were developed and approved by the physicians. If the product was available in both a metered dose inhaler and a dry powder inhaler, the metered dose inhaler product was utilized. A charge per puff billing structure was instituted. Based on using, whenever possible, metered dose inhalers, 100 percent compliance with the therapeutic interchange, and an estimated fifty percent compliance with common canister, a projected cost savings analysis was performed. A respiratory department policy was written to outline the process for common canister. The proposed therapeutic interchange and common canister program were approved by the System Pharmacy and Therapeutics Committee. In order to facilitate utilization of the formulary inhalers and to reinforce best practice, a COPD physician order set was developed.

Results: After implementation of the therapeutic interchange and the common canister program, oral inhaler expenditures have been reduced by 50 percent for the hospital system. Respiratory therapists have the oral inhalers available on the nursing units thus eliminating the wait to obtain the inhaler from the pharmacy. The medical staff, nursing, respiratory therapy and pharmacy have been supportive of this initiative and agree that the process is working as planned.

Conclusion: The use of an oral inhaler therapeutic interchange in combination with a common canister program can significantly reduce the cost of treating patients with chronic obstructive pulmonary disease.

5-056

Category: Clinical Service Management

Title: Coordinating and standardizing similar residency rotation learning objectives and experiences across a multi-site integrated delivery system

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Purpose: One of the challenges in a large, integrated health-system is that residency preceptors at individual sites like to customize and develop their rotation based on their experience, expertise, and the opportunities available at the individual practice sites. This offers the resident learners a unique experience, but also poses some challenges. When the health system is accredited as one residency program, it is important to have a core element of consistency among similar rotations. Balancing this consistency with the individual preceptors creativity and uniqueness can be challenging. Our health-system consists of an accredited residency program based out of 4 large community teaching hospitals. A recent accreditation survey recommended more consistency in goals, experiences and responsibilities among similar rotations. We sought to accomplish this by establishing networks of pharmacists in similar practice areas across the system with rotation standardization as one of the initial role of these networks.

Methods: A proposal was submitted to the hospital directors of pharmacy and other stakeholders to initially approve the network structure and the time involved to participate in these meetings. A subgroup of the system-wide residency advisory committee (RAC) was tasked with developing a standard rotation syllabus template to be used during this process. We started with developing networks for the core rotation areas (ambulatory care, internal medicine, and pharmacy administration). Once this was accomplished, we started working on some of most common elective rotation areas (antibiotic stewardship, cardiology, critical care, and emergency department). For each area, there was a set of core elements in the rotation syllabus. This included the common residency learning system goals and objectives chosen for the rotation, rotation experiences that help demonstrate competency in that area, and required topic discussions. In addition, the goals and objectives taught and evaluated were compared across all the core and elective rotations evaluated.

Results: A standard rotation syllabus has been completed for our core rotation areas (ambulatory care, internal medicine, pharmacy administration). In addition, this has also been developed in the identified elective rotation areas (antibiotic stewardship, cardiology, critical care, and emergency department). These updates to the rotation syllabus and evaluations will be implemented in the 2011-2012 residency year. Additional common elective rotation areas are being evaluated for implementation this year as

well. While rotations must use the core elements of the rotation template, there is still flexibility beyond these for customizability by the preceptor after meeting the core element requirements. In addition, with standardization of the goals and objectives taught, this has allowed for better coordination across rotations and a decrease in the number of goals taught in each rotation to allow for better feedback.

Conclusion: Using networks of pharmacists across a system, it is possible to establish a common syllabus with includes core elements shared among similar rotations, while still allowing for preceptor flexibility. Addition benefits from this project include the sharing of best practices, both in clinical practice and rotational experiences. This will allow for more consistency in training of residents in a multi-hospital integrated delivery system.

5-057

Category: Clinical Service Management

Title: Utilizing students to provide tangible benefits to organizations, staff and students

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Purpose: Students are an integral part of the practice of pharmacy. The advanced practice experience (APPE) shows students how to apply their didactic education into practice and teaches them technical and administrative aspects of providing comprehensive pharmaceutical care and services in a health system. In todays tight market it may be difficult to divide time and resources between the varieties of pharmaceutical services that are required to maintain a robust clinical practice. Our solution for providing clinical surveillance and researching cost savings initiatives with limited resources was to incorporate students into the health systems quality improvement process.

Methods: Pharmacy representatives from each of four hospitals in our health system met to discuss potential projects for evaluation across the system. The group decided upon four projects involving medication-use evaluations focusing on clinical outcomes and/or operational process measures. Once data was collected it was analyzed to detect facility-specific or system-wide opportunities for improvement. Results were presented to administration for cost savings initiatives and to System Pharmacy &Therapeutics Committee to qualify clinical performance of pharmacist led protocols.

Results: The system-wide initiative successfully reviewed four student projects for the 2010-11 rotation year. These included evaluations for intravenous vancomycin dosing, enoxaparin dosing and monitoring, weight-based heparin infusion, and warfarin dosing. The vancomycin dosing evaluation assessed the percentage of vancomycin troughs outside the therapeutic target of 10-20 mg/L. Four institutions completed this project for a combined result of 26% of patients outside the target range. The incidence of nephrotoxicty was minimal. The enoxaparin project evaluated compliance with a collaborative drug therapy management (CDTM) agreement for the dosing and monitoring of enoxaparin. Results from four sites were compiled and 80% of patients receiving enoxaparin were dosed within agreement of the CDTM guidelines. This reflected both physician and pharmacist dosing which was found in varying degrees between hospitals. Additionally, usage data are being analyzed for a potential cost savings initiative. The heparin project evaluated utilization of two indication-based order sets. Among other results, students found that the correct order set was utilized 86% of the time and patients achieved therapeutic target within an average of 25.3 hours. The final project evaluated warfarin dosing at two health system entities. The primary result revealed that on average eight percent of hospitalized

patients on warfarin will have a supratherapeutic episode (INR 4) with current inpatient dosing strategies.

Conclusion: Utilizing students to participate in the development and analysis of clinical pharmacy services provides tangible benefits to organizations, staff and students. Organizations are privy to collated health system data that can be used to improve clinical services and identify cost savings initiatives. Staff are involved in quality precepting experiences without having to sacrifice daily patient care tasks. Students learn evidence-based approach to clinical pharmacy practice and are participating in meaningful quality improvement initiatives that impact an entire health system of patients.

5-058

Category: Clinical Service Management

Title: Implementation of collaborative drug therapy management in a tertiary academic medical center

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Purpose: The Commonwealth of Massachusetts (MA) recently promulgated regulations governing Collaborative Drug Therapy Management (CDTM). Collaborative practice will permit pharmacists to practice at the top of their licenses and further, enabling the pharmacy department to provide excellent pharmaceutical care in a cost-efficient manner. We aim to describe the steps taken in order to develop and implement a regulatory compliant CDTM policy in an outpatient hospital setting.

Methods: The regulations were promulgated by the MA Board of Medicine and MA Board of Pharmacy. The Brigham and Womens Hospital Pharmacy Department drafted a policy that authorizes appropriate credentialed pharmacists to practice CDTM with close review of the MA regulations. The policy establishes criteria for clinician credentials, subject matter expertise, quality review and other requirements for pharmacists and physicians to practice CDTM. Credentialed pharmacists will be allowed to practice as a mid-level practitioner without requiring physician co-signature on orders or prescriptions thought the CDTM policy. Once the hospitals regulatory compliant CDTM policy is in place, pharmacist and physician content experts can develop clinical protocols based upon the best medical evidence. Each clinical protocol directs all clinicians practicing under an approved protocol to develop quality metrics for assurance of appropriate practice.

Results: The draft CDTM policy was reviewed by the Office of General Counsel to assure regulatory compliance. Key pharmacy, nursing, and physician leaders gave input and edits to the draft protocol. The protocol will be reviewed and approved by the Pharmacy and Therapeutics Committee. Once the Pharmacy and Therapeutics Committee approves the policy, it will be brought to the hospitals committee structure that reviews all mid-level practitioner credentials. The policy will be amended based upon commentary received from each of the reviewing committees.

Conclusion: Development and implementation of a regulatory complaint CDTM policy in a hospital outpatient setting requires review by multiple stakeholders and hospital committees.

5-059

Category: Clinical Service Management

Title: Increasing IV to PO therapeutic interchanges through an unique collaboration

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Purpose: As finances become tighter, hospitals are being asked to do more with less, often finding unique solutions in order to work smarter. In an effort to increase interventions and cut costs at this large, tertiary care hospital, a program was developed to utilize both arms of the Department of Pharmacy: Pharmacy and Clinical Nutrition. Through this program, the dietitians help identify patients which may be eligible for automatic IV-to-PO therapeutic interchanges.

Methods: Using the computer order entry system, a report was developed to identify all patients that had received one of the ten drugs for which the hospital has approved automatic IV-to-PO therapeutic interchanges. Additionally, alvimopan was included in the report as part of an initiative to eliminate use after bowel function returned in bowel surgery patients. The report is printed daily and the dietitians identify patients with orders for diets and notify the pharmacy for further follow-up. Data on interventions has been collected since implementation in November 2010.

Results: : In the months prior to implementation, documented IV-to-PO interventions averaged 82.3 interventions per month. In the months since implementation, interventions have averaged 152.4 interventions per month, an increase of 84%. Additionally, the average number of doses decreased for alvimopan from 8 to 6 doses, accounting for approximately $40,000 in drug cost avoidance.

Conclusion: This unique collaboration between the pharmacy and dietitians has significantly improved IV-to-PO interventions which has led to increased cost avoidance. Additionally, the data can be used to show productivity for both groups, which is especially important given the current financial picture.

5-060

Category: Clinical Service Management

Title: Impact of a pharmacist-managed glycemic control service in post operative cardiac surgery patients

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Purpose: The prevention of post operative hyperglycemia in cardiac surgery patients has been demonstrated to improve surgical outcomes and reduce sternal wound infections. The national average for achievement of post operative morning blood glucose control (<200 mg/dL) is reported to be 93% by the Centers for Medicare and Medicaid Services (CMS). After reviewing existing glycemic control data for this population at PeaceHealth Southwest Medical Center (PHSW), areas for improvement were identified. The purpose of this project was to evaluate the outcomes associated with a pharmacist-run patient-centered glycemic control service for post operative cardiac surgery patients on national quality measures and continuity of diabetes care.

Methods: A multidisciplinary task force was established in October 2007 to develop a patient-centered glycemic control program for all post operative cardiac surgery patients. Under the supervision of an endocrinologist, a pre-printed order consisting of an insulin infusion algorithm, hypoglycemia treatment algorithm, and guidelines for transitioning from intravenous (IV) insulin to subcutaneous (SC) insulin were developed. The protocol allowed the pharmacist to formulate a patient-specific treatment plan for the duration of hospitalization. The pharmacists evaluated each patient to determine appropriate timing for transitioning to SC insulin based on HbA1C, insulin requirements, oral intake, and clinical status. In conjunction with the cardiac surgeon, the pharmacist and certified diabetes educator (CDE) were able to initiate and/or modify diabetes medications and facilitate appropriate discharge planning to ensure continuity of diabetes care. Blood glucose data and basic demographic information were maintained by the team and routinely reviewed by the task force to identify areas of improvement and outcomes of the program.

Results: Between January 2008 and December 2010, 679 patients underwent coronary artery bypass grafting and/or valve replacement and were managed by the glycemic control team pharmacists. Morning (6 AM) blood glucose measurements on post operative day 1 (POD1) and day 2 (POD2) were less than 200 mg/dL in 96.5% of patients (98.5% on POD1 and 97.9% on POD2). Of the 442 non-diabetic patients, 62% of them were transitioned to SC insulin on POD1 and 23% on POD2. Of the 237 patients with a pre-existing diagnosis of diabetes, 32% were transitioned to SC insulin on POD1 and 42% on

POD2. Of the 76 diabetic patients with HbA1C greater than or equal to 8%, 87% were maintained on IV insulin through POD2 or longer as per protocol guidelines. The incidence of hypoglycemia was also reviewed and found to be minimal, with 0.1% of all blood glucose measurements less than 40 mg/dL and 2% less than 70 mg/dL. Blood glucose measurements greater than 200 mg/dL were also reviewed and comprised 4.6% of all measurements obtained during the hospitalizations. Of all 679 patients, 14% required pharmacist intervention for modification of their home diabetes regimen based on comorbidities and glucose control prior to admission. An additional 6% of patients were initiated on diabetes-related medications as a result of a new diagnosis of diabetes. The CDE provided education to patients who required lifestyle modifications, glucose monitoring, and/or insulin teaching while hospitalized.

Conclusion: The impact of a pharmacist-run, patient-centered glycemic control service at PHSW exceeded the national average for cardiac surgery quality measures, maintained consistent glucose control throughout hospitalization, and improved continuity of care by providing diabetic education and modifications of diabetes-related medication regimens.

5-061

Category: Clinical Service Management

Title: Clinical pharmacy networks facilitate collaboration, identification and implementation of best practice, and enhance feedback and support of health system pharmacy initiatives

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Purpose: One of the challenges in a large, integrated health-system is ensuring that decentralized clinical pharmacists are given opportunities to collaborate with other practitioners who practice in their area of specialty. In addition to encouraging pharmacists to be engaged in local and national professional associations, the corporate clinical pharmacy manager and directors of pharmacy perceived a need to facilitate communication and collaboration among like practitioners across a twenty two hospital system. Additionally, feedback from an American Society of Health-System Pharmacists pharmacy practice residency accreditation visit focused on the need to create minimum rotation standards for like-rotations in each hospital.

Methods: A proposal was submitted to the hospital directors of pharmacy and other stakeholders to initially approve the network structure. For the initial clinical pharmacy networks identified, clinical pharmacists were nominated by their director of pharmacy for participation. Each clinical pharmacist was given a region or area in which they were to be the liaison between the clinical pharmacists and the network. Individual charters were drafted for each network that outlined the scope, accountability structure, goals, and membership. These charters were approved by the clinical pharmacists who were invited to the networks, and were forwarded to the administrative committee with oversight of these networks for approval. Directors of pharmacy were encouraged to establish annual goals around participation in the clinical pharmacy network with the network members.

Results: A total of seven clinical pharmacy networks were established in the clinical areas of internal medicine, critical care, cardiovascular care, ambulatory care, emergency medicine, investigational drug studies, and antimicrobial stewardship. These networks meet in person once quarterly, and engage in email dialogue on an ongoing basis. Since their inception, the networks have developed a standardized pharmacy practice residency rotation curriculum that highlights the residency goals that are required and optional for the rotation, the learning experiences that will address those goals, as well as a topic discussion agenda. The networks have been engaged in a number of practice development and medication utilization review projects including review of an outpatient hyperlipidemia management collaborative practice agreement, review of the use of factor VII/pro-thrombin complex concentrate, and standardization of the review process and fee structure for investigational drug studies.

Conclusion: Establishing a series of clinical pharmacy networks resulted in increased communication and discussion among practitioners across a large, integrated healthcare delivery system. Clinical pharmacy networks are a useful resource in a variety of quality improvement and medication-use initiatives.

5-062

Category: Clinical Service Management

Title: Impact of the pharmacy department on a re-engineered discharge pilot program targeting heart failure patients

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Purpose: Heart Failure presents a tremendous, multi-faceted burden for patients, providers, hospitals, health systems, and the nation as a whole. The challenge faced nationally impacts acute care institutions given the focus of Center for Medicare and Medicaid Services (CMS) on the acute hospitalization, notably, the specific interventions that are to occur, at minimum, during hospitalization and after. A core measure, with performance related to heart failure is published for public review. Although a chronic disease, the focus of this heart failure discussion is the peri-hospitalization period, and the time proximal to the admission, both prior to and subsequent to that admission, i.e., the transitions of care. Located in an inner-city, socioeconomically challenged area, this institution has been faced with growing numbers of patients hospitalized with heart failure. The decision to adopt the systemic approach to prevention of readmissions offered by Project RED was determined to be a valuable opportunity in the prevention of heart failure readmissions. Indeed, the premise of Project Red, which targeted heart failure diagnoses at this institution, was embraced by this 432 bed community teaching hospital. The core group of the committee which was convened to implement this pilot consisted of administration, key physicians, nurse leaders, a nursing disease management specialist, social workers, dietitians, and physical therapists, in addition to pharmacists. The department was asked to meet the minimum expectation of a post-discharge follow-up call to the patient. Additionally, the pharmacy department was requested to participate in medication history/reconciliation on admission and to provide patient medication education during hospitalization. Given the existing unpredictability of the patient discharge process, pharmacist medication reconciliation at discharge was deemed not feasible; however, pharmacists are retrospectively reconciling medications. Not specifically requested by the committee was focused pharmacy involvement in the management of inpatient heart failure medications. Given that the ideal discharge occurs with medications optimized during hospitalization, pharmacy committed to actively contribute to inpatient management of heart failure pharmacotherapy. Heart failure medication management was an area new to pharmacists at this institution; therefore, a plan for the attainment of pharmacist competency was formulated. A comprehensive learning module on heart failure, focusing on disease and management, was developed for pharmacists as a mandatory learning experience, with key case examples. This learning module was reinforced with several practice-based

tools to facilitate daily clinical functions, which included a dosing card (initial, titration, and optimal dose ranges, with adverse effects and exclusions to use) and cost information (with special attention to public assistance coverage and the self-pay patient). The purpose of this evaluation was to determine the extent of pharmacist contribution to medication management of heart failure pilot patients, spanning the transitions of care : prior to, during, and subsequent to admission.

Methods: Pharmacists completed the newly developed mandatory education / competency and were introduced to the institution-specific reference tools. Subsequent to the initiation of the Project Red pilot within the hospital, all Project RED patients were concurrently followed by a pharmacist. The pilot is ongoing; however, the data presented in this abstract spans February and March 2011. Not all heart failure patients were captured in the pilot; those not able to communicate effectively in English and those refusing to participate / be contacted after discharge were excluded. For each admission, Pharmacy was notified of the patient inclusion and a pharmacist reviewed the patient record; conducted medication histories and reconciled medications; provided recommendations on medication management and affected order changes on the inpatient side, if warranted. During the post-discharge phase, pharmacist involvement included the required post-discharge call and any actions necessary to address issues identified either in the phone call or in the retrospective medication reconciliation. The interventions were tracked and acted on concurrently. Prescribers and any other professionals were contacted as needed. The interventions completed during the hospitalization were broadly categorized to medication history/reconciliation; medication addition / selection; dose optimization; and other medication issues. On an outpatient basis, phone call discussions were broadly delineated to ensuring the patient is receiving the appropriate discharge medications at the correct dose, adequacy of medication availability, compliance, well being (stated symptoms). Physicians, some not associated directly with the institution were in some cases contacted for clarification and/or medication or dose changes. Also, given the frequency with which some issues arose, e.g., those parameters likely associated with a lower socioeconomic condition, other issues were then tabulated, e.g., lack of a valid phone number, disconnected phone, or inability to pay for prescriptions.

Results: Compared to the absence of specific heart failure-related interventions documented in the six months prior to pilot implementation, a substantial number of interventions were made on behalf of the heart failure pilot patients in the study months of February and March. Of the 23 admissions (20 patients) who were included in the pilot: one patient was readmitted for heart failure; the other two readmissions occurred for unrelated diagnoses. Medication history/reconciliation and education was done for all possible patients; three were missed given the timing of pharmacy notification and discharge. A subsequent phone call attempted to rectify any gaps in these three patients. Key interventions in the inpatient setting total 16 and include: initiation of an ACEI (1); re-initiation of either ACEI/ARB or beta-blockers as soon as feasible subsequent to a hold order (5); recommendation for dosing increase (3); identification of orders for excessive, either in terms of dose or shortened time period, dose escalation (2); suboptimal agent selection (use of carvedilol in two admissions with acute asthma exacerbation (2) and use of metoprolol tartrate vs. succinate (3)). Post discharge, other issues were noted as problems. Attempts were made to call all patients, however, this one not always possible: one phone was disconnected, one phone number was invalid and two patients did not pick up calls from

the hospital. Most other patients were called once or twice. If issues arose, more calls were required: 3 patients were called twice and one patient each required 5 and 6 calls, respectively. Missing medications presented some of the greatest challenges in all 3 instances since in these cases, the primary care physician was not hospital-based. During the CMS follow-up for the February to March patients, heart failure readmissions decreased substantially from the previous months, decreasing from a rate in excess of the DRG Readmission Rate to a rate below that.

Conclusion: A review of the literature reveals that most published reports, which cite benefits of pharmacists in the management of heart failure, encompass the ambulatory care setting exclusively, or at least the post-discharge period. This study, though limited in size, demonstrates that opportunities for optimization of therapy in an inpatient setting are extensive. Issues such as disconnected phones, invalid phone numbers, lack of finances to purchase medications are likely associated with the lower socioeconomic setting of this institution. These specific interventions, occurring post discharge, extensively consumed pharmacist time; however, they were extremely worthwhile in the critical need to maintain heart failure therapy post discharge. Additionally and especially since the disease is so dominated by medication management, the need for pharmacist involvement in evaluation of the medication regimen during hospitalization is vital to ensuring that the medication management is optimized at discharge. Further, pharmacist contributions to patient education are worthwhile. The documented efforts by pharmacists in this limited experience support the range of patient care a pharmacist can provide; notably this care is provided both in inpatient and in ambulatory care and in the transitions between the settings. The number of interventions by pharmacists after the pilot implementation was definitive. Although the study group is far too small to determine significance, it is noteworthy that during the CMS follow-up for the patients managed February through March, the heart failure readmissions decreased substantially to below the DRG Readmission Rate of 8 percent. In contrast, the readmission rates in previous months exceeded the DRG Readmission Rate. The numbers are inadequate to draw conclusions; however, it is likely that the interdisciplinary effort, including that of pharmacy, contributed to this decline, at least to some extent. Further study is needed, ideally encompassing the inpatient setting and, very importantly, the transitions of care.

5-063

Category: Clinical Service Management

Title: Pharmacy interns and the value of clinical pharmacy services

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Purpose: The University of Texas Harris County Psychiatric Center (UTHCPC) is a 250 bed teaching facility delivering comprehensive psychiatric services to more than 6,100 inpatient admissions each year. Patients are assigned to one of seventeen multidisciplinary treatment teams consisting of a psychiatrist, medical resident, registered nurse, and social worker. As of October 2008, the hospital has one full-time clinical pharmacist who maintains the elective six-week psychiatric pharmacy rotation. As a result, pharmacy interns are utilized to increase patient access to clinical pharmacy services.

Methods: Fourth year pharmacy interns serve on one of the multidisciplinary teams to perform comprehensive medication reviews, verbally communicate recommendations during rounds and provide drug information. Upon discharge, interns are responsible for medication reconciliation and discharge counseling on their patient care unit. Quantifi, a web-based software application was utilized to demonstrate the clinical and financial contributions of the pharmacists and pharmacy interns over a three-year period.

Results: From January to May 2008, pharmacists documented a total of 651 interventions saving the hospital $41,132.00. After the employment of the clinical pharmacist in October 2008, the total number of interventions increased to 1702 (2009) saving the facility $61,600 (2009) in the same five month period. Overall, the clinical pharmacist and pharmacy interns have saved the facility approximately $37, 460 over a three-year period

Conclusion: Pharmacy interns play an integral role in advancing clinical pharmacy services in psychiatric settings. In addition, students can improve patient outcomes, reduce expenses and facilitate in the documentation of value services.

5-064

Category: Clinical Service Management

Title: Improvement in medication turnaround time: a process improvement initiative

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Purpose: Timely administration of medication is a key quality measure for healthcare institutions, e.g., administration of anti-infectives subsequent to diagnosis of pneumonia (currently a core measure) and sepsis (in consideration). In fact, failure to ensure the timely administration of medication is termed a medication error and, in some cases, can be associated with serious adverse outcomes. Given the magnitude of impact on both patient safety and quality, examination of medication turnaround time provides a definitive measure of service, providing insight into the performance of the department. The purpose of this study was twofold: firstly, the objective was determination of a baseline medication turnaround time for STATS, to ensure that pharmacy was providing urgently needed medications in a time-appropriate manner, and secondly to determine whether a process improvement initiative could decrease turnaround time for such orders. Medication turnaround time can be defined as the interval from time of medication order composition (either on paper or on the electronic medical record) to the time of medication administration. Given that new technology had recently been implemented, including MedCarousel, the decision was made to focus primarily on the process steps occurring within the pharmacy so that the intra-pharmacy process be evaluated for streamlining and optimization at this 432 bed community teaching hospital.

Methods: The process involved in the disposition of a STAT order within the pharmacy was deconstructed. Four discrete steps in preparation and dispensing were identified: time elapsed for the printed label to be pulled by a pharmacy staff member; time required to process the label (either time in clean room or time in the main pharmacy); time elapsed awaiting pharmacist check; and time delay in sending the checked preparation to the unit. Based on the aforementioned steps, a time measurement tool was developed and tested for use in an observational, time motion study. Subsequent to the baseline evaluation of one weeks STATs March 2011, the data was reviewed, overall, then delineated on a daily basis, on a time of day basis, and on an overall workload basis. The data was used to identify potential barriers via analysis and then reconstruction of the elements of each of the 4 steps; also, the data was used to identify sources of dysfunctional patterns and variability in performance. Root causes were determined; also, a failure mode and effects analysis was performed. Pharmacy staff members were included in team discussions about potential improvements in process, thereby facilitating staff

commitment to the change. Barriers to improvement were identified and addressed, including difficulties in searching for and finding medications; involvement of unnecessary staff members; unnecessary hand-offs; underuse of the pneumatic tube system; and interruptions by phone and at the pharmacy window. Subsequent to a thorough process review, workflow was streamlined, incorporating change in the functions of key positions overall; explicit delineation of staff roles in the disposition of orders in general and STATs in specific was provided, in addition to definitions of communication standards and handoffs. Additionally, several key decisions were made on a management level, including technology optimization and the addition of more high-volume premixed intravenous solutions to routine stock. The turnaround time goals for STAT, now, and routine orders were redefined, for both the hospital and pharmacy staff; a new goal was set, based on benchmarking with best practice. Finally, education materials and posters were shared with staff.

Results: The follow-up evaluation, conducted over a span of a week in early June 2011, demonstrated substantial improvement; the average turnaround time for a medication entered as a STAT decreased from 36.9 to 21.5 minutes. Variability decreased greatly, from a turnaround time range of 14 to 50 minutes in the pre-study to a range of 14 to 27 minutes in the post study. The average turnaround times for each of the 4 identified and measured steps also declined, respectfully. Specifically, changes in the averages, for each of the 4 steps: time elapsed for the printed label to be pulled by a pharmacy staff member was reduced from 7:50 to 6:47 minutes; time required to process the label (either time in clean room or time in the main pharmacy) was reduced from 14:20 to 9:49 minutes; time elapsed awaiting pharmacist check was lowered from 5:20 minutes to 2:17 minutes; and lastly the time delay in sending the checked preparation to the unit was reduced from 7:59 minutes to 5:10 minutes. Consistently, for all parameters measured, variability decreased. Further, the times during the lunch hours, which were consistently longer, also decreased in both magnitude and variability. As is true of observation studies in general, the Hawthorne effect is potentially a confounder; however, the first measurement series was entirely unknown to staff and the second set was discretely conducted.

Conclusion: Although improvement in the turnaround time for STATs decreased by 41.7 percent; further improvement is warranted given the departments newly established goal for a maximum of 15 minute turnaround time for a STAT medication order. Most changes to the process, thus far, have been limited internally to the pharmacy and pharmacy staff. More enhancements within the pharmacy are planned, including further stock organization and additional technician workflow reorganization. Expanding changes beyond the department to address specific barriers to timely dispensing is also warranted. Changes external to the department which are being proposed to administration include organizing and solidifying a floor stock replacement system, cessation of OTC sales, and elimination of all non-pharmaceutical products from pharmacy stock. Optimized pharmaceutical care is provided, in part, through implementation and measurement of processes to ensure the efficient and timely functioning of pharmacy processes, including the dispensing of medications. The magnitude of improvement and the consistency of improvement across all processes has demonstrated the effectiveness of this pharmacy department process improvement initiative. The review, deconstruction, examination of each step and inter-relationships among steps, and reconstruction of the process resulted in a more efficient process. The marked decrease in variability across the board provides evidence of the soundness of the

processes. Given the success achieved, this process improvement technique will be utilized to yield further improvements in turnaround time and other quality initiatives.

5-065

Category: Drug Information

Title: Evaluation of the content of Arabic language consumer medication information (CMI) leaflets for three drugs

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Purpose: We conducted an evaluation of the information content of commercially available Consumer Medication Information (CMI) leaflets for three drugs written in Arabic to assess their scientific accuracy. The CMI for celecoxib, paroxetine, and lamotrigine published by a single vendor were assessed. These three drugs were chosen because of their potential for adverse drug reactions.

Methods: Scientifically accurate information was defined as meeting a set of explicit criteria derived from or consistent with the US Food and Drug Administrations (US FDA) approved professional product labels for these drugs. A similar methodology had been used in four large US studies assessing the quality, including the usefulness and scientific accuracy of commercially produced CMIs distributed in US pharmacies over the past decade. Information content evaluation forms were developed for each of the drugs based on their most current US FDA approved professional product labels. Explicit evaluation criteria for each drug were identified. The evaluation forms contained 37, 50, and 35 explicit criteria for celecoxib, paroxetine, and lamotrigine respectively. The criteria included information covering the drugs Black Box Warnings; contraindications; warnings and precautions; drug interactions; use during pregnancy and lactation; approved uses; and instructions for patients on recognizing potential adverse reactions and what steps to take should such reactions appear. The content evaluation for each form was performed by two experienced pharmacists whose first language is Arabic and who are also fluent in English.

Results: None of the Arabic language CMI leaflets met the study definition of scientifically accurate and therefore could not be considered as useful. The Arabic CMI for celecoxib, paroxetine, and lamotrigine were found to contain 30%, 24%, and 20% scientifically accurate information based on the study definition.

Conclusion: The Arabic language CMI leaflets for the three selected drugs produced by a single North American commercial drug information vendor failed to meet the study definition of useful and scientifically accurate. A larger study is being planned to include CMI leaflets produced by more vendors and to assess a larger number of drugs. At this time, we suggest that pharmacists in Arabic speaking countries or communities consider carefully the usefulness of commercially available CMI leaflets written in Arabic before distribution.

5-066

Category: Drug Information

Title: Development of a medication website portal for perioperative medication management services

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Purpose: To develop an intra-departmental website portal that provides Pre-Hospital Assessment Services (PHAS) with evidence-based medication guidelines during the perioperative period. Pre-hospital assessment services, a Wellspan department specializing in perioperative patient medication instruction, requested medication recommendations and education from the Pharmacy Department. The Preoperative Clinical Effectiveness Team, consisting of pharmacists, physicians, nurses and ancillary personnel, was established to standardize medication instruction across the Wellspan Health system. An evidence-based consistent approach for medication management was developed. These guidelines were used as the basis during both the educational process with PHAS and implementation of the website portal.

Methods: A literature search for "perioperative medication recommendations, polypharmacy and perioperative medications in the elderly, perioperative considerations with herbal products, drug interactions for the anesthesiologist, and perioperative management of the geriatric patient" revealed similar perioperative recommendations based on medication classifications. Medications were divided into review of systems categories, which were easily compartmentalized and applicable to nursing personnel. Common medication classifications were included utilizing both generic and brand names. Educational sessions were provided to PHAS clarifying medications to be continued or avoided perioperatively and to address general principles of perioperative medication management and challenges specific to the elderly population. Recommendations were also reviewed for an accurate patient medication history to include over the counter (OTC), herbal, and prescription medications and valid medication orders were reviewed, to include accurate medication name, dose, route and frequency. After providing presentations, the result was a need for uniform distribution of the recommendations. The necessary clearances were obtained and Information Services was contacted. PHAS' website portal was developed using the educational content from the presentations provided. The presentation was organized onto an Excel spreadsheet that included generic and brand name of the medication, medication class, review of systems classification and evidence-based recommendations which was then uploaded onto the newly developed PHAS portal. The website portal is searchable for specific medications which enhances its use for patient information. The portal is available throughout the Wellspan system enabling off site locations to obtain clear and consistent recommendations for perioperative medications.

Results: Prior to a patient's surgery, PHAS contacts the patient and reviews pertinent information such as: current medications, fall risk assessment and review-of-systems. During the interview process, the patient is instructed to continue or avoid medications prior to surgery. Through an intranet-based

protocol, Wellspan Health System has the ability to search for appropriate perioperative recommendations for medications, which has provided an evidence-based standard of care. Information provided on the website also includes a decision support tool for bridging anticoagulation during warfarin interruption and guidelines for warfarin reversal. Pre-hospital assessment services utilize medication information that is standardized and uniform across York Hospital inpatient and outpatient services.

Conclusion: The task of the pre-hospital assessment group is to ensure patient safety and continuity of care. Medications are one important aspect of the assessment performed by PHAS. Future development relates to including policy and procedure guidelines for perioperative management of patients and their medications on the website portal. The next goal is to expand the scope beyond perioperative medications to specific test recommendations. Standardization of patient recommendations is positive. A future study goal is to determine frequency of portal use, impact on patient care as a result of implementation and consistency of managing select medications pre and post portal implementation.

5-067

Category: Drug Information

Title: Guide for handling queries about incorrect storage of medicine

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Purpose: In 2010 approximately 25 per cent of all inquiries (equivalent to 196 questions) received by the Medicine Information Centre have been regarding storage and stability. The majority of these inquiries concern incorrect storage of expensive refrigerated medicines. To prevent the disposal of expensive medicines a guide has been developed to ensure high quality, consistent and systematic replies.

Methods: Inquiries regarding incorrect storage of medicines involve assessment of several factors.The guide is based on relevant literature studies, professional discussions with pharmacists and pharmacy technicians from The Medicine Information Centre and a representative from The Danish Medicines Agency.

Results: The guide is divided into three elements: 1. List of questions to ensure all relevant information is obtained when receiving an inquiry about incorrect storage. 2. Following references which are compulsory to consult: a. An internal department list. b. Summery of product characteristics. c. National question and answer database. The manufacturer is contacted if the above references are insufficient. 3. Lists with general points to remember for future storage and handling.

Conclusion: The guide ensures all relevant information is obtained to compile a professional pharmaceutical assessment and give a qualified and timely respons. The poster will display the guide.

5-068

Category: Drug Information

Title: Learning in a virtual world: drug dispensing practices in Second Life

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Purpose: 3D virtual worlds offer a number of unique pedagogic opportunities such as immersion, visualization, exploratory learning and training, networking and collaboration, co-Web browsing, education and entertainment, etc. This project was designed to implement and evaluate the use of a virtual world platform for learning in pharmaceutical practice through the development of an activity about the dispensation of anti-asthmatic agents. Second Life (SL) was chosen for the study due to the following features: this is the most widely used virtual world platform, there is no charge for accessing it, and there are several simulation sites where pharmacists and nursing or medical students can practice through virtual equipment, procedures, or lab results.

Methods: The experience was designed as an obligatory activity for the students of the subject called Clinical Pharmacy, which is offered in the 5th year of the Pharmacy Degree. The students (divided into groups of 8), through an Internet connection anywhere, met the instructor in a previously designed and built in Second Life dispensary. Clinical situations that may occur during the dispensation of anti-asthmatic agents were simulated for two hours. Then, an on-line survey aimed to evaluate the resolution of each proposed clinical case was completed by students. Such survey deals with the adaptation to the dispensing protocol, the drug information provided to patient and the pharmacist communications skills. An additional anonymous survey was also completed at the end of the session in order to assess the opinion students and instructors about this practice.

Results: 33 students completed the surveys from the 54 participants. The results of the study indicated that the students had no difficulty in adapting to the virtual platform. Although only one of them was familiar with SL, none of them devoted more than 2 hours to become trained before the practice. They reported a high degree of satisfaction (mean score 2.36 on a scale of 0-3). The assessment of professional skills revealed a high global performance of the group. The instructors encountered more difficulties in adapting themselves to the activity although they considered this an interesting experience able to open new possibilities in teaching and research areas.

Conclusion: The results of this project suggest that virtual worlds offer new possibilities for enhancing learning outcomes applied to all phases of pharmaceutical education. Virtual worlds can be used as learning spaces that simulate any kind of professional environment without its corresponding temporal and/or spatial limitations.

5-069

Category: Drug Information

Title: Comparison of Drug Information Curricula in Schools of Pharmacy with the Entry-level Competencies Needed for Pharmacy Practice in Hospitals and Health-Systems

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Purpose: The American Society of Health-System Pharmacy (ASHP) and Accreditation Council for Pharmacy Education (ACPE) Task Force developed a list of competencies during the American College of Clinical Pharmacy 2010 Annual Meeting that should be met by students at end of their didactic education. The list was designed in order to keep an up-to-date skill set as pharmacists now have increased roles in health care, i.e., collaboration with other healthcare professionals and providing direct patient care. The purpose of this study is to determine if current drug information curricula in schools of pharmacy prepares students for the entry-level competencies needed for pharmacy practice in hospitals and health-systems.

Methods: A survey was developed reflecting the four drug information skills noted in the Entry Level Competencies. The four drug information skills included: 1) Accessing appropriate tertiary resources and responding to drug information questions 2) Contributing to P&T at a student level 3) Knowledge of National Standards and the Medication Use Process and 4) Analyzing a recently published trial. Appropriate changes to the survey were made based on suggestions and comments from a peer reviewing group consisting of selected drug information specialists from Colleges of Pharmacy. An email with the survey link requesting participation was sent to Deans of ACPE accredited colleges of pharmacy. The online survey, hosted by SurveyMonkey, was made available for three weeks. A reminder and link to the survey was emailed after two weeks. To characterize the demographic description of respondents the geographical region of the college was collected.

Results: A total of 60 schools/colleges of pharmacy responded to the survey. Most drug information curricula includes a hands on Medline tutorial (85%) and a hands on experience with online tertiary resources (82%) such as Micromedex, Lexi-Comp, or Facts & Comparisons. Forty-eight percent of responses to drug information questions were verbal, likewise the same percentage of responses were verbal and written. Three percent of schools did not have a drug information question assignment. The majority of curricula (53%) did not have students prepare a drug monograph; however 48% did learn about medication use evaluations. A total of 52% and 53% learned about medication use process and national standards, respectively. The majority of students (82%) had a journal club presented verbally and as a written assignment; however, 5% had no such assignment.

Conclusion: There is a wide range of items (1% for national standards to 53% for drug monographs) not covered in DI curricula. If Pharm.D. candidates do not obtain the necessary experiences to meet each drug information entry-level competency from drug information curricula or APPEs, schools of pharmacy should revise their curriculum in order to provide adequate drug information training and skills needed for entry-level practice in the hospital setting. Ernest Mario School of Pharmacy, Rutgers, The State University of New Jersey will be considering revisions to the 2011 DI curriculum based on the suggestions from the ASHP/ACPE Task Force with the addition of a Medication Use Evaluation lecture and drug monograph assignment.

5-070

Category: Drug Information

Title: Extended stability data for regular insulin drips

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Purpose: The continuous infusion of regular human insulin(Novolin R) to achieve blood glucose levels between 100 and 150 mg/dL is a common practice in critical care, and intensive care units. In the absence of stability data, the preparation of premixed insulin bags has been a daily task in our institution. To our knowledge, no stability data exist regarding insulin storage beyond twenty-four hours. Data is needed identifying insulin stability beyond this time period to help prevent medication waste if the full amount prepared is not used. The intent of this study was to assess ten-day stability of regular insulin drip stored at temperature maintained between 2 and 8 degrees Celsius as well as to assess overall cost saving to the institution post implementation of this extended stability.

Methods: The test solution was prepared manually by using aseptic technique by adding 1 mL of regular insulin 100 units/mL to 100 mL of 0.9 percent sodium chloride injection in Partial Additive Bag (PAB) which is Latex-free, PVC-free: DEHP-free resulting in final concentration of 1 unit/mL. After the study drug was mixed, 5 mL sample was withdrawn from the test solution at time 0, 24, 48, 72 hours and 4, 5, 6, 7, 8, 9, 10 days. The test solution was stored in a refrigerator at all times. The withdrawn samples were frozen and stored at -20 degrees Celsius until analysis by Chemiluminescent Immunoassay. Stability was defined as the retention of greater than and equal to 90 percent of the initial concentration. To determine the overall amount of regular insulin drip hospital waste, the number of compounded regular insulin drip bags returned daily to the pharmacy during a three-week period were counted prior to implementation of this study.

Results: Insulin concentrations remained above 99 percent of the final concentration (1 unit/ml) for a total of 10 days. Visual inspection found no changes in appearance in any of the samples tested. On average, nine regular insulin drip bags per day were returned to the pharmacy to waste. The institutional cost (drug acquisition and pharmacy preparation) of one regular insulin drip bag is approximately 6 dollars.

Conclusion: Based on the stability data obtained, regular insulin can be produced in batches in normal saline at concentration 1 unit/mL in PAB minibags, stored for 10 days at temperature maintained between 2 and 8 degrees Celsius. By extending retention of these stable premixed insulin drips from 24 hrs to 10 days can potentially result in approximately 19,440 dollars savings per year. Additional cost

savings may be realized by reducing overall pharmaceutical waste which must be incinerated and is regulated by the EPA (Environmental Protection Agency).

5-071

Category: Drug Information

Title: Concordance of ganciclovir dosage recommendations according to creatinine clearance in the biomedical literature and coincidence with the actual dose in a series of patients

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Purpose: Assess the correlation between the recommended dose, based on creatinine clearance, from differents biomedical sources, and the coincidence with the actual dose, based on drug serum levels, in a series of patients treated with Intravenous ganciclovir.

Methods: Retrospective, observational study which includes the dosage and creatinine clearance (Cockcroft-Gault formula) of patients treated with intravenous ganciclovir and drug serum levels, during a period of six years (2004-2010) in a tertiary hospital. Dosing recommendations were collected by six bibliographic sources: Micromedex 2.0 [MMX] (Thomson Healthcare), Drug Prescribing in Renal Failure [DPRF] (American College of Physicians), Drug Information Handbook [DIH] (Lexicomp), Martindale [M] (Medicines Complete) and Label Information (US Food and Drug Administration [LIFDA] and European Medicines Agency [LIEMA]). Recoded actual dose was based on ganciclovir serum levels (Cmin). The degree of coincidence between the recommended dose and the actual dose was evaluated following a linear regression analysis. P values above 0.05 were considered significant. Similarly, the degree of concordance between different bibliographic sources was also determined.

Results: Sixty-six patients were included (media age 54 years, 62% male) treated with Intravenous ganciclovir and documented serum levels. The media creatinine clearance (Cockcroft-Gault) is 80.5 ml/ min (16.7-199.0), the median actual dose is 7.0 mg/ kg (1.1-22.5) and media serum level (Cmin) is 2.3 mg/ mL (0.5 -33.0). MMX, DIH, LIFDA and M dosing recommendations showed a significant association with actual doses, whereas DPRF and LIEMA did not show. The proportion of coincidence between the recommended dose and actual dose is 50%, 35% of patients receiving a dose lower than recommended and 15% higher dose. The regression shows no statistically significant association between any of the different recommendations and the actual dosage. Finally, in 44% of patients the recommendation in the six sources evaluated is not concordant.

Conclusion: Dosing recommendations from bibliographic sources are not fully associated to actual dose (2/6 are not significant); and there is poor concordance between them (50%), in the study patients. Moreover, the degree of coincidence of these recommendations with the actual dosage is low (44%), and underdosing is the most frequent discrepancy.

5-072

Category: Drug Information

Title: Standard operating procedure to develop evidence-based information to support pharmacy and therapeutics committee decision for formulary management at a university hospital

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Purpose: Pharmacy and Therapeutics Committees (PTC) are responsible for the effective management of medicines use through maintenance of Hospital Formulary. Standard operating procedures (SOP) were designed to overcome the need to develop strategies for PTC decision support, in response to technology progress along with rising costs, to make available evidence based information.

Methods: Literature search to find guidelines on items of information needed to support PTCs decisions to develop a model for its delivery. Search to identify resources with valid and evidence based information on each needed item on new medicines and technologies, to develop the systematic strategy to look for information. SOP was tested with 25 medicines and 5 medical devices (MD).

Results: Main items needed to support PTCs decision include comparative analysis, regarding pharmacodynamic/pharmacokinetic profile, efficacy, safety and economic impact. Search strategies were developed, with keywords and mesh terms, to identify primary and secondary literature on Medline/PubMed and most essential journals. Information resources identified were characterized regarding quality criteria and content. The 80 resources gathered, delivering evidence based information and quality assessment on new technologies, comprehend websites, freely available, of medicines agencies, governmental and nongovernmental organizations, databases, mainly from UK and USA. Document types include monographs, health technology assessment reports, PCTs reports and therapy/safety bulletins. Seven paid databases were tested. Response from all resources, vary according to: the item; web resource country of origin; document type; technology and accessibility type. With this procedure, PTC has evaluated 5 medicines in 2009, 13 medicines and 1 MD in 2010 and 8 medicines and 4 MD in 2011 and has supported their decision to include 12 of 25 medicines and 2 of 5 MD. From 2011, 6 medicines and 1 MD wait decision.

Conclusion: We have created a SOP to find information needed to support PTC decision and develop a model to deliver it.

5-073

Category: Drug Information

Title: Development of a drug information electronic library access model

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Purpose: One dilemma facing students during advanced pharmacy practice experiences (APPEs) is the inconsistent availability of drug information resources at different rotation sites. Although many pharmacy schools are moving toward the use of electronic libraries via the purchase of prepackaged online curricular resources, access to specific publications may be difficult to navigate. The purpose of this project was to develop and implement an innovative electronic library access model that guides users directly to desired resources in a quick and efficient manner.

Methods: Numerous databases containing multi-titled collections available through University purchases were reviewed for specific resources and publications that might be useful to pharmacy students during APPEs. Publications included in the electronic library were chosen based on the content required to answer typical drug information questions asked of students during APPEs. A web page was developed that organized the various drug information resources by category of question type. Direct hyperlinks to individual titles were created to allow easy access without requiring circuitous navigation within several databases. The drug information electronic library webpage was introduced to students during didactic lecture in the 3rd professional year and distributed to all students prior to initiation of APPEs. A satisfaction survey using a Likert-type scale was distributed to students to determine ease of use and attitudes toward the drug information electronic library access model.

Results: The completed electronic library model has resulted in increased efficiency and access as demonstrated through use during drug information APPEs. Additionally, results of students surveyed during off-campus APPEs indicated satisfaction with the ease of use and scope of resources available within the electronic library.

Conclusion: The use of an innovative drug information electronic library access model has improved student access and efficiency in the retrieval of drug information. This model may have applications in practice settings for pharmacists and other health care professionals.

5-074

Category: Drug Information

Title: Review of the use of tigecycline in a university general hospital

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Purpose: Tigecycline was included into hospital's pharmacologic formulary in November 2006 to treat skin and soft tissue infections and complicated intraabdominal infection. Recently FDA alerted of increased mortality due to tigecycline, so its use should be restricted to patients who have not any other alternatives. The aim of this study is to analyze tigecycline use in a Spanish hospital since its inclusion in the hospitals pharmacologic formulary.

Methods: Retrospective, observational study performed from November 2006 to May 2011 in a 500 bed university hospital. Data collected included demographics, antibiotic indication, treatment duration, isolated microorganism and patients' evolution.

Results: The study included 39 patients, 17 patients were men and 14 women with an average age of 65 (15.2), eight of them were not evaluable because of inappropriate treatment duration (less than 48 hours). Mean duration of tigecycline treatment was 14 days (range 3-56). 23 patients (74.2%) received tigecycline according to the recommendations in summary of product characteristic. Ten of them used it to treat skin and soft tissue infections and 13 patients to treat complicated intraabdominal infections. Of the other eight patients (25.8%), four were allergic to penicillin, three had previous treatment failure and one was treated as empirical antibiotic therapy. There were 26 microorganisms isolated, 17 (65.4%) were coccus gram positive (in order of prevalence: Enterococcus sp. in 12 cases, meticillin resistant S. aureus in four and in one case S. pyogenes), five (19.2%) nonfermentative gram negative bacillus (Acinetobacter sp., Pseudomonas sp. and Stenotrophomas sp.) and four cases (15.4%) multiresistant enterobacterias. In all cases, except Pseudomonas sp., microorganisms were sensitive to tigecyclines action. 13 patients (41.9%) were exitus, five (16.2%) switched to other antibiotic due to the antibiogram results and the rest (41.9%) progressed favourably.

Conclusion: Tigecycline was used correctly in a high percentage of cases. In relation with morbidity we found no link between patients decease and treatment with tigecycline, because all of them presented an elevated grade of comorbidities.

5-075

Category: Drug Information

Title: **Pharmacists recommendations for over-the-counter cough and cold medications in children**

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Purpose: The Food and Drug Administration (FDA) recently recommended that over-the-counter (OTC) cough and cold products should not be used in children and infants under the age of 2 years due to the potential occurrence of serious and possible life-threatening side effects. Subsequently, drug manufacturers changed the labels on these products to say do not use for children under 4 years of age. In light of the FDAs recent recommendation against recommending these products in children, there is no current data on the type of products that pharmacists actually do recommend. Therefore, we conducted a study to determine which cough and cold products are currently being recommended by pharmacists.

Methods: Institutional review board (IRB) approval was obtianed from the Texas Southern University IRB. Surveys were created and distributed to 100 pharmacists in various community pharmacies throughout the Houston area. Results were analyzed using Excel 2007 and descriptive statistics were used to present the results.

Results: According to the collected surveys, 100% pharmacists were aware of the FDAs recommendation, and this has altered the medications that were suggested to parents. Of the pharmacists surveyed, 95% of them were aware that manufacturers voluntarily changed their labels to exclude use in children under the age of four. Parents rely heavily on pharmacists for guidance, as a majority of pharmacists (70% report being asked for cough and cold remedies for children at least once daily. The results of this survey show that with the recent FDA changes, the majority of pharmacists are no longer recommending OTC products for cough and cold. The majority of recommendations are either for prescription medications 45% or supportive care 41% such as saline drops or humidifiers. Approximately 70% of the pharmacists who were surveyed approved of the cessation of OTC products for children under 4 years of age. As a result of the conducted study, pharmacists are adhering to the FDA recommendations and have made changes in how they advise parents.

Conclusion: Although many pharmacists continue to recommend certain over-the-counter products, a majority still refer concerned parents to their childrens primary care physician especially those under 4 years of age. Due to FDA regulations, pharmacists are making recommendations with more precaution

and concern to help avoid any negative impact on children and their parents. With these improvements, the occurrence of life-threatening side effects should be significantly reduced.

5-076

Category: Drug Information

Title: Knowledge, use, and decision-making considerations for drug information resources in community and hospital pharmacies

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Purpose: Timely and relevant drug information (DI) resources are necessary and valuable tools in a pharmacists informational arsenal. States and Boards of Pharmacy recognize that access to DI resources is paramount to pharmacy practice and have consequently introduced laws and regulations to reflect this need. However, there is limited literature evaluating pharmacists use of and knowledge about DI resources and State requirements. Thus, the purpose of this study was to determine pharmacists preferences and rationales regarding DI references.

Methods: A 20-item survey was developed by the authors to assess knowledge, use, and decision-making considerations regarding DI references by practicing pharmacists. Additional survey items explored familiarity with DI resource-related requirements to maintain compliance with State mandates. A randomized sample of community (n=500) and hospital (n=500) pharmacists classified as staff pharmacists involved with answering drug information questions as part of their expected job responsibilities were invited to participate in a voluntary and anonymous self-administered survey. The sample was comprised of pharmacists in all 50 states. Survey results were tabulated into a Microsoft Excel spreadsheet; descriptive statistics were utilized to summarize data. This study was approved by the institutional review board.

Results: 115 pharmacists completed the survey. The most common primary work setting of participants was hospital/health system. Approximately 71% of respondents use electronic resources more frequently than print references in their practice setting. Eighty-nine percent of pharmacists believe they have sufficient print references in their pharmacies in the event that the electronic resources are not operational. The most commonly (24%) used resource among surveyed pharmacists was Micromedex [electronic]. Only 66% of survey participants were certain that they knew which drug information resources must be maintained in their specific pharmacy to be in compliance with state law. Additionally, pharmacists are approximately 55% certain that they know which DI resources must be maintained for all pharmacy settings and specialties to be in compliance with state law. Fifty-three percent of survey respondents believe that electronic resources should be allowed to satisfy all legal requirements for resources maintained in a pharmacy.

Conclusion: A majority of the survey participants used electronic resources, but no single reference was dominant for answering all categories of DI question types. Pharmacists should be educated regarding their state DI resource requirements. Further research that can be generated from this study includes assessing the benefit of pharmacy law continuing education regarding legal requirements for DI resources.

5-077

Category: Drug Information

Title: Stability of generic omeprazole, spironolactone and ursodiol oral suspensions by ultra high pressure liquid chromatography

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Purpose: Previous studies reported omeprazole suspensions stable up to 14 days at 22 to 25C and up to 30 days at 5C, with stability defined as ≥90% of original drug concentration remaining; spironolactone suspensions stable up to 4 weeks at 25C; and ursodiol suspensions stable up to 90 days at 3 to 5C. The purpose of this study was to compare the stability of omeprazole, ursodiol, and spironolactone compounded oral suspensions using generic medications from multiple manufacturers.

Methods: Suspensions of omeprazole, spironolactone, and ursodiol were each compounded from products obtained from three available generic manufacturers. Omeprazole was prepared as 2mg/mL, spironolactone as 5mg/mL, and ursodiol as 60mg/mL concentrations. Samples were maintained at room temperature (22-25C) and refrigeration (4-6C). Aliquots of each sample were drawn and stored at -140C until stability testing was performed. Ultra high pressure liquid chromatography was used to determine the stability of each drug, with stability defined as retention of ≥ 90% of the original drug concentration. Samples were tested at 0, 1, 2, 3, 4, 5, 7, 14, 21, 28, 35, and 42 days.

Results: Omeprazole at room temperature and refrigeration had an average drug concentration remaining of 89.5 and 94.8% at 14 days, and 79.8% and 98.7% respectively at 42 days. Spironolactone had drug concentration remaining of 107.3 and 113.2% at 42 days at room temperature and refrigeration. Ursodiol had drug concentrations remaining of 106.8 and 97.3% at 42 days at room temperature and refrigeration.

Conclusion: The results from this study support previous stability tests reporting omeprazole stable up to 14 days at room temperature, and at least 42 days under refrigeration; and spironolactone and ursodiol suspensions stable at least 42 days at room temperature and under refrigeration.

5-078

Category: Drug-Use Evaluation

Title: Use of acid suppressive therapy in hospitalized non-critically ill patients

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Purpose: Acid suppressive therapy (AST), mainly proton pump inhibitors (PPIs) and histamine-2 receptor antagonists (H2RAs), is commonly prescribed for stress ulcer prophylaxis (SUP) to hospitalized non-critically ill patients without appropriate indication. Furthermore, it appears that once AST is started, medications are continued even after discharge, resulting in unnecessary increased drug cost and adverse events. The purpose of this study was to assess the appropriateness of prescribing AST therapy in a general medicine service in a tertiary care hospital.

Methods: In this retrospective observational study, we reviewed the inpatient records of all patients admitted to the general medical service in a tertiary care hospital in Beirut, Lebanon, from April 1 till May 31, 2011. Treatment with AST was considered appropriate if the patient had a specific indication or appropriate treatment purpose (e.g., gastroesophageal reflux disease (GERD), peptic ulcer disease (PUD), dyspepsia, acute or suspected GI bleeding). Appropriate administration of SUP was derived from an internal guideline that is based on the ASHP guidelines. Prophylaxis was considered appropriate if a patient had 1 absolute indication (coagulopathy or requiring mechanical ventilation for more than 48 hours), or 2 or more relative indications (sepsis, occult bleeding, use of high dose corticosteroids, recent use of non-steroidal anti-inflammatory drugs (NSAIDs) for more than 3 months, renal or liver failure, enteral feeding, and anticoagulant use).

Results: Of the 153 patient admissions during the study period, 130 patients (85%) were started on AST out of which 11 (8.5%) had a diagnosis that supports the use of this therapy (GI bleed, gastritis, and GERD), 16 (12.3%) had an absolute indication for SUP, and 59 (45.4%) had 2 or more relative indications for SUP, and 44 (33.8%) received AST without an appropriate indication. In addition, one patient with an absolute indication for SUP and four with two or more relative indications did not receive AST. Rabeprazole was the most frequently used AST (59.2%), followed by omeprazole (24.6%), esomeprazole (11.5%), and ranitidine (4.6%). The dose of AST was appropriate in 126 patients (96.9%) and the route of administration was appropriate in 123 patients (94.6%). Fifteen of the admitted patients (10%) were discharged on AST, 7 of which (47%) did not have an appropriate indication.

Conclusion: AST is overused in hospitalized non-critically ill patients and many patients are discharged on unnecessary AST which can increase cost, drug interactions, and adverse events. Potential interventions include implementation of institutional protocols and prescriber education.

5-079

Category: Drug-Use Evaluation

Title: Use and toxicity evaluation of lenalidomide in cutaneous lupus erythematosus patients

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Purpose: The use and toxicity profile of lenalidomide in patients with cutaneous lupus erythematosus (CLE) in a tertiary hospital are described.

Methods: We included all patients with CLE to which lenalidomide was dispensed during 2010, in the Outpatient Unit of the Pharmacy Service. All medical histories of each patient were reviewed and biodemographic data, diagnosis, previous treatments, dosage, duration of treatment, dose variation and reason for withdrawal were collected.

Results: Medication was dispensed to 7 patients (mean age 44.6 years, 100 percent women). All patients had been treated previously with thalidomide, which had to be withdrawn due to toxicity in 71 percent (5) and/or ineffectiveness in 43 percent (3) of patients. The mean daily dose of lenalidomide was 3mg (standard deviation plus/minus 1.62), for a median duration of 9 months (range 6 to greater than 22). All patients showed improvement of lesions and in 5 became inactive. The daily dose had to be reduced in all patients (4 due to efficiency, 2 due to toxicity), by increasing the dose range (from 24 to 48 or 72 hours, or a weekly dose). However, 6 patients needed to restart the initial dose because cutaneous lesions were exacerbated. Reasons for withdrawal were inefficiency in 4 patients and toxicity in 2 patient. The main adverse effects were gastrointestinal disorders such as nausea and diarrhea (4), polyneuropathy (1), ankle edema (1), insomnia (1) and arthralgia (1).

Conclusion: Lenalidomide is an immunomodulatory drug that has shown activity in our serie of patients with CLE and who are refractory to other treatments. The dose reduction in responding patients can improve tolerance to treatment but it is a reactivation cause of cutaneous lesions in a large number of patients (6/7). Adverse events can sometimes be managed with dose reduction, but can be a withdrawal reason in some patients (2/7). The only currently approved indication of lenalidomide in Spain is for the treatment of relapsed or refractory MM in combination with dexamethasone. Thus, the off-label treatment approvals must be individualized and the accurate compilation of results is of utmost importance to ensure selection of more efficient treatments.

5-080

Category: Drug-Use Evaluation

Title: Evaluation of the argatroban protocol at Jeanes Hospital for patients with known or suspected heparin induced thrombocytopenia

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Purpose: The National Patient Safety Goal 03.05.01 requires the use of approved protocols for the initiation and maintenance of anticoagulant therapy, as well as evaluating the protocols for safety and efficacy. At Jeanes Hospital, a 200 bed community hospital, pharmacists manage several anticoagulation related protocols. Since the commencement of the pharmacist initiated argatroban protocol for patients with suspected heparin induced thrombocytopenia (HIT), the efficacy and safety data has not yet been formally analyzed.

Methods: This was an Institutional Review Board approved retrospective chart review for patients at Jeanes Hospital whom were placed on argatroban protocol from January 1, 2008 through December 31, 2010. To be included in the study, patients must have been initiated on the argatroban protocol for known or suspected heparin induced thrombocytopenia and had at least 3 consecutive activated partial thromboplastin time (aPTT) values recorded. Excluded protocols included the use of improper baseline lab values or not following protocol order sets. Descriptive statistics were used to evaluate the primary outcome of time to a patient specific therapeutic aPTT goal and percentage of time spent within that therapeutic aPTT range. The secondary outcome of safety was defined as major bleeds, defined as retroperitoneal and intracranial bleeds, as well as the need for transfusions or a hemoglobin decrease of more than 2 grams per deciliter.

Results: After screening 65 protocols, a total of 46 protocols met inclusion criteria. For the primary outcome, the average time to patient specific goal aPTT was 6.4 hours. There was one patient that was not therapeutic until 32 hours, but the patient was off of the infusion for procedures. Of the protocols, 98% were therapeutic within 24 hours. Protocols were within patient specific aPTT goal ranges 67% of the time. For secondary outcomes, there were a total of 13 bleeding events, with 2 requiring blood transfusions. There were 11 all cause mortality events, none directly related to argatroban. Finally, there was 1 documented new deep vein thrombosis (DVT).

Conclusion: The argatroban protocol at Jeanes Hospital is both safe and effective in treating patients with known or suspected HIT.

5-081

Category: Drug-Use Evaluation

Title: Changing doctors prescriptions of morphine and oxycodone a regional drug committee perspective

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Purpose: In the Danish Capital Region, morphine is the recommended first-line opioid in both primary and secondary care. Nevertheless, the use of morphine has decreased over the latest years while the use of another opioid, oxycodone, has increased. This represents a potential problem since oxycodone is considered equally effective but more expensive than morphine. The aim of this study is to describe the effect of the regional drug committees (RDC) multi-factorial intervention designed to increasing the use of morphine and reducing the use of oxycodone.

Methods: The RDC intervention comprised: 1) Four educational meetings for general practitioners (GP); 2) newsletters to GPs; 3) individual visits to GPs; 4) a consensus meeting with the local pain specialists; 5) a letter to the 13 hospital drug committees summarizing the published evidence on oxycodone and local data on the use of morphine and oxycodone; 6) a meeting with representatives of the local orthopaedic surgeons and framing of the statement, that morphine should be preferred over oxycodone in orthopaedic surgery wards; 7) several follow up letters to the local drug committees including guidance on how to switch from oxycodone to morphine. Finally, 8) a letter from the CEO of the Capital Region to all hospital managers emphasizing restricted use of oxycodone.

Results: In the hospitals of the Capital Region, the use of oxycodone decreased from approximately 14.000 defined daily doses (DDD) to less than 1.000 DDD per month. In primary care, the use of oxycodone decreased from approximately 100.000 DDD to 90.000 DDD per month. Moreover, the expenditures decreased more than 0.5 million Euro.

Conclusion: The described multi-factorial intervention seems an effective means to reduce irrational use of oxycodone, especially in the hospital setting and to a lesser extend in primary care.

5-082

Category: Drug-Use Evaluation

Title: Evaluation of proton pump inhibitor therapy post transfer from a critical care unit at a community hospital

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Purpose: Pantoprazole is the current formulary approved proton pump inhibitor at St. Josephs Healthcare System- Wayne Hospital. PPIs have long been the mainstay for gastric acid suppression therapy. This class of medication is very effective with minimal adverse effects with short term use. Studies have shown however the overuse and inappropriate prescribing of this medication class has led to increased drug-drug nteractions, nutritional deficiencies, fractures, and infectious diseases (Clostridium difficile and respiratory infections). The purpose of this drug utilization review is to evaluate the appropriateness of proton pump inhibitors (PPI) therapy upon transfer from critical care unit (post stress ulcer prophylaxis necessity).

Methods: Patients who were admitted to the intensive care unit at any point during their hospital admission and prescribed pantoprazole were selected. In total 96 charts were retrospectively reviewed. Appropriate PPI use prior to admission as well as documented history of pneumonia and C. difficile infections in conjunction with prior PPI use, drug-drug interactions, and appropriate continuation of therapy post transfer/discharge were documented and analyzed.

Results: On admission 42 (44%) patients were using PPI, 24 (57%) of which had no prior history of GI issues documented. Fifty-four (56%) patients were initiated on PPI therapy after admission. At discharge 40 (42%) patients were prescribed a PPI 22 of which were considered appropriate. Eighteen of the 40 patients (45%) who were prescribed a PPI on discharge were deemed inappropriate due to lack of definitive indication. Twenty-six patients were not prescribed an acid suppressive therapy upon discharge. Thirty charts were not evaluated for PPI use upon discharge; 15 patients expired, 15 patients discharge information was not available for review. Seventeen out of 96 patients were considered to have a severe DDI with pantoprazole; 16 plavix, 1 mesalamine. Three patients with history of pneumonia and 5 with history C. diff were maintained on PPI therapy prior to admission to the hospital.

Conclusion: Though patients may have had an indication for acid suppressive therapy in critical care, continuation of PPI therapy may still be inappropriate. Ultimately, we plan to implement a protocol for discontinuation of PPI or conversion to an alternative acid suppression therapy for inappropriate indications post critical care discharge. This will lend to a reduction in overuse and complications. Further examination of PPI use will be conducted.

5-083

Category: Drug-Use Evaluation

Title: Boosted HIV protease inhibitor monotherapy for the treatment of HIV-1 infection: assessment and monitoring at a University reference hospital

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Purpose: Several trials have shown that boosted human immunodeficiency virus (HIV) protease inhibitor (PI) monotherapy compares favourably to standard triple regimens in some selected HIV-1-infected subjects. It minimizes long-term side effects, is easier to use, and may improve patient quality of life and adherence, while maintaining viral suppression. The goal of this study is to assess whether boosted HIV PI monotherapy is a safe and effective strategy in the routine clinical practice, and to estimate its economic impact.

Methods: Descriptive, retrospective and observational cross-sectional study performed at a University reference hospital between June 2009 and March 2010. Sixty-eight patients simplified their HAART to a ritonavir-boosted PI monotherapy, and fifty-six of them were included in the study. The primary endpoint was to evaluate the virological and immunological efficacy (patients rate without therapeutic failure, defined as confirmed HIV RNA >50 copies/mL). The secondary objectives were to analyze and quantify the simplifications and assess the pharmacoeconomic impact.

Results: The main reasons to start a PI monotherapy were toxicity and simplification (42,86% each one). At the end of the study (10 months) 52 of 56 patients (92,86%) had HIV RNA <50 copies/mL, three of 56 patients (5,36%) had HIV RNA between 50 and 500 copies/mL, and one of 56 patients (1,78%) had HIV RNA >500 copies/mL. The mean change from baseline in CD4 cell count was -17,66 cells/L (95%CI: +19,33, -54,65; p=0,343). Six patients discontinued the simplification therapy, five of them due to adverse events and one with virological failure that finally achieved virological suppression after the reintroduction of nucleoside analogues. This strategy saved 154.258,72 on antiretroviral hospital drug budget during a period of 10 months. No patients developed hepatic toxicity.

Conclusion: Our results suggest that a simplified maintenance therapy with a ritonavir-boosted PI monotherapy has a high virological and immunological efficacy in carefully selected patients with HIV-1 infection in the routine clinical practice. It positively impacts the antiretroviral budget when compared to the previous triple regimen.

5-084

Category: Drug-Use Evaluation

Title: Efficacy and safety of rotavirus vaccine- one year follow-up assessment in Taiwan

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Purpose: Rotavirus is one of several viruses known to cause acute gastroenteritis in infants and young children of six months to 2 years old. Oral rotavirus vaccines have been shown to be efficacious in preventing rotavirus diarrhea and in reducing the severity of the disease. To understand the efficacy and safety, the study was to describe the use patterns of rotavirus vaccines and follow up the efficacy and adverse effect of vaccination in a municipal pediatric hospital.

Methods: The study was conducted in Branch of Women and Children, Taipei City Hospital. A questionnaire was completed voluntarily by the families of the infants and young children who received the first vaccination of rotavirus vaccines from April to June 2008. The questionnaires included the basic information, background of infants and their families, and track the protection effects and the adverse reactions over 1 year after taking the rotavirus vaccine.

Results: 35 infants, 10 boys (28.57%) and 25 girls (71.43%), were included in the study. Age of infants ranged from 4 to 6 months, and the average age were 4.3 months. The most common occupation of parents is business (45.71%), university or graduate institute is the most common education level of parents (88.57%). None of the infants were infected by the rotavirus during the 1 year follow-up period. There are three young children have some adverse reactions after the oral vaccination within 24 hour, but the relationships between adverse reaction and the vaccine was not established. Overall, the families of infants received vaccines hold a positive attitude (77.14%).

Conclusion: The study indicated a satisfactory prevention effect of oral rotavirus vaccine. Although there were adverse reaction reports, the incidence is low and is not related to the use of vaccines. Overall, the vaccine's effectiveness is relatively good, but the efficacy and safety under long-term use need to be further studied.

5-085

Category: Drug-Use Evaluation

Title: Evaluation of inhaled corticosteroid conversion in asthma patients within a community-owned healthcare system

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Purpose: Providing cost-effective therapy despite a decline in resources has become a challenge. In February 2008, patients on Fluticasone propionate inhalation aerosol (FL) were automatically switched to Mometasone furoate inhalation powder (MO) according to a Pharmacy and Therapeutics approved dosing protocol. This therapeutic interchange (TI) generated $28K in initial cost savings, with as subsequent annual cost decrease of $44K; hence, the initial goal to reduce cost was attained. However, there was a need to ensure clinical outcomes for asthma management were unaffected by the positive economic outcome and so, this medication utilization evaluation (MUE) was conducted, with approval from the appropriate ethics committees, for the purpose of assessing asthma control in patients whom were converted from FL to MO.

Methods: A randomized, retrospective analysis of electronic medical records was conducted in 22 patients who were converted from FL to MO. To access baseline changes and outcomes related to asthma control, data was collected according to a 24 month review period, 12 months baseline and 12 months post-conversion. The primary measures of asthma control were 1) no increase in recorded ED/hospital admissions for asthma exacerbations or 2) no prescriptions for oral corticosteroid. Secondary measures of asthma control included, 1) no increase in ambulatory asthma consultations with diagnosis of asthma exacerbation; 2) no add-on therapy- long-acting beta-agonists (LABA), leukotriene inhibitor, immunmodulator, methylxanthine-, or change in maintenance therapy; and 3) no increase in short-acting beta agonist (SABA) use.

Results: The mean baseline demographics for study patients with regard to age, sex, and BMI are 54.2 years of age, 72.7% (n=16)male, and 33, respectively. Fifty-nine percent (59.1%; n=13) patients reported they never smoked, compared to 27.3% (n=3) and 13.6% (n=6) for current and former smoking status, respectively. Asthma classification was known for all patients. Unspecified extrinsic asthma (77.3%; n=17) compared to persistent asthma (4.5%; n=1)) was the most common asthma classification, with no patients classified with cough-induced asthma. The severity classification of most patients was unknown (54.5%; n=12)), where persistent moderate, persistent severe, or intermittent classification were documented in 36.4% (n=8), 4.5% (n=1), and 4.5% (n=1) patients, respectively. Eighty-one (81.8%; n=18)) of patients received FL for greater than 6 months compared to 18.2% (n=4) for patients receiving therapy for less than or equal to 6 months, where 50% (n=11) of patients received MO for either greater than 6 months or less than or equal to 6 months. Prior to conversion to MO, Sixty-eight percent (68.2%; n=15) of patients received FL 110 mcg per inhalation compared to 31.8% (n=7) who received 220 mcg per inhalation. FL dose per day ranged from 220 mcg to 880 mcg, with 45.5% (n=10), 36.4% (n=8), and

18.2% (n=4) patients receiving 220 mcg, 440 mcg, and 880mcg, respectively. The daily dose of MO after conversion to MO 220 mcg per inhalation ranged from 220 mcg to 880 mcg, with 36.4% (n=8) receiving either 220 mcg or 440 mcg (n=8) compared to 27.3% (n=6) for 880 mcg. The use of short-acting beta-antagonist was constant between pre-conversion and post- conversion time periods, with 50% (n=11) of patients on FL and MO using greater than 6 inhalers per 12 months. No additional maintenance therapy was used as add-on therapy after the conversion in 36.4% (n=8) of patients, with 27.3% (n=6), 9.1% (n=2), 4.5% (n=1), 0%, or 0% patients receiving a LABA, oral corticosteroids, leukotriene inhibitor, immunmodulator or methylxanthine, where 22.7% (n=5) of patients were switched back to FL. Overall, most patients did not experience an asthma exacerbation requiring an emergency department (ED) visit or hospitalization pre-conversion (86.4%; n=19)) or post-conversion (81.8%; 18). Regarding asthma consultations, 68.2% (n=15) compared to 81.8% (n=18) of patients were seen pre-conversion and post-conversion, respectively. Most patients experienced 1 or 2 asthma consultation visits prior to the conversion, 9.1% (n=2) and 22.7% (n=5), respectively. After the conversion, patients experienced 1 or 2 asthma consultations visits, 13.6% (n=3) and 4.5% (n=1), respectively.

Conclusion: The study results show that indicators regarding for poor asthma control did not increase, in most study patients, after the therapeutic interchange between FL and MO. After the therapeutic interchange, there was a decrease in the number of ED visits/hospital admissions and asthma consultations visits for asthma exacerbation, despite a small percentage of patients with LABA and oral corticosteroid as add-on therapy.

5-086

Category: Drug-Use Evaluation

Title: Pioglitazone use evaluation in a county hospital

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Purpose: Avandia (rosiglitazone) and Actos (pioglitazone) are currently the only available thiazolidinediones (TZDs) also known as glitazones which work to reduce serum glucose levels by reducing insulin resistance via fat and muscle metabolism for the treatment of type two diabetes. Recent studies showed a 43% higher risk for myocardial infarction (p=.03) and a 64% higher risk of cardiovascular death (p=.06) with rosiglitazone which prompted a Risk Evaluation and Mitigation Strategy (REMS) placement on the drug by the Food and Drug Administration (FDA). In contrast, recent studies for pioglitazone showed an 18% relative risk reduction for death, myocardial infarction or stroke (p<.005) and a 41% increase in relative risk for heart failure (p<.002). Pioglitazone is the only available TZD at Harris County Hospital District (HCHD) and remains the most prescribed prior authorization drug at the county despite formulary restriction criteria constituting post-failure of combination therapy including insulin plus one oral agent plus a HbA1C of >8%. High prescribing trends and formulary requests for pioglitazone use within the county, in addition to recent information regarding the adverse cardiovascular related profile of its counterpart drug, rosiglitazone, prompted a medication usage evaluation of pioglitazone. The primary aim was to evaluate effectiveness of pioglitazone therapy through reduction in A1c. The secondary aim was to evaluate the frequency of cardiovascular events in patients on long-term pioglitazone therapy.

Methods: A retrospective review of 324 outpatients on long-term pioglitazone therapy (minimum of 24 months) between January 2007 and October 2010 who were 18 or older. Failure to show therapy compliance for 24 months within the 3 year data collection period resulted in exclusion from the study. Baseline demographics along with cardiovascular risk factors, doses, A1c and adverse effect information were collected.

Results: Of 324 patients, a 1.07%, 0.92%, 0.93% mean reduction from baseline A1c was seen at 3-6, 7-9, and 10-12 months respectively. Approximately, 18 patients met target goal (A1C <7) at 3-6 months. Goal was not meet in patients with baseline A1C 12. Sub-analysis of results showed patients meeting formulary restriction criteria for pioglitazone consisted of roughly 43%. Non-compliance with formulary restriction criteria consisted of patients with A1c<8 (n=149) or patients on monotherapy (n=52). Of patients meeting HCHD criteria (n=138) a 1.66% reduction in A1C was seen at 12 months.

Approximately, 11% of patients were hospitalized for cardiovascular-related events after initiation of pioglitazone therapy.

Conclusion: Pioglitazone effectively decreased A1c by 0.5 to 1% in patients with type two diabetes. Although there was a high incidence of hospitalization for cardiovascular events, these hospitalizations could not be attributed to their pioglitazone therapy as the patients had significant cardiovascular comorbidities. A re-evaluation of formulary restriction criteria with consideration to appropriateness of A1c requirement within the county hospital has been prompted as a result of this study.

5-087

Category: Drug-Use Evaluation

Title: Medication utilization evaluation for acamprosate in a county hospital system

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Purpose: According to the National Institute on Alcohol Abuse and Alcoholism (NIAA), 20012002 National Epidemiologic Survey on Alcohol and Related Conditions reported approximately four percent (4%) of the United States population is alcohol dependent; with 700,000 Americans receiving alcoholism treatment on every given day. Acamprosate is used as adjunct therapy with comprehensive management programs that help patients abstain from alcohol. Acamprosates (Campral) mechanism of action is not fully understood; it is an analog of gamma-amino butyric acid (GABA) and it lowers neuronal excitability; resulting in less hyper excited state, anxiety, insomnia, and restlessness helping patients maintain abstinence. The Prevention of Relapse with Acamprosate in the Management of Alcoholism (PRAMA) study showed a 67% versus 50% abstinent rate for patients on acamprosate and placebo respectively after 60 days of treatment; and abstinent rate after 48weeks was 39% and 17% for acamprosate and placebo patients respectively. Several studies have found that pharmacotherapy and steady behavioral support was the most effective therapy for alcohol dependence. The protocol for prescribing acamprosate at the Harris County Hospital District (HCHD) requires that the patient must be an active participant and must make all appointments with the comprehensive management program; complete alcohol detoxification (maintained abstinence from alcohol for at least seven days); have a creatinine clearance greater than 30 milliliters per minute; never have attempted suicide and have no current suicidal ideation; and not be breastfeeding or lactating. The purpose of this medication utilization evaluation is to determine whether acamprosate is being prescribed according to the protocol and also whether patients that received acamprosate were compliant with the therapy. The acamprosate checklist is faxed to the clinical pharmacist managing the prior authorization program for review; once approved, the pharmacist will note the approval in the patients profile.

Methods: A retrospective analysis was conducted using the electronic medical records of patients in the Harris County Hospital District who received a prescription for acamprosate during the period of April, 2010 to April, 2011. The data endpoints collected include: medical record number; age; gender; the date the therapy was started; the last date the patient filled their prescription; patient enrollment in a comprehensive management program; last date of alcohol intake; suicide attempt in the past and current thoughts of suicide; creatinine clearance; breastfeeding and lactating status; any medication for

depression and history of depression. Patient compliance is defined as actively participating in the comprehensive management programs that includes psychosocial support; filling all prescriptions at the Harris County Hospital District pharmacy and being in therapy for at least 12 months or duration set by the prescribing physician. All the patients evaluated met the criteria for creatinine clearance.

Results: Seventeen patients were analyzed of which 59% (10/17) were male with an average age of 45.7 9.6 years. The prescribing protocol was followed 59% (10/17) of the time acamprosate was prescribed with the primary reason for protocol non-adherence being prescribing the medication to patients who were not involved in a comprehensive management program. About 30 %(5/17) of the patients had diagnosed depression at the time acamprosate was prescribed; depression is one of the serious adverse effects of acamprosate. Of the evaluated patients, only one patient (1/17) was compliant with the acamprosate therapy, 64.7% (11/17) of the patients were not compliant, 23.5 %(4/17) were intermittently compliant, and one patient (1/17) discontinued therapy due to an allergic response to acamprosate. Non-adherence to the comprehensive management programs was found to be the most common reason for patient non compliance, accounting for 64.7% of the non compliant patients. Forty-seven percent (8/17) of the patients never filled their prescriptions; 17.6 %(3/17) accounted for those that filled their prescription once; 17.6 %(3/17) filled their prescriptions twice; 17.6% (3/17) filled theirs three times or greater.

Conclusion: The evaluation revealed that the prescribing protocol for acamprosate in the Harris County Hospital District is not being followed about 40% of the time it is prescribed; while only one (1/17) patient was compliant with therapy. The recommendation is that the current prescribing protocol for the county hospital system should be adhered to; and restricting the prescribing of acamprosate to physicians and staff managing the programs should be considered since acamprosate is an adjunct therapy with comprehensive management programs. Another evaluation should be conducted 12 months after implementation of this recommendation.

5-088

Category: Drug-Use Evaluation

Title: Iron sucrose medication use evaluation

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

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

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

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

5-089

Category: Drug-Use Evaluation

Title: Use and toxicity evaluation of lenalidomide in hematological patients

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Purpose: Lenalidomide is a structural analogue of thalidomide with antineoplastic, immunomodulatory, antiangiogenic and pro-erythropoietic properties that has been used in several hematological disorders such as myelodysplastic syndrome (MDS), multiple myeloma (MM), primary amyloidosis (PA), primary myelofibrosis (PMF), etc. However, the only currently approved indication in Spain is for the treatment of relapsed or refractory MM in combination with dexamethasone. Thus, the off-label treatment approvals must be individualized and the accurate compilation of results is of utmost importance to evaluate clinical practice. The use and toxicity profile of lenalidomide in different haematological pathologies in a tertiary hospital are described.

Methods: We included all patients with hematological disorders to which lenalidomide was dispensed during 2010, in the Outpatient Unit of the Pharmacy Service. All medical histories of each patient were reviewed and biodemographic data, diagnosis, dosage, duration of treatment, dose variations and reasons for withdrawal were collected.

Results: Medication was dispensed to 31 patients. Of them, 35.5 percent (11) had a MDS (average age 77.1 years, 82 percent female), in 36 percent (4) of which was identified the 5q- deletion; 45.2 percent (14) had MM (70.3 years, 43 percent female); 12.9 percent (4) had PA (61 years, 50 percent female) and 2 patients had PMF (69 years, 100 percent males). Patients with MDS (11) received a mean daily dose (MDD) of 8.9 mg (standard deviation plus/minus 2.2) for a median duration of 5 months (range 2 to more than 19). Initial dose needed to be reduced in 18 percent (2) of the patients because of the toxicity, which was also the cause for withdrawal in 45 percent (5), while in the remainder patients was due to progression of the disease. Nowadays, 1 patient is still on treatment after more than 19 months. Patients with MM (14) received a MDD of 17.7 mg (plus/minus 6.7) for 5.5 months (2 to more than 18). Dose was reduced in 64 percent (9) of the patients because of toxicity. Treatment was withdrawn for progression in 36 percent (5), and 21 percent (3) are currently on treatment after more than 18 months. Patients with PA (4) received 13.2 mg (plus/minus 6.6) for 3.5 months (1 to7). Dose was reduced in 50 percent (2) of the patients, and the reason of withdrawal was due to inefficacy in 75 percent (3) and adverse effects in 25 percent (1). Of the 2 patients with PMF, one received 10 mg for 1 month and next withdrawed due to a lack of response, while the other is currently on treatment with 5mg after more

than 14 months. The main adverse events were infection in 23 percent (7) of patients (86 percent of them had MM), cytopenias in 19 percent (6), mainly neutropenia (83.3 percent) gastrointestinal disturbances in 13 percent (4), skin disorders like rash or pruritus in 13 percent (4) and deep venous thrombosis in 6.5 percent (2).

Conclusion: Lenalidomide has shown variable activity in our serie of patients in which side effects, that are related to the dose, are the limiting factor to maintain full doses in some patients (45 percent). Outcomes allow the risk-benefit balance assessment and head the selection of more efficient treatments.

5-090

Category: Drug-Use Evaluation

Title: Evaluation of vertebral and non-vertebral fractures in patients receiving long-term proton pump inhibitor therapy

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Purpose: In 2010, the FDA communicated it reviewed seven published studies, six of which reported an increased risk of fractures of the hip, wrist, and spine with the use of proton pump inhibitor (PPIs). The FDA rescinded preliminary caution subsequently in 2011, with a statement that determined an osteoporosis and fracture warning on over-the-counter (OTC) PPI medication Drug Facts label is not indicated at this time for low-dose, short-term PPI use. Some studies suggest PPI use for 7 years or longer is associated with higher risk of osteoporosis-related fracture. Moreover, many outpatients within our healthcare system are on PPI therapy, where the indication for long-term treatment is unknown. The purpose of this medication use evaluation (MUE), with approval from the appropriate ethics committees, is to evaluate the incidence of vertebral and non vertebral fractures for patients on long-term PPI therapy.

Methods: This was a randomized, retrospective sub-analysis of an initial MUE evaluating PPI utilization within the Harris County Hospital District (HCHD) outpatient setting for outpatient prescriptions dispensed between March 2009 and August 2009, which included 203 patients. The sub-analysis included patients that were greater than or equal to 50 years of age and receiving PPI therapy for greater than or equal to 36 months Sixty-nine (n=69) patients were stratified per the inclusion criteria for age and duration of therapy, with 50 patients randomized for evaluation. Data was collected for age, duration of therapy, smoking status, concurrent osteoporosis therapy, drug therapy (i.e. glucocorticoids) or health conditions (i.e. seizures, dementia), associated with possible increase in fracture risk. Each electronic medical record was reviewed for fracture event(s) occuring after the initiation date of the first PPI prescription of record, which was the primary endpoint.

Results: Most patients were female and non-smokers, 72% (n=36) and 90% (n=45), respectively. The mean age was 61 years (range: 50-82 years). Four percent (n=2) of patients receiving PPI therapy received concurrent bisphosphonate therapy compared to 16% (n=8), and 14% (n=7) who received calcium and glucocorticoid therapy, respectively. The data was stratified by duration of therapy, where patients received less than or equal to 48 months, 49-72 months, or 73 months of therapy. Forty- eight percent (n=24) of patients were in the group that received therapy for 49-72 months compared to the other groups less than or equal to 48 months (16%; n=8) and greater than or equal to 73 months (36%;

n=18). Most patients (82%; n=41) did not experience a fracture event compared to 18% (n=9) that did experience a fracture event during PPI therapy. There was only 1 patient that experienced a vertebral fracture. Non-vertebral fracture events occurred in 8 patients and included, shoulder, ankle, rib, metacarpal and metatarsal phalanx, distal radius fractures.

Conclusion: Long-term PPI use within HCHD was associated with a low incidence of non-vertebral and vertebral fractures. The results of this study are not consistent with previous case-control cohort studies observing the incidence of hip fractures in long-term PPIs users. No hip fractures were identified in patients that were using PPIs for more than 36 months, although 1 vertebral fracture event occurred after 36 months of PPI therapy.

5-091

Category: Drug-Use Evaluation

Title: Natalizumab in multiple sclerosis: efficacy and security in long-term patients

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Purpose: The aim of this study is to evaluate the efficacy and safety of Natalizumab in relapsing-remitting multiple sclerosis patients receiving the monoclonal antibody for longer than 24 months.

Methods: An online search for randomized and controlled trials including the terms [NATALIZUMAB] AND/OR [MULTIPLE SCLEROSIS] was performed. A retrospective, multicentric study including patients diagnosed with high-activity relapsing-remitting multiple sclerosis (RRMS) was conducted. Inclusion criteria: 1. Documented disease progression defined by either an Expanded Disability Status Score (EDSS) increase greater than 2 points or at least 2 documented flare-ups (relapses) with new demyelination plaques confirmed by nuclear magnetic resonance imaging (NMRI) in the last year (prior to the beginning of Natalizumab). 2. Having received a monthly infusion of Natalizumab for periods of at least 24 months. An exhaustive review of medical records was undertaken in order to evaluate the efficacy and safety. Data sources: ClinicalTrials.gov, Outpatient Dispensing Pharmacy Unit Softwares (Farmatools, Doctor), Andalusian Digital Medical Records (Diraya) and paper-based medical records. The efficacy was defined by the increase of EDSS and the number of relapses since the start of Natalizumab. According to this, we established 4 groups: Group 1: Lack of relapses and documented EDSS decrease. Group 2: Lack of relapses and/or EDSS augmentation <0.5 points. Group 3: zero to one relapse and/or EDSS increase between 0.5 -1. Group 4: two (or more) relapses and/or EDSS increase >1.5. Groups 1 and 2 reached the Efficacy Primary Endpoint (disease stabilization). Safety: a database (Microsoft Excel) was completed to describe the adverse event profile of Natalizumab according to CTCAE v.4.0. The safety primary endpoints were the non-appearance of Progressive Multifocal Leukoencephalopathy (PML) and the absence of anti-Natalizumab serum antibodies during the treatment.

Results: 24 trials were retrieved but none focused on the efficacy and safety of Natalizumab after a monitoring of more than 2 years. We identified 29 patients who met the inclusion criteria: high-activity RRMS with known progression and continuous monthly intravenous infusion of Natalizumab for at least 24 months. Study Population Data: 24 were female and 7 male (ratio 3.4:1), with a mean age of 40.6 years (23-60) and an average time since MS diagnosis of 8.3 years (2.7-18.1). 24 patients had received previous immunomodulatory therapy: Interferon -1a (different presentations) in 22 cases, interferon -1b in 6 patients and Glatiramer Acetate in 4, with documented progression or poor tolerance. Natalizumab

was prescribed de novo in 4 patients. Natalizumab average treatment time: 32.6 months (26-40). Two patients interrupted the treatment after 32 and 33 months, respectively, and another one was switched to bimonthly infusion after 25 months, by medical advice, without reported lack of efficacy or adverse effects. Efficacy assessment: 19 patients (6 belonging to group 1 and 13 to group 2) met the efficacy primary endpoint. Furthermore, 6 additional patients showed an EDSS augment between 05-1 and zero to one relapse (group 3). Finally, 3 patients had EDSS increase >1 and/or image-confirmed new inflammatory injury since start of Natalizumab, requiring hospital income and corticoid bolus (group 4). Safety assessment: No evidence was found of either PML or anti-NTZ antibodies (safety primary endpoints). Other adverse events registered (CTCAE grades I and II): transient episodes of migraine (4 patients), recurrent UTI and Herpes simplex virus infections (4 cases), temporary numbness of limbs (3 cases), mild-to-moderate post-infusional hyperthermia favorably resolved with NSAIDS (3 patients), pruritus and flushing of the upper limbs (2 patients) and liver enzymes slight elevation (1). No grade 3 or higher adverse events were registered.

Conclusion: The lack of randomized clinical trials supporting the efficacy and safety of Natalizumab after periods longer than 24 months (maximum approved by either FDA or EMA) makes observational studies the only available evidence. In this cohort, the long-term use of Natalizumab was evaluated by the analysis of 29 RRMS patients receiving the monoclonal antibody for periods above 2 years. In 86.2% of cases, regular intravenous of Natalizumab infusion halted considerably the disease progression, with 65.5% of cases (those belonging to groups 1 and 2) with significant outcomes and 20.6% of cases (group 3) with more moderate improvement. In addition, patients from group 1 showed a paradoxical EDSS reduction. No evidence of anti-Natalizumab antibodies (estimated by several authors over 9% in prolonged treatments) or PML was found (even though its incidence seems to be increased in long-standing treatments). Natalizumab-related adverse events profile varied widely but all were mild-to-moderate (grades 1 & 2) and were not forced to discontinue monthly infusion except in one case (until normalization of hepatic enzymes). This study shows that Natalizumab has been used as an effective and safe drug to reach disease control in long-term MS patients, improving in most cases the outcomes achieved by the previous therapy. This is especially relevant in patients with a highly active demielynation course and/or refractory to other immunomodulatory therapy.

5-092

Category: Drug-Use Evaluation

Title: Evaluation of daptomycin therapy in a community teaching hospital

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Purpose: Daptomycin (Cubicin) is a cyclic lipopeptide antibiotic approved by the Food and Drug Administration (FDA) for the treatment of complicated skin and skin structure infections (cSSSI) caused by Gram-positive bacteria (Staphylococcus aureus, including methicillin-resistant isolates; Streptococcus pyogenes; Streptococcus agalactiae; Streptococcus dysgalactiae; Enterococcus faecalis, vancomycin-susceptible isolates only) and for blood stream infections (bacteremia) caused by methicillin-susceptible (MSSA) and methicillin-resistant Staphylococcus aureus (MRSA). Daptomycin use in our institution is restricted to infectious disease for the FDA approved indications when a patient is hypersensitive to vancomycin or linezolid, or when a patient has failed vancomycin therapy. The purpose of this study was to assess the utilization patterns of daptomycin with emphasis on the type of infection, organisms for which daptomycin was prescribed, dosage, potential drug interactions and any documented adverse events. A secondary objective was to determine whether daptomycin use met approved institutional guidelines.

Methods: This retrospective medication use evaluation included patients who received daptomycin from May 15, 2010 to May 15, 2011 in our 240-bed community teaching hospital. Pertinent data collected on each patient included demographic data, drug allergy status, indications for antibacterial therapy, type of therapy (empiric or streamline), microbiology, dosing regimen, concomitant antibiotic therapy, drug interactions and adverse reactions. The data was analyzed using Microsoft Excel.

Results: Daptomycin was administered to 132 patients in our institution during the 1 year study period; 73 patients were women and 59 were men. The mean age of patients was 57.5 years (range, 24 to 95 years), mean weight was 82.4 kilograms (range, 39 to 170 kilograms), and mean height was 65.7 inches (range, 45 to 80 inches). About half (48 percent) of the study patients had an antibiotic allergy as follows: 35 (55 percent) to beta-lactams and 6 (9.3 percent) to vancomycin. Two patients also had an unspecified documented allergy to daptomycin but still received this medication. Daptomycin was prescribed for cSSSI in 47 (35.6 percent) patients, sepsis in 39 (29.5 percent) patients, osteomyelitis in 31 (23.5 percent) patients, endocarditis in 5 (3.7 percent) patients, and other infections in 10 (7.7 percent) patients. Based on institutional guidelines, only 10 (7.5 percent) patients received daptomycin appropriately, all of which had a documented intolerance to vancomycin. For the remaining 122 patients who did not meet the approved guidelines, daptomycin was used for FDA approved indications in 79

(64.7 percent) of those patients. Daptomycin was initiated as empiric therapy in 33 (25 percent) patients, while 99 (75 percent) were for the following organisms: vancomycin-resistant enterococcus (VRE) 41 (41.4 percent); MRSA 24 (24.2 percent); MSSA 22 (22.2 percent); MRSA and VRE 12 (12.2 percent). The mean duration of therapy was 5.7 days (range, 1 to 25 days) and mean dosage was 438.8 milligrams (range, 100-1000 milligrams), with 14 patients (10.6 percent) who received subtherapeutic doses for their indication. Eighty-four (63.6 percent) patients had creatinine clearance (CrCl) of 30 milliliters per minute or above and received daptomycin every 24 hours, whereas 48 (36.4 percent) patients had CrCl less than 30 milliliters per minute or were on hemodialysis. Of the 48, all but 1 patient received daptomycin every 48 hours, while 1 patient received their dose with each hemodialysis. Baseline creatinine kinase (CK) levels were obtained for 106 (80.3 percent) patients and 11 had CK levels above normal limits at baseline; mean CK levels were 155.4 units per liter (range, 7 to 1996 units per liter). Thirty-seven patients received daptomycin for more than 1 week and of those, 9 (24 percent) had follow-up CK levels. Additionally, 11 (10.4 percent) patients experienced an increase in CK concentration during their hospitalization, 2 of which had levels that exceeded 1000 units per liter. Daptomycin was discontinued immediately in one patient and continued in the other. Of note, the continued patient was admitted on daptomycin with a diagnosis of endocarditis, osteomyelitis and sepsis, and had failed vancomycin therapy. His CK level was greater than 1996 units per liter on admission, increased to 2130 units per liter by day 2, then decreased to 917 units per liter by day 3. Concurrent therapy with simvastatin was seen in 23 patients; 3 (13 percent) had elevated CK levels and simvastatin was discontinued in these patients. Other adverse events documented were diarrhea in 2 patients and nausea in 1 patient. The most frequently used concomitant antimicrobial therapy included piperacillin/tazobactam 33 (25 percent); doripenem or meropenem 29 (22 percent); levofloxacin or ciprofloxacin 28 (21.2 percent); vancomycin 19 (14.4 percent); cefepime or ceftriaxone 18 (13.6 percent); metronidazole 18 (13.6 percent); gentamicin or tobramycin 7 (5.3 percent). Of note is that 6 of the 19 patients who received concomitant vancomycin therapy also had pneumonia.

Conclusion: Ninety-two percent of patients prescribed daptomycin did not meet our institution approved guidelines. However, 64.7 percent of daptomycin used was for an FDA approved indication. Twenty-five percent of patients received daptomycin for empiric therapy, while 10.6 percent of patients received subtherapeutic doses of the drug. Additionally, concurrent use of daptomycin with simvastatin potentially contributed to elevations in CK levels in 13 percent of the patients and inappropriate concomitant therapy with vancomycin was seen in 13 (10 percent) patients. In order to preserve daptomycins role in the antimicrobial armamentarium against serious Gram-positive infections and ensure that prescribing is appropriate at our institution, daptomycin drug usage guidelines will be modified and enforced. Pharmacy will also recommend discontinuation of simvastatin while a patient is receiving daptomycin and ensure appropriate dosing based on indication.

5-093

Category: Drug-Use Evaluation

Title: Enoxaparin-evaluation of use and minimization of errors

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Purpose: The Veterans Affairs (VA) and Joint Commission (JC) have set guidance for healthcare organizations to reduce patient harm associated with anticoagulants. The VA Anticoagulant Consensus Guidance 2008 has outlined methods to reduce errors caused from anticoagulants through centralizing and standardizing their management. At VA Black Hills Health Care System (BHHCS), all inpatient and outpatient anticoagulants are managed via the Pharmacy Service Anticoagulation Clinic. Enoxaparin, an injectable low molecular weight heparin (LMWH), is the preferred formulary LMHW for VA BHHCS. For many reasons, enoxaparin is subject to misadventure. This review highlights the types of errors reported by the VA BHHCS Anticoagulation Clinic and the processes implemented to reduce or eliminate these errors.

Methods: All enoxaparin prescriptions utilized both inpatient and outpatient are centrally managed via the Pharmacy Service Anticoagulation Clinic. Errors involving enoxaparin were tracked over a six-month period and included both prescriber (pharmacist)- and patient-induced mistakes. Errors involving the nursing staff were not recorded. Anticoagulation Clinic processes were then examined to reveal where improvements could be made to minimize enoxaparin errors. IRB approval pending.

Results: Errors reported to the Anticoagulation Clinic involving enoxaparin are summarized. Primary reasons for errors included: patients reporting not take their enoxaparin injections per enoxaparin bridging schedule post-procedure, patients reporting not following enoxaparin bridging schedule pre-procedure by taking a dose of enoxaparin the night prior to procedure, a patient reported taking enoxaparin as five shots subcutaneous daily, enoxaparin dosed incorrectly based on patients renal function, enoxaparin dosed incorrectly based on patients weight, and a patient started on treatment dose enoxaparin instead of prophylactic dose enoxaparin post knee surgery. Analysis of these errors was utilized to improve the Anticoagulation Clinic processes. The clinic has implemented the following standard practices to minimize or avoid enoxaparin errors. First, each prescription for enoxaparin is double checked by another Anticoagulation Pharmacist prior to dispensing the medication. Enoxaparin bridging schedules are double checked by another Anticoagulation Pharmacist prior to educating the patient and/or caregiver. During enoxaparin counseling sessions, patients are asked to repeat back instructions to confirm patient understanding of their enoxaparin dosing. In order to ensure patient adherence to bridging schedule, Anticoagulation Pharmacy Technicians call the patient the day after their procedure to discuss their enoxaparin bridging schedule and remind patients to continue their enoxaparin injections when restarting warfarin. Staff education was provided via in-services regarding changes in clinic processes and appropriate enoxaparin dosing and monitoring. Patient education material on enoxaparin was reviewed and updated. The Anticoagulation Clinic Pharmacists and

Technicians meet monthly to discuss practices, review patient cases, analyze quality assurance (QA) results, and continue clinic improvement.

Conclusion: Enoxaparin is a complex medication for both providers to prescribe and patients to use appropriately. Evaluation of the errors associated with enoxaparin at VA BHHCS revealed the need for Anticoagulation Clinic process improvements and education to prescribers and patients. As a high-risk anticoagulant, enoxaparin continues to be a focus of the VA BHHCS Pharmacy Service Anticoagulation Clinic. Continuous quality analysis and process improvement will help prevent enoxaparin misadventures in the future.

5-094

Category: Drug-Use Evaluation

Title: Clinical and economic review of daily dose phosphodiesterase-5 (PDE-5) inhibitors in erectile dysfunction (ED)

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Purpose: It is estimated that ED affects 30 million men in the United States. The price of treatment may inhibit some men from seeking therapy, or prevent them from engaging in optimal treatment. Both undertreated and untreated patients may be more susceptible to psychosocial comorbidities such as depression, anxiety, marital issues, and low self-esteem. PDE-5 Inhibitors, which include sildenafil (Viagra), tadalafil (Cialis), and vardenafil (Levitra), are commonly used to treat male ED. Daily dosing has been shown to be safe and may also reduce the impact of psychosocial comorbidities. The purpose of this evaluation is to determine whether a once daily dosing regimen of PDE-5 inhibitors will lead to a more favorable reduction in the occurrence of ED, and whether this regimen will minimize the incidence of unwanted psychosocial implications associated with ED. The review also discusses the economic implications of third party payer polices regarding ED.

Methods: A systematic search and review of literature on ED revealed that patients with this disease are often faced with several negative psychological and social stressors such as low self-esteem, depression, relationship problems, and anxiety. Standard depression indices such as the Beck Depression Inventory (BDI), Hamilton Depression Rating Scale (HAM-D), and Primary Care Evaluation of Mental Disorders (PRIME-MD) questionnaire were used to confirm the association of depression and depressive-like symptoms often found in patients challenged with ED. The International Index of Erectile Function Erectile Function domain (IIEF-EF), Self-Esteem and Relationship (SEAR) questionnaire, and Sexual Encounter Profile Questions 2 (SEP-2) were used as outcome measures for ED in many of the trials reviewed.

Results: An in-depth literature review of several clinical studies led to a significant amount of data supporting daily use of PDE-5 inhibitors. All three PDE-5 inhibitors have been clinically shown to be safe and effective for daily administration. However, tadalafil was found to have the most abundant supporting clinical data for daily administration amongst the three PDE-5 inhibitors. The association of ED and depressive-like symptoms was made clear in several studies as well. Manson et al revealed that ED does indeed lead to psychosocial complications and mental stresses including fear, loss of image and self-confidence, and depression. There was a statistically significant increase in the occurrence of

depressive-like symptoms in men with ED (54 percent) versus men without ED (21 percent). Data from this study also reveal that effective treatment of ED improves overall quality of life, including the unwanted depressive-symptoms and potential marital conflict that may occur as a result of ED. Next, Sugmori et al examined the relationship between depression, anxiety, and ED in men aged 40 to 64 years. Results showed a significant association between ED and depression in age groups 45 to 49 (OR 3.42, 99 percent CI; 1.51-7.76) and 50 to 54 years (OR 2.43, 99 percent CI; 1.11-5.35), and anxiety in the 50 to 55 year old age group (OR 2.48, 99 percent CI; 1.12-5.47). Additionally, several studies gave light to the evidence supporting the efficacy of daily PDE-5 inhibitors in the treatment of ED. Seftel et al. revealed that daily tadalafil is effective in improving erectile function, sexual quality of life, and sexual satisfaction of the participant and his partner. Furthermore, results from this placebo-controlled trial illustrated tadalafils superiority in improving confidence (25 versus 3) and self-esteem (29 versus 6), (P less than 0.001). Mean increase in the SEAR total score for participants was higher for the tadalafil arm versus placebo (30 versus 5; P less than 0.001). McMahon et al. conducted an open-label, parallel arm crossover design study that compared on-demand tadalafil 20 mg versus daily dosing of tadalafil 10 mg for a total of 26 weeks. IIEF-EF domain scores increased from a baseline of 14.6 to 23.3 and 14.6 to 26.4 in the on-demand and daily tadalafil arms, respectively. Successful penetration as evaluated by SEP2 improved from 36 percent at baseline to 67 percent and 80 percent in the on-demand and daily tadalafil arms, respectively (both arms vs. baseline P less than 0.001.) Patients additionally had a 30 percent mean rate of completing intercourse successfully at baseline (SEP3), but after treatment, 67 percent of on-demand and 80 percent of the daily treatment groups had successful intercourse when compared to baseline (P less than 0.001). Finally, Porst et al. conducted a long-term, open-label, once-daily study of tadalafil that extended two previous trials that lasted either 12 or 24 weeks and extended them for either 1 or 2 years, respectively. After one year of treatment patients improved their IIEF-EF by 10.4. After two years of treatment IIEF-EF scores increased by 10.8, and more than 90 percent of patients answered yes to GAQ1 and GAQ2. Treatment was tolerable for both groups with only 7.6 percent of patients in both trials experiencing a serious adverse event. Wrishko et al. used clinical data provided in two studies evaluating the use of daily tadalafil 2.5, 5, and 10 mg to compare the drugs pharmacokinetic and pharmacodynamic profile versus on-demand dosing. Pharmacokinetic parameters were evaluated using the peak plasma concentrations at steady-state and the area under the concentration-time curve at steady state. Data from both studies were used to extrapolate the pharmacokinetic profile of daily tadalafil dosing versus on-demand dosing. Results showed that tadalafil plasma concentrations should be sustained around 55 ng/mL for maximal clinical effect. Evaluation of pharmacokinetic data reveals that once daily dosing of tadalafil 5 mg provides a sustained level of efficacy for a full 24-hour interval. The sustained 24-hour concentration of once daily tadalafil 5 mg could only be matched by on-demand dosing when tadalafil 20 mg was taken either two or three times a week. Seidman et al conducted a trial that assessed the treatment of ED in men with depressive symptoms. Participants were either given sildenafil or a matching placebo. Treatment of ED with sildenafil illustrated improvements in depression. HAM-D scores decreased in participants who responded to sildenafil treatment (10.6 decrease) and in non-responders (2.3 decrease). Althof et al. conducted a 12-week, double-blind, placebo-controlled international study to assess the impact of sildenafil on psychosocial elements including self-esteem, confidence, and sexual relationship satisfaction in men with ED. The primary efficacy measure was

change in self-esteem from baseline to the end of treatment using the Self-Esteem subscale of the SEAR. Self-Esteem subscale scores significantly improved with the sildenafil arm. In the 4 countries used to recruit participants evaluated, mean change from baseline to endpoint ranged from 33.6 to 46.3 points in the sildenafil arm, compared with change of negative 7.6 to positive 25.7 in the placebo arm. Hatzichristou et al. conducted a 12-week double-blind, placebo-controlled flexible-dose study to assess the effect of vardenafil on quality of erection, satisfaction with the sexual experience, symptoms of depression, and overall confidence in men with ED. Vardenafil treated patients experienced significantly greater erection hardness satisfaction (P less than 0.005). Satisfaction with the sexual experience was greater in the vardenafil group (P less than 0.005). Patient yes responses to the question assessing penis enlargement and ejaculation success rates were greater with vardenafil. There was no statistically significant difference between the treatment and placebo arm for non-depressed men. Several studies also examined the cost-burden implications of ED. Smith et al. evaluated the cost effectiveness of sildenafil in men greater than 60 years by creating a Markov decision model. Participants receiving sildenafil gained 0.35 more QALYs than the untreated group at a cost of 3970 dollars, with an incremental cost-effectiveness ratio of 11,290 dollars. From a third-party payer perspective, 3950 dollars was spent for the same QALYs gained and the incremental cost-effectiveness ratio was 11,230 dollars. Sun et al. analyzed the direct cost of ED in a managed care setting. In 2001, ED imposed a 122,669 dollars annual burden to a health plan of 100,000 people, or 0.11 cents per member each month. Patients with ED spent 119.26 dollars annually for all ED related services and treatments. Of the 7 most commonly used treatments at that time, PDE-5 inhibitor therapy had the lowest annual cost.

Conclusion: Once daily dosing of PDE-5 inhibitors should be considered for optimal treatment of ED. Data found from several studies show that a daily regimen of PDE-5 inhibitors is effective and leads to a profound improvement in sexual satisfaction. Although all three PDE-5 inhibitors can be used once daily, tadalafil has the most extensive data supporting daily administration. In addition, studies reveal that patients prefer tadalafil as their PDE-5 inhibitor of choice. The abundance of clinical data available has led to recent FDA-approval of daily administration of tadalafil. With the evidence supporting such an improvement in sexual quality of life, it can be deduced that daily regimens of PDE-5 inhibitors should be considered for third party reimbursements. Third party formulary coverage for regimens of daily PDE-5 inhibitors will optimize treatment of ED and may potentially lead to cost-savings.

5-095

Category: Drug-Use Evaluation

Title: Evaluation of vancomycin use in a health system community hospital

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Purpose: Vancomycin has been the first choice drug for methicillin-resistant Staphylococcus aureus (MRSA) infections in hospitalized patients. The purpose of this study was to evaluate vancomycin therapies and optimize utilization according to findings.

Methods: Data from hospitalized patients in vancomycin therapy was collected during a two week period. Expedients were selected based in vancomycin orders by a printed report from the computerized pharmacy system. According to the report there were 15 patients in vancomycin therapy. Twelve expedients were fully evaluated for indications, cultures with vancomycin sensitivities, conversion to other antibiotic therapies and therapeutic levels.

Results: The indications for vancomycin therapy were pneumonia (5), bacteremia (2), skin infection (4) and cellulitis (1). There were five cultures with microorganisms susceptible to vancomycin, two culture sensitivities revealed resistance and other two were negative; there were two cases without documented cultures and one case of a gram negative bacteria without sensitivities for vancomycin. Resistant cases were changed to linezolid and rifampin respectively (2); another therapy was changed to linezolid due to poor improvement to vancomycin therapy (1); one therapy was deescalating to cefoxitin because of methicillin susceptible Staphylococcus aureus (MSSA) evidence, the other eight therapies were kept in vancomycin. Therapeutic levels (trough) were drawn only in 4 patients.

Conclusion: Vancomycin utilization was appropriate according patient diagnosis and culture susceptibilities. The hospital has a written policy for drawing vancomycin levels, but according to the study results it has not been fully implemented by nursing staff. Orientation of nursing staff regarding vancomycin levels will be the following steps in order to optimize vancomycin utilization.

5-096

Category: Drug-Use Evaluation

Title: Evaluation of colchicine use in a Rural VA Health Care System

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Purpose: Colchicine, a commonly prescribed medication for gout, has been widely utilized for years as an unapproved drug by the Food and Drug Administration (FDA). In July 2009, the FDA approved the first single ingredient oral colchicine product. At that time, the FDA highlighted important safety considerations in the use of colchicine, including usual doses could be life threatening and fatal in certain patient populations and using lower doses for the treatment of acute gout flares. In October 2010, The Veterans Affairs Pharmacy Benefit Management Services released Clinical Guidance in the Management of Gout to ensure appropriate use of colchicine. The purpose of this medication use evaluation was to determine if the use of colchicine within our healthcare system met the PBM Clinical Guidance.

Methods: The institutional review board approved this retrospective chart review. Patients were included in the chart review if they had an active prescription for colchicine in November 2010. The computerized medical record was reviewed for the following data: age; gender; colchicine start date, dose, frequency and indication; use of urate lowering medication; uric acid level; creatinine clearance; liver function test; and p-GP and CYP3A4 inhibitor medications.

Results: Out of the 59 patients with an active colchicine prescription, 30 patients were treated for acute gout flares and 29 patients were treated for gout prophylaxis. Only 16% of patients with an active prescription for acute gout flares were following the new clinical recommendations. All patients receiving prophylaxis colchicine (defined as daily or twice daily dosing) were on therapy for greater than six months with 65% also receiving concomitant urate lowering medication. Colchicine dose adjustments for severe renal dysfunction and drug interactions occurred 18% and 40% respectively. By following the FDA recommendations for the use of colchicine, the healthcare system could potential save $6000 per month.

Conclusion: Colchicine use within the healthcare system was not following the new FDA recommendations or the VA PBM clinical guidance on the management of gout. Extensive provider and pharmacist education and the development of a gout management order set was developed to improve the prescribing of colchicine and reduce the risk of serious adverse events related to colchicine therapy.

5-097

Category: Drug-Use Evaluation

Title: Impact of evidence in literature on the prescribing of ezetimibe in a county hospital

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Purpose: The ezetimibe and simvastatin in hypercholesterolmia enhances atherosclerosis regression (ENHANCE) trial was a 2-year, randomized, double-blind, controlled trial, designed to test whether treatment of hypercholesterolemia using ezetimibe in combination with simvastatin was more beneficial on carotid artery intima-media thickness than simvastatin monotherapy. The result of the trial which was published on April 24, 2008 in the New England Journal of Medicine showed minimal benefit of ezetimibe, or the combination with simvastatin in reducing, or shrinking buildup in artery walls. Although an intermediary endpoint, the results of this study can be extrapolated as evidence that ezetimibe users might be more prone to cardiovascular disease. Prior to the publication of the trial, Merck/Schering Plough (the manufacturers of ezetimibe) issued the preliminary results at a press release on Jan 14, 2008 alerting physicians and patients of the trials findings. The purpose of this analysis was to evaluate the effect of the ENHANCE trial on the prescribing patterns of ezetimibe alone and in combination with simvastatin, at the Harris county Hospital District (HCHD).

Methods: A retrospective analysis was done using data from all ezetimibe and ezetimibe in combination with simvastatin, prescribed at the HCHD between July 2007 to July 2010. Total quantities of ezetimibe, and its combination with simvastatin prescribed between Jul 2007 and July 2010 were analyzed. The data covered six months prior to the press release by Merck/Schering Plough, and 27 months, after the publication of the trial results. All data was collected from the monthly NDC summary report of the HCHD.

Results: Results obtained from this analysis revealed a downward spiral in the prescribing pattern of ezetimibe, and ezetimibe in combination with simvastatin, after the trial was published although there was no change in the formulary status of these agents. There was a 25% decline in the number of ezetimibe, and ezetimibe in combination with simvastatin within a year after the press release. There was also a 30% decline in the prescribing pattern a year after the entire ENHANCE trial was published. As of July 2010, there has been a total of 60% decline since the press release. The decline prior to ENHANCE trial publication can be attributed to the press release by Merck/Schering Plough which was published in major news papers like Jan 14, 2008 New York times and on the FDA website.

Conclusion: Based on the results above, physicians and patients did consider the evidence obtained from the ENHANCE trial in making treatment decisions.

5-098

Category: General Clinical Practice

Title: Analysis of COPD exacerbations based on two operational definitions in the pivotal trials of roflumilast

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Purpose: Exacerbations of chronic obstructive pulmonary disease (COPD) can have a major impact on patients, as exacerbations lead to decreased lung function, accelerated COPD progression, and also decreased quality of life; thus, the prevention of exacerbations is very important. Patients experiencing exacerbations will often require changes in treatment or hospitalization and may report exacerbations to pharmacists. Roflumilast is a new, once-daily, oral, selective phosphodiesterase 4 inhibitor that is approved to reduce the risk of COPD exacerbations in patients with severe COPD associated with chronic bronchitis and a history of exacerbations. In the roflumilast pivotal trials, moderate or severe exacerbations were assessed by medical intervention (moderate=oral/parenteral corticosteroid use; severe=hospitalization/death). However, assessments of exacerbations reported in clinical studies can be affected by the different definitions used. In this post hoc analysis, we examined primary outcome measure exacerbation events from the two roflumilast pivotal trials using two alternative exacerbation definitions based either on symptoms or rescue medication use, characteristics which may be reported to pharmacists.

Methods: Data were pooled from two 52-week pivotal trials of roflumilast (500mcg once-daily) in subjects with severe-to-very-severe COPD, chronic bronchitis, and a history of exacerbations. Each exacerbation event based on the primary outcome definition was analyzed using two alternative definitions. Exacerbations associated with symptoms were defined by either worsening of cough/sputum for two consecutive days within +/-5 days of moderate/severe exacerbation onset or worsening of total symptom score (0.5) within +/-3 days from average of 6 days prior to +/- 3 days window. Exacerbations associated with rescue medication were defined by an increase in rescue medication (3 puffs/day for 2 consecutive days) within +/-5 days of moderate/severe exacerbation onset.

Results: A total of 1537 subjects received roflumilast and 1554 placebo. Based on primary outcome measure definitions there were 2978 moderate or severe exacerbations (roflumilast=1299; placebo=1679); of these the post hoc analysis found that 1833 were associated with symptoms (796 for roflumilast; 1037 for placebo) and 287 were associated with rescue medication (113 for roflumilast; 174

for placebo). The rate ratio of exacerbations associated with symptoms for roflumilast compared with placebo was 0.824 (95% CI 0.730, 0.931, P=0.0018). Similarly for exacerbations associated with rescue medication use, the rate ratio was 0.697 (95% CI 0.504, 0.964, P=0.0289). When exacerbations with two definitions were combined, the rate ratio was 0.802 (95% CI 0.712, 0.904, P=0.0003).

Conclusion: Medical intervention-based exacerbation definitions in the pivotal roflumilast trials were substantiated by this analysis of symptomatic and rescue medication exacerbation definitions that may be reported by patients to pharmacists. This post hoc analysis proves that the efficacy of roflumilast for reducing the risk of exacerbations is robust.

5-099

Category: General Clinical Practice

Title: Integration of a clinical pharmacist across the full spectrum of palliative care services

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Purpose: Given the complexity of illness, frailty and polypharmacy experienced by hospice and palliative care patients, medication side effects, interactions and cost become central concerns. Palliative care and pharmaceutical care both aim to achieve the best quality of life for patients. Incorporating a pharmacist into the interdisciplinary care of hospice and palliative care patients across all settings of care is a logical step in the comprehensive management of symptoms in a safe and cost-effective manner.

Methods: A pharmacist with advanced training (PGY2 specialty residency) in pain and palliative care was integrated into the care of patients across the full spectrum of hospice and palliative care services including inpatient and extended care facility palliative care consult services, an inpatient acute palliative care unit, a palliative care outpatient clinic and home and extended care facility based hospice care. The pharmacist functions as a full member of five interdisciplinary teams and serves as a resource for drug information in this patient population for which evidence-based guidelines are limited and where reliable routes of medication administration change frequently. The pharmacist works with physician and nurse members of the inpatient and outpatient services utilizing available evidence to develop and revise consistent and cost-effective medication regimens for inpatient and outpatient symptom management. Central to the pharmacist role is education for patients, staff and physicians and collaboration regarding the safe and effective use of medications which may be off-label and outside the comfort level of healthcare providers and caregivers. The pharmacist developed and conducted various continuing education programs for nurses, physicians and pharmacists and participates in the orientation process for incoming palliative care fellows, hospice nurses and inpatient pharmacists. The pharmacist precepted students during Advanced Pharmacy Practice Experience rotations and PGY1 pharmacy residents during elective hospice and palliative care rotations, focusing not only on medication management of symptoms but also on the role of the pharmacist in an interdisciplinary team.

Results: A clinical pharmacist was successfully integrated into the care of patients across the full spectrum of hospice and palliative care services. Impact on the system includes medication cost savings (dollars per patient per day for the hospice patients), increased educational opportunities for pharmacists, nurses and physicians, and the development of and adherence to symptom management protocols.

Conclusion: Incorporating a clinical pharmacist into an integrated hospice and palliative care service resulted in substantial cost savings, increased educational opportunities for physicians, pharmacists, staff and students, and improved quality of life for patients.

5-100

Category: General Clinical Practice

Title: Pharmacist participation in interdisciplinary team rounds: a transitions of care initiative

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Purpose: Transitions of care from inpatient to outpatient providers have become quality indicators for hospitalized patients. Medication management and patient education were identified as key elements of successful, uniform coordination of care across the healthcare continuum. This project was designed to utilize clinical pharmacists to optimize medication management and education prior to patient discharge via participation in interdisciplinary team rounds.

Methods: Clinical pharmacists were trained to identify medication related opportunities to improve transitions of care. Focus areas for intervention included medication reconciliation, IV to PO conversion, assessment of patient ability to obtain medications at discharge, necessity for outpatient intravenous antibiotics, and the provision of education for patients being discharged on five or more chronic medications, long acting narcotics, or anticoagulants. Tools were developed in the electronic health record to complement the pharmacists' activities. A paper data collection tool was also utilized to facilitate documentation. Pharmacists attended daily interdisciplinary team rounds prior to inpatient medical rounds. The interdisciplinary team was comprised of a physician, pharmacist, nurse, care manager, nutritionist, physical therapist, and respiratory therapist. Pharmacists communicated and worked collaboratively with the team to resolve medication management issues and promote a seamless transition from inpatient to outpatient care.

Results: Decentralized clinical pharmacists participated in interdisciplinary team rounds beginning in June 2009 on one inpatient care unit. The program progressively expanded to encompass eight inpatient care units. The facilitator for interdisciplinary interaction was identified as the inpatient hospitalist physician. All patients on each care unit were reviewed by the interdisciplinary team daily. The need for early identification of target discharge date and time was identified as a critical component to facilitating successful transition and timely medication teaching prior to discharge. A tool was created in the electronic health record to document anticipated discharge dates for all patients. This date was updated daily during the interdisciplinary team meeting. Pharmacists reported any need for medication reconciliation, IV to PO conversion, prescription insurance assistance, and medication teaching for each patient daily. Pharmacists also served as liaisons to outpatient anticoagulation clinics and home infusion centers to facilitate discharge planning and follow up. They also provided any patient education necessary prior to discharge and reported completion of the teachings to the team. Pharmacists were also identified as a valuable resource for drug information questions arising during the meetings.

Interdisciplinary team participants surveyed indicated that the meetings promoted an integrated holistic approach to patient care, facilitated exchange of information, and fostered professional interaction between providers. Readmission rates and length of stay for patients reviewed by the interdisciplinary process have been compared. Although not statistically significant, a downward trend in readmissions has been observed.

Conclusion: Pharmacist participation in interdisciplinary team rounds promoted optimization of medication management and patient education which supported successful, uniform transitions of care from inpatient to outpatient providers.

5-101

Category: General Clinical Practice

Title: Assessing the proper use of asthma medications among patients with recent hospitalizations or emergency department visits for acute asthma exacerbation

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Purpose: Acute asthma exacerbations are a major preventable burden on the healthcare system. The United States Center for Disease Control reported that in 2002 asthma caused 4,261 deaths, 1.9 million Emergency Department (ED) visits, and 484,000 hospital admissions. It has been hypothesized that poor compliance with inhaled medications is a major reason for inadequate asthma control. The purpose of this project was to assess the prevalence of misconceptions among patients concerning the proper use of their inhaled asthma maintenance medications.

Methods: The subjects of the study were patients who presented to the Shands Jacksonville Medical Center between June 1, 2010 and October 1, 2010 for acute asthma exacerbation as defined by primary ICD-9 diagnosis code who were discharged with prescriptions for budesonide/formoterol (Symbicort) or fluticasone/salmeterol (Advair). Patients had to fill their prescriptions at the Shands Jacksonville Ambulatory Pharmacy and have an active phone number. After discharge patients were contacted by telephone and read a questionnaire designed to assess their understanding of proper inhaler technique, the source of their medication counseling, and degree of comfort with their medication. The primary study endpoint was the proportion of patients able to correctly describe their medication regimen (i.e. number of puffs and frequency). Secondary endpoints included: Incidence of counseling, source of counseling (i.e. physician, pharmacist, nurse, respiratory therapist, other) reported by patients; location of medication counseling (i.e. hospital, pharmacy, clinic, other) reported by patients; degree of comfort with medications expressed by patients; and rate of hospitalization in the previous year among enrolled patients. The responses between these groups were compared to assess the effectiveness of inpatient counseling on proper medication administration.

Results: Of the thirty-eight patients enrolled, fourteen (37%) were able to correctly describe their medication regimen as prescribed and twenty-four (63%) could not. The most common misconceptions reported by patients were the use of their inhalers on an as needed basis (n=14) as well as using their inhaler once daily as opposed to recommended twice daily dosing (n=8). This occurred despite the fact that 36/38 (94%) of patients reported being very comfortable with their medication regimen. Twenty-five of the thirty-eight patients enrolled (66%) reported being counseled on their medications. Patients who correctly described their regimen were more likely to report being counseled compared to those

who did not correctly describe their regimen [14/14 (100%) vs. 11/24 (45%), p=.0009.] The most common sources of counseling reported were physicians (n=21) and pharmacists (n=9). The most common location of counseling was in the hospital (n=12). There were no statistically significant differences found when comparing the reported source or location of counseling for correct responders versus incorrect responders. Patients unable to correctly describe their medication regimen were shown to average more hospital visits in the year proceeding enrollment when compared to those who correctly described their regimen (8.08 visits/year vs. 3.92 visits/year, p=.0183)

Conclusion: The high rate of misconceptions about proper medication usage among patients presenting to the hospital may be attributable to the lack of medication-related education or that counseling was done when patients may not be receptive to learning (i.e. periods of acute illness). Quality patient counseling may help to increase understanding of medications. Increased understanding was associated with a decreased incidence of hospital visits. Since patients with poor understanding of their medications present to the hospital more frequently, clinicians have more chances to provide counseling, which may improve patient understanding and overall outcomes.

5-102

Category: General Clinical Practice

Title: Dosing of sitagliptin in renally impaired patients at an academic medical center

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Purpose: Renally dosing medications is an integral part of pharmacist-optomized patient care. Sitagliptin, a dipeptidyl-peptidase-IV inhibitor used in the management of type 2 diabetes mellitus, is excreted through the kidneys and requires dose adjustment in patients with renal impairment. This project was designed to educate prescribers regarding sitagliptin dosing and to ensure that patients within the hospital receive the appropriate dose.

Methods: The pharmacist reviewed the dose and renal function for all patients hospital-wide on sitagliptin on a daily (Monday through Friday) basis for approximately one year. The Cockgroft-Gault formula was used to estimate renal function. The pharmacist would contact the prescriber if the patient was on 100mg and the renal function was less than 50mL/min or if the patient was on 50mg and the renal function was less than 30mL/min. Based on the conversation with the prescriber, the dose would be changed accordingly.

Results: A total of 384 patients were reviewed. There were 67 recommendations with an 85% acceptance rate (57 recommendations). 27 patients were switched from 100mg to 50mg, 23 patients were switched from 50mg to 25mg , 5 patients were switched from 100mg to 25mg, 1 patient from 200mg to 25mg and 1 patient from 50mg to discontinuing the medication. Approximately 15% (10 recommendations) were not accepted with the main reason cited being that the patient had an endocrinologist managing their diabetes.

Conclusion: A pharmacist driven renal dosing monitoring program for sitagliptin was well accepted by practitioners throughout the institution. The pharmacist is a valuable resource in appropriately dosing medications.

5-103

Category: General Clinical Practice

Title: Appropriate use of erythropoietin stimulating agents through pharmacy interventions

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Purpose: Erythropoietin stimulating agents (ESAs) play a major role in the management of anemia. However, due to the increasing evidence of serious life threatening side effects associated with ESAs, strategies to enhance their efficacy and reduce harm have been recommended. One such recommendation is to maintain transferrin saturations with intravenous iron supplementation. This has been proven to help achieve target hemoglobin levels and decrease ESA requirements. The purpose of this study is to implement a protocol which allows a pharmacist to optimize patients iron saturations prior to initiation or continuation of darbepoetin alfa therapy.

Methods: This study is IRB approved. Phase I consisted of a retrospective chart review of patients who received darbepoetin alfa prior to the implementation of a pharmacist driven protocol. Phase II consisted of a prospective review and evaluation of patients who were prescribed darbepoetin alfa. The primary outcome was to ensure the optimal use of darbepoetin alfa by having transferrin saturation greater than 20 percent, achieving target hemoglobin levels, and obtaining corresponding labs. Secondary outcomes included amount of darbepoetin alfa doses dispensed, amount of elemental iron used, and number of pharmacist interventions. The study outcomes were compared between phase I and phase II.

Results: Prior to protocol implementation, initial use of darbepoetin alfa was appropriate in 59 out of the 172 (34.3 percent) doses dispensed. Post-protocol implementation, darbepoetin alfa use was deemed appropriate in 99 of 126 doses dispensed (78.6 percent, p is less than 0.05). When comparing the retrospective phase to the prospective phase, the average number of darbepoetin alfa doses dispensed per patient was 1.87 versus 1.31 (p equals 0.021). The average darbepoetin alfa dose was 102.3 versus 85.2 micrograms per week (p is less than 0.01). The average amount of intravenous iron per patient was 624.2 milligrams versus 712.2 milligrams (p equals 0.054). The percentage of patients receiving intravenous iron supplementation was 33.7 percent versus 51.5 percent. During the prospective phase, 83 interventions were made.

Conclusion: Appropriate use of darbepoetin alfa was increased when a pharmacist was involved in evaluating indication, hemoglobin levels, and transferrin saturation levels.

5-104

Category: General Clinical Practice

Title: Pharmacist discharge counseling: effects on discharge medication errors on a medical surgical unit

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Purpose: In August 2010 a pharmacist led discharge counseling program was initiated at a community hospital on a 32 bed, teaching, medical surgical unit. In addition to the counseling, the pharmacists completed discharge medication reconciliation. Errors were identified during the process. Such errors on the discharge medication list may lead to patient or caregiver confusion as well as increases in readmission rates. The objective was to compare the number of discharge errors and readmission rates before and after implementation of a pharmacist discharge counseling and reconciliation program.

Methods: The study was conducted as a retrospective chart review of pre and post program data. March and April 2010 served as the pre-program time period. March and April 2011 served as the post-program time period, seven months after initiation of the service. One hundred randomly selected subjects were included from each time period. Inclusion criteria consisted of subjects discharged from the medical surgical unit. Subjects were excluded if they left against medical advice, did not have discharge instructions completed, or were transferred to another acute inpatient facility. The subjects medications on the discharge instructions were compared to medications administered during hospitalization and the admission medication list. The following information was collected: discharge date, if subject was readmitted to the facility within 30 days, medication with error, and type of error. The Chi-square test was used for analysis of change in percent of discharge instruction errors. The investigational review board approved the study.

Results: Pharmacist intervention at discharge significantly decreased the number of errors from 76 percent to 47 percent pre and post-program initiation, respectively (Chi-square 17.759, P less than 0.0001). Error totals pre and post-program initiation were 188 and 84, respectively. For subjects that had a medication error on the discharge instructions, the number of medication errors per subjects was 2.5 (range: 1 to 17) pre-program initiation and 1.8 (range: 1 to 8) post-program initiation. Readmission rates were not significantly affected through pharmacist intervention, 7 percent and 10 percent, pre and post-program initiation, respectively (Chi-square 0.579, P equals 0.4469).

Conclusion: Implementation of a pharmacist discharge counseling program significantly decreased the number of discharge medication errors. The readmission rates were not statistically affected by pharmacist discharge counseling. Larger studies should evaluate if pharmacist reconciliation and counseling affect readmission rates.

5-105

Category: General Clinical Practice

Title: Dofetilide outpatient discharge process improvement

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Purpose: Dofetilide is a class III antiarrhythmic agent, restricted by manufacturer due to its risk of QTc prolongation resulting in torsades de pointes. Patients initiated or re-initiated on dofetilide must be placed in a facility for a minimum of 3 days to provide continuous electrocardiographic monitoring. At our institution, an inpatient dofetilide protocol exists, outlining prescribing physician, nursing and pharmacist responsibilities during hospital stay as well as at discharge. Despite our protocol, the dofetilide discharge process can be prolonged if the outpatient retail pharmacy does not participate in the dofetilide education program resulting in missed medication doses and need for re-hospitalization and medication re-initiation. The primary goal of this project was to standardize and streamline the current outpatient discharge process for patients initiated on dofetilide therapy.

Methods: A multidisciplinary group was formed and included representation from cardiology chairs, inpatient and outpatient pharmacists and nursing. The group met on monthly basis. A paper form was developed to guide transition between the inpatient and outpatient settings and served as a prescription for first seven day supply of dofetilide and subsequent drug refill options at outpatient retail pharmacy of the patients choice. A pilot of the paper form was initiated in one of the cardiac units to streamline and refine the process. Education was provided to the certified physicians, nurses and inpatient and outpatient pharmacy staff.

Results: A paper form was created outlining the dofetilide discharge prescription filling options for initiation of therapy and was trialed successfully. Certified prescribers, pharmacists and nurses were educated on the new dofetilide discharge process. House-wide implementation of dofetilide outpatient prescription is slated for fall 2011, including protocol updates and computerized physician order entry changes.

Conclusion: In order to improve our current dofetilide discharge process, a multidisciplinary team focused on this quality improvement initiative to streamline the dofetilide discharge process within our organization. Development of dofetilide discharge prescription form, unit specific education of nurses, certified prescribers and pharmacists and initiation of a pilot were implemented. Despite these changes, there are additional opportunities for improvement, including house-wide education, dofetilide guideline and CPOE changes as well as ongoing monitoring.

5-106

Category: General Clinical Practice

Title: An Audit of Electronic Prescribing in Intensive Care

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Purpose: To compare the number and type of medication errors pre and post the introduction of electronic prescribing in Intensive Care

Methods: -Prospective study with consecutive sampling. -10-day data collection period. -Comparable data collection to previous prescribing audit. -Results compared to previous audit.

Results: 66 prescribing errors pre vs. 43 post electronic prescribing The introduction of CPOE has eliminated some common errors associated with handwritten prescriptions e.g. incomplete or illegible prescriptions. The prescribing of drug name, dose, route & frequency are now mandatory fields and cannot be omitted. Every prescription can be traced to the prescriber, as every user of the system has a unique password protected identity. The number of patients with incomplete allergy status has declined from 37 to 3, as it is a mandatory field. The number of duplicated prescriptions has increased with the use of CPOE from 3 to 8. Drug prescribed for the wrong patient (n=1). IV infusions appearing as active although the patient is no longer receiving them (n=20).

Conclusion: Electronic prescribing reduces prescribing errors but it does not eliminate them. It changes the nature of the error and can introduce new errors. This audit has helped identify what modifications and improvements are required for the system. As a result of this audit, a set of prescribing rules have been drawn up to help improve the safety of CPOE. Each prescriber and every computer now has a laminated list of these rules

5-107

Category: General Clinical Practice

Title: Pharmacists' interventions in decreasing the length of stay of COPD patients

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Purpose: St. Rita's Medical Center's average length of stay (LOS) in 2009 for patients with COPD and a major complication/comorbidity population was 5.66 days. This is 0.96 or almost 1 day over expected geometric length of stay (GMLOS) of 4.7 days. A multidisciplinary team was created to use LEAN/Six-Sigma tools to help improve LOS, improve quality of care, increase customer satisfaction, and decrease costs to the organization and patient.

Methods: The multidisciplinary team identified two major interventions to help decrease the LOS. First, a clinical pharmacist would review each COPD patient daily. The clinical pharmacist ensured the use, dose, and route of administration of both systemic corticosteroids and antibiotics was appropriate based upon the most recent evidence-based guidelines. Interventions included IV to PO interchanges, corticosteroid tapering, antibiotic stewardship, and physician education on appropriate corticosteroid dosing in COPD exacerbations. The second major intervention was a pharmacy and nursing collaboration to write a new evidence-based COPD exacerbation order set.

Results: After implementation of the two major interventions, the medical center saw a decrease in the LOS. The first quarter post-implementation showed a reduction to 4.29 days and a second quarter reduction to 5.04 days. The pharmacists rounded daily ensuring the appropriate use and dose of corticosteroids and antibiotics. Education was provided via newsletters and letters to physicians and nursing staff. The order set was approved by medical staff and utilized.

Conclusion: Pharmacists' interventions, education initiatives, and collaboration on building an order set helped lead to a decrease in length of stay in COPD patients with a major complication/comorbidity. The increase in LOS from first to second quarter demonstrates the need for continual physician education and diligence needed to ensure optimal results.

5-108

Category: General Clinical Practice

Title: Development, implementation and initial evaluation of the pharmacist's role on an inpatient palliative care service

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Purpose: Pharmacists are integral components of many interdisciplinary services. In 2002, the American Society of Health-System Pharmacists (ASHP) issued a position statement on the pharmacists role in hospice and palliative care. ASHP recommends that pharmacists be integral members of these interdisciplinary teams. Palliative care patients benefit from the pharmacists' knowledge of drug therapy to treat a variety of conditions, including pain, constipation, nausea, depression and delirium. Pharmacists are particularly skilled at presenting drug information to a variety of healthcare professionals, patients and caregivers. The purpose of this study was to briefly characterize the development and implementation of the role of the pharmacist on the palliative care team as well provide an initial evaluation of the impact of the pharmacist on patient care.

Methods: An excel spreadsheet was used to capture all pharmacist interventions for palliative care patients. Data was collected from 6/10/10 to 6/10/11. The type and description of the intervention and physician response were recorded.

Results: The internal medicine pharmacy service at the institution assumed responsibility for rounding with the palliative care team. The team was comprised of a physician, an advanced practice nurse, a pharmacist, a social worker and a chaplain. Interdisciplinary rounds were attended daily. Pharmacists made recommendations directly to the resident or attending physician. Pharmacists attended family meetings and saw patients as appropriate. Ninety-nine patients were evaluated and 118 recommendations were made over the first year. Broad categorizations of recommendations were: pain control (49 percent), symptom control (49 percent) and other (2 percent). Pain recommendations consisted of opioid initiation and titration, opioid dose conversions and utilization of adjuvant analgesics. After implementation of accepted recommendations, pain control was reassessed and improved in the majority (91 percent) of patients. Symptom control was categorized into constipation (40 percent), nausea (17 percent), depression (13 percent), delirium (8 percent) and other (22 percent). Ninety percent of pharmacist recommendations were accepted by the patients primary care team.

Conclusion: A pharmacist was successfully incorporated into an interdisciplinary palliative care team. Patients, family and nurses reported improved pain control after pharmacist intervention. Pharmacists recommendations had a high physician acceptance rate and contributed to the overall acceptance of a palliative care program at our institution.

5-109

Category: General Clinical Practice

Title: Evaluation of the use of proton pump inhibitors and histamine-2 receptor antagonists in hospitalized patients

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Purpose: Proton pump inhibitors (PPIs) and histamine-2 receptor antagonists (H2RAs) are commonly used for the prevention of stress related mucosal disease in hospitalized patients. There is no indication for the routine prophylactic use of these agents except with certain risk factors such as mechanical ventilation >48 hours and coagulopathy. The use of these agents is associated with increased risk of Clostridium difficile associated diarrhea (CDAD) and pneumonia. The purpose of this study was to evaluate (1) appropriateness of the use of PPI/H2RA in the hospital and upon discharge, (2) incidence of CDAD and pneumonia in the hospital, (3) concomitant use of clopidogrel and PPI, and (4) medical residents knowledge of GI prophylaxis indications.

Methods: A retrospective chart review of adult patients on oral or intravenous PPI/H2RA from December 12th to 18th, 2010 was conducted. Exclusion criteria included active GI bleeding, continuous infusions or twice daily dosing of PPI and use of PPI/H2RA prior to admission. The data gathered included age, gender, admission diagnosis, comorbidities, patient location, indication for GI prophylaxis, admitting service, teaching status of the patient, clopidogrel use, duration of drug therapy and hospital acquired CDAD or pneumonia. The appropriateness of the indication was based on the guidelines set forth by ACCF/ACG/AHA 2008 and 2010 Expert Consensus Documents. Medical residents knowledge was assessed by a questionnaire. Logistic regression models were used to analyze the data. This study was approved by the institutional review board.

Results: Out of the 515 charts reviewed, 256 patients were included for final analysis. Twenty percent of these had appropriate use of PPI/H2RA in the hospital. Twenty-seven percent were discharged on PPI/H2RA of which 23% were appropriate. Three percent developed CDAD and 2% developed pneumonia in the hospital. Five point eight percent of patients on PPI were also on clopidogrel. A total of 17 medical residents filled out the knowledge questionnaire with an average score of 22%. Results from logistic regression showed that more inappropriate use in the hospital was associated with floor admissions [odds ratio (OR) = 0.20, $p<0.001$], absence of comorbidities (OR = 0.22, $p<0.001$), non-teaching patient status (OR = 0.37, $p = 0.016$) and male gender (OR = 0.34, $p = 0.009$).

Conclusion: This study showed that at our medical center, appropriate use of PPI/H2RA during the hospital course and at discharge was low. Resident physicians knowledge of the indications was poor. The estimated cost savings associated with eliminating the inappropriate use of PPI/H2RA was calculated to be approximately $100,000 per year.

5-110

Category: General Clinical Practice

Title: Outcomes of implementing hypoglycemia and hyperglycemia management protocols at an inpatient rehabilitation hospital

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Purpose: Effective in-patient glycemic control is associated with reduced morbidity and mortality and reduced cost to healthcare institutions. The American Diabetes Association recommends that hospitals have a standardized plan for treating patients with hypoglycemia. Prior to hypoglycemia protocol implementation there was no standard hypoglycemia management at our institution, which resulted in several rapid responses (RR) and code blues leading to patients being transferred to the nearest facility with emergency room (ER). When patients are admitted to rehabilitation hospital from acute care hospitals, changes in medical management, dietary intake and activity levels makes it imperative to adjust the diabetic drug therapy including insulin dosing. Failure to make these changes can result in severe adverse events. The purpose of this study was to describe the outcomes of implementation of the hypoglycemia protocol and insulin management guidelines in a 128 bed rehabilitation hospital.

Methods: A multidisciplinary task force was formed that included the representatives from pharmacy, nursing, nutrition services, medical staff and quality assurance departments. Adverse drug reaction (ADR) reports of hypoglycemia from January 2010 to December 2010 were used as a comparison. Hypoglycemia is defined as blood sugar less than 70 mg/dl. Hypoglycemia related ADRs were identified for the study by the use of reversal agents, code blue, rapid response and ER transfer reports to ensure all the incidents were captured. A comprehensive review of hypoglycemic events was conducted and following the gap analysis, a consensus decision was made to create a standard hypoglycemia management protocol as well as standard insulin sliding scales as a part of hyperglycemia management guidelines. These protocols were developed using the data collected from literature searches as well as collaboration from neighboring healthcare facilities. Education was provided by pharmacy and nursing teams to pharmacists, nurses and physicians. Laminated cards were distributed to all the clinical staff for quick reference. Standard insulin sliding scale and hypoglycemia treatment order sets were built in the Meditech system for ease and consistency of physician order entry.

Results: A retrospective review of 24 episodes of hypoglycemia due to insulin use in the calendar year 2010 (Jan-Dec) was performed. The review indicated that 13 of the 24 reported incidences (54%) were rapid responses secondary to hypoglycemia symptoms (54%) and 6 of the 13 RR (25%) led to ER transfer for further management. The issues commonly noted were inappropriate and inconsistent management of hypoglycemia and hyperglycemia, and delayed administration of reversal agent due to lack of

standard protocols and the knowledge gap. The implementation of protocol and education began in Nov 2010 and was completed by Dec 2010. Further review of hypoglycemia episodes from Jan 2011 through May 2011 indicated that 2 out of 16 reported incidences (12.5%) were rapid responses and none of them led to emergency room transfer. All the patients were managed in-house appropriately with the use of protocol.

Conclusion: The multidisciplinary task force was instrumental in developing and implementing the hypoglycemia & hyperglycemia protocol which resulted in improved patient safety and better hypoglycemia management. After the implementation of protocol the number of rapid responses decreased to 12.5% from 54% and emergency transfers decreased from 25% to 0%. Although there has been a significant change in utilizing the insulin sliding scale appropriately, a high number of hypoglycemic events continued to be reported some of which were possibly due to unexpected drug interactions, polypharmacy and increased surveillance and reporting. Further research needs to be done to identify and decrease the preventable insulin related adverse events.

5-111

Category: General Clinical Practice

Title: Incorporating clinical pharmacy services into a residential PTSD treatment program for veterans

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Purpose: It is estimated that Posttraumatic Stress Disorder (PTSD) affects approximately 3.6% of adult Americans in any given year. Within the veteran population, the prevalence may be as high as 25-30%. Treatment of PTSD commonly includes cognitive behavioral therapy (CBT) in combination with pharmacotherapy. As a variety of medications have been useful in treating PTSD, an opportunity to expand clinical pharmacy services into the residential PTSD treatment program at VA Black Hills was sought. During the course of the treatment program, patients meet with a multidisciplinary team to assess their goals and progress. Usual participants included in the treatment team meetings include social workers, therapists, a psychologist, and a health technician. Due to limited clinician time, it is very difficult for a health care provider (medical doctor, nurse practitioner, or physician assistant) to attend these meetings. In attempt to fill this clinical gap at the interdisciplinary team meeting, a clinical pharmacist was asked to participate with the intent of providing individualized medication counseling and the ability to address health care related issues as a health care provider. To augment the individual and group psychotherapy, the clinical pharmacist was also asked to lead an additional topic session on PTSD medications for each cohort.

Methods: Pharmacist time was estimated to be approximately 2.5 to 3 days per each 7-week program. The Chief of Pharmacy Service was able to arrange time to allow a pharmacist to participate in the interdisciplinary treatment team meetings and the topic sessions. The assigned clinical pharmacist developed a patient oriented presentation discussing common medications used to treat PTSD including antidepressants, anxiolytics, sleep medications, and mood stabilizers. Pharmacy was given a one-hour time period per treatment program to discuss the topic with the patients.

Results: Pharmacy has been able to participate in the residential PTSD treatment program since October 2009, making access to clinical pharmacy services more available to our veterans. Many health care related issues have been handled during team meetings where the clinical pharmacist was present and able to intervene, thus limiting unnecessary office visits to primary care and mental health clinics. Pharmacy has been able to build trusting relationships with the veterans by playing an active role in their PTSD treatment. Furthermore, veterans participating in the treatment program have become more familiar with their medications and more involved in their health care and treatment options.

Conclusion: The clinical pharmacist has played a vital role in the PTSD program since implementation, saving valuable clinician time by filling a role as a knowledgeable healthcare provider, limiting unnecessary primary care and mental health office visits, and providing a quick resource for drug information.

5-112

Category: General Clinical Practice

Title: Importance of patient counseling in the community pharmacy setting

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Purpose: While state pharmacy regulations require that pharmacists in the community setting offer verbal counseling for their patients, it has been reported that the frequency of such service is variable. The objective of this study was to assess the baseline knowledge of patients about their medications and to describe their perception about the need for pharmacists counseling.

Methods: The study consisted of a survey conducted by Pharm. D. students during their rotation at a community pharmacy site in the state of New Jersey. The survey consisted of a two-part questionnaire. The first part collected information about patients overall compliance with their medication regimens and baseline comprehension of their disease management. The second part requested from the patients to provide their opinion about their trust in the pharmacists counseling. This part also assessed the patients evaluation of the pharmacists knowledge and the importance of counseling. Copies of the survey were left on the counter of the pharmacy to be voluntarily picked-up for completion by the patients who were willing to participate.

Results: From 3/1/2011 through 5/31/2011, a total of 133 patients completed the survey (60 males, 73 females). The majority of the patients were between 30 to 50 years of age (36.8 percent), and had chronic diseases (41.3 percent), acute illnesses (12 percent) or other medical conditions (46.6 percent). The first part of the questionnaire revealed that 97.7 percent of the patients knew the indication for each medication prescribed, 26.3 percent missed to take timely doses of their medications, 15 percent stopped taking medications on their own if they felt worse, and 47.6 percent stopped their medications if their disease was under control. In the second part of the questionnaire, patients reported having excellent (42.2 percent), good (48.8 percent) or fair (9 percent) trust in pharmacists counseling. Patients ranked the knowledge of the pharmacists as excellent (38.3 percent), good (56.3 percent) or fair (5.2 percent). A total of 78.2 percent of patients thought that pharmacists counseling is important and can prevent medication errors. Additionally, 77.4 percent of patients thought that appropriate medication compliance may prevent disease complications.

Conclusion: The findings of this survey suggest that that many patients with a variety of illnesses need additional pharmacist counseling. According to patients judgment, counseling plays an important role in

preventing medication errors and enhancing compliance. More efforts are to be concentrated on time dedication for counseling.

5-113

Category: General Clinical Practice

Title: Evaluation of the timeliness of the pharmacy department to prepare and deliver alteplase for the treatment of acute ischemic stroke

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Purpose: Traditionally, urgently needed medications such as alteplase for the treatment of acute ischemic stroke have been prepared at the bedside by the nursing staff. The new trend is leading towards the pharmacy department admixing all medications, regardless of their urgency. In the interest of patient safety, our pharmacy admixes all intravenous medications prior to dispensing to the nursing units. However, a concern is the timeliness of this process especially with urgently needed medications where delays may adversely affect patient care. The purpose of this evaluation was to identify the time it takes for the pharmacy department to admix and deliver alteplase to the patient's bedside when ordered for the treatment of acute ischemic stroke in a community hospital.

Methods: We conducted a prospective observational evaluation over a ten-month period (July 2010 May 2011) of patients who received alteplase for the treatment of acute ischemic stroke. The study population included all patients who received intravenous alteplase. Patients who received intra-arterial alteplase were excluded from the analysis. The alteplase bolus dose was prepared in a syringe and the infusion dose was prepared in an intravenous bag. In this evaluation, the time period was measured from the moment the pharmacist received the order through delivery of alteplase to the patient's nurse. The primary outcome was the average time taken from receipt of the alteplase order to delivery of alteplase to the patient's bedside.

Results: Patients who received intravenous alteplase for the treatment of acute ischemic stroke were identified (n = 22). Two patients were excluded. The average time taken for delivery of alteplase to the patient's bedside from the time of the order was 8.2 minutes.

Conclusion: The final results of this prospective observational study demonstrated alteplase for acute ischemic stroke can be safely prepared in the pharmacy department and delivered to the patient's bedside in a timely manner.

5-114

Category: General Clinical Practice

Title: Collaboration of pharmacists and hospitalists to increase use of American Diabetes Association recommended insulin regimens in internal medicine patients: implementation of a pilot program

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Purpose: American Diabetes Association (ADA) goals for hospitalized patients include: premeal blood glucose (BG) <140 mg/dl, random BG <180 mg/dl and avoid hypoglycemia (BG<70mg/ml). To achieve these goals, ADA recommends use of basal-mealtime-supplemental (BMS) insulin regimens, avoidance of sliding scale insulin monotherapy (SSIM) and adjustment of insulin based on BG. We evaluated a collaborative model involving hospital pharmacists and hospitalist physicians for its effectiveness in increasing the implementation of ADA recommended regimens and on attainment of ADA glycemia targets in hospitalized patients.

Methods: This was an institutional review board approved prospective, randomized, open label, parallel group trial in diabetic inpatients prescribed insulin. Hospitalist physician-led medical teams were randomized to study intervention (INV) or usual care (UC). In the INV group hospital pharmacists daily evaluated BG control and nutrition intake of patients. Pharmacists made recommendations for adjustment of the insulin regimen to the medical team using a weight-based insulin dosing algorithm and ADA guidelines. Physicians in the UC group prescribed insulin according to usual practice. Results were also compared to a historical cohort (HC).

Results: 188 UC and 181 INV subjects were enrolled over 29 weeks. 96 patients comprised the HC. Mean daily blood glucose was 194 mg/dl HC, 176 mg/dl UC and 179 mg/dl INV (p less than 0.001 HC-INV). More insulin adjustments were performed in the INV group, 423 INV, 184 UC, 94 HC (p less than 0.001 UC-INV). Hypoglycemic event days, 10.8% HC, 10% UC, 8.7% INV occurred less often in the INV group (p equals NS). The INV group used basal insulin 60.3% of days vs.52% UC (p less than 0.001). BMS regimens were utilized 23.3% of days in the INV group vs. 18.5% UC (p equals 0.004). Use of SSIM was 46.2% UC and 39.1% of days INV (p less than 0.001). Premeal BG goals were attained 31.9%, 39.5% and 38.4% in the HC, UC and INV groups respectively (p less than 0.001 HC-INV). BG changes after morning dose intervention +7.1 mg/dl UC, +18.4 mg/dl INV, lunch intervention -18 mg/dl UC, - 22.7 mg/dl INV, dinner intervention -7.6 mg/dl UC, - 16 mg/dl INV, and bedtime intervention -48.1 mg/dl UC, -53.8 mg/dl INV (p equals NS). Hypoglycemia after intervention occurred 1.2% UC, 0.7% INV (p less than 0.05).

Conclusion: Hospitalist pharmacist collaboration increased the use of basal insulin and BMS regimens and decreased the use of SSIM without increased risk of hypoglycemia. The pharmacist intervention group performed more dose adjustments than in usual care and maintained patient safety. The effect of

individual adjustments on blood glucose was similar in both groups. Attainment of target premeal blood glucose values improved during the study compared to the historical cohort. Non-scientific survey of the hospitalists showed that they valued the input of the hospital pharmacists in managing the insulin regimen of their patients.

5-115

Category: Infectious Diseases

Title: Antiviral therapy with entecavir in acute liver failure associated acute hepatitis B virus infection

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Purpose: The role of antiviral therapy for patients with acute infection remains unclear. We report the use of entecavir in a woman with acute hepatitis B virus infection and fulminant hepatic failure. A 48-year-old woman was admitted with jaundice that began 24 hours before. She referred loss of appetite, dark urine and non-specific epigastric and abdominal pain. On examination she had hepatomegaly. No fever, nor splenomegaly, nor digestive disorders were observed. She reported no risk sexual contact, nor alcohol and nor drugs abuse. At hospital admission the laboratory analysis showed elevated liver enzymes (alanina aminotransferse (ALT) 3.363 UI/ml, lactate dehydrogenase (LDH) 2.568 UI/ml), direct bilirrubin level 11,9 mg/dl, indirect bilirrubin level 1,4 mg/dl, total bilirrubin level 13,3 mg/dl, prothrombin time activity 19,4 sg, international normalized ratio (INR) 1,66, partial thromboplastin time (TTPA) 36,6 sg and trombophenia 122.000 per microliter. Serology was positive for DNA viral hepatitis B and negative for virus hepatitis C, hepatitis E, HIV, toxoplasmosis. Hepatitis B markers were: HBV DNA 124.0573 copies/ml, surface antigen (HbsAg) positive, antibodies anti surface antigen (anti-HBs) negative, e antigen positive, antibodies to core antigen (anti-HBc) positive. Other causes for acute liver failure were excluded. The patient was diagnosed with acute liver failure induced by hepatitis B virus. During hospitalization she had no signs of hepatic encephalopathy but she presented ascites that was treated with intravenous diuretics. Her ALT peaked at 3.557 UI/ml, LDH at 3.479 UI/ml, direct bilirrubin level 38,3 mg/dl, indirect bilirrubin level 2,3 mg/dl, total bilirrubin level 40,6 mg/dl, prothrombin time activity 20,7 sg, INR 1,74, TTPA 41,5 sg and thrombocytopenia decreased to 102.000 per microliter. She was included in transplant waiting list in case of data suggesting a life-theratining condition. The treatment was started with entecavir 0,5 mg daily (48 hours after admission) due to higher genetic barrier to resistance, tenofovir was not consider because of their potential nephrotoxicity. The patient improved rapidly in 72 hours after initiation of antiviral treatment with entecavir. Her liver enzymes showed a downward trend and other pathologic parameters rapidly decreased. The patient was discharged after nine days of hospitalization, liver function had improved and the patient was fully recovered with good oral intake, normal coagulation laboratory values and regulates rhythm of the bowel. During a follow-up period of fifteen days with entecavir, the patient showed a very good response to the treatment, all symptoms disappeared except jaundice and pruritus that were less intense. Laboratory data were almost normalized: ALT 117 UI/ml, LDH 441 UI/ml, direct bilirrubin level

3,8 mg/dl, indirect bilirrubin level 1,5 mg/dl, total bilirrubin level 5,3 mg/dl, prothrombin time activity 10,1 sg, INR 0,91, TTPA 26,8 sg and platelet count 231.000 per microliter. Therapy was well tolerated and no side effects were observed. This case report shows that entecavir is effective and safe in acute liver failure due to acute viral hepatitis B.

Methods: N/A

Results: N/A

Conclusion: N/A

5-116

Category: Infectious Diseases

Title: Evaluation of antibiotic treatment for complicated urinary tract infections

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Purpose: Increasing bacterial resistance has made empiric antibiotic selection for patients with complicated urinary tract infections (UTIs) more challenging. Healthcare associated pathogens are more likely to be multi-drug resistant compared to those that are acquired from the community. In order to optimize antibiotic therapy, empiric regimens should be based on likely pathogens seen in the hospital and local area. The purpose of this study was to identify common microorganisms causing complicated urinary tract infections in patients presenting to Scripps Memorial Hospital La Jolla (SMHLJ) and to evaluate appropriateness of antibiotic use by evaluating local resistance patterns, while differentiating between community acquired (CA) versus healthcare associated (HA) UTIs.

Methods: This was a retrospective, single center review of electronic and paper medical records. Adult patients who were admitted with a diagnosis of urinary tract infection, urosepsis, or pyelonephritis and had positive urine cultures during their hospital stay were included. The primary outcome was to identify the most common microorganisms causing complicated UTIs. The secondary outcome was to identify an ideal empiric antibiotic regimen for patients admitted with CA and HA complicated UTIs.

Results: A total of 60 patients were included. Enterics (E. coli, Klebsiella, Proteus) were the most commonly isolated microorganisms (79.7%) with E. coli being the most prevalent (47.8%). Of the E. coli organisms, 12% were extended spectrum beta-lactamase producers. Enterococcus was the second most common organism isolated in 8.3% of patients, all of whom had a history of prior UTIs. Excluding broad-spectrum anti-Pseudomonal antibiotics, ceftriaxone had the highest susceptibilities overall (76.7%), followed by trimethoprim-sulfamethoxazole (63.8%), ciprofloxacin (58%), and cefazolin (43.5%). As expected, resistance rates were slightly higher in HA compared to CA UTIs. Ceftriaxone was active against 78.1% and 75% of pathogens in the CA and HA group, respectively. Adding an aminoglycoside to ceftriaxone in patients with HA UTI results in a higher likelihood of empiric therapy having activity against the offending organism (85.7%).

Conclusion: At SMHLJ, ceftriaxone monotherapy has a high likelihood of being appropriate empiric therapy for patients with CA complicated UTI. For patients with HA complicated UTI, consider adding an aminoglycoside to ceftriaxone as empiric therapy. Fluoroquinolone monotherapy is not recommended due to high rates of bacterial resistance. Enterococcus coverage may be considered in patients with a history of documented Enterococcus UTI. The results of this study should be used to guide empiric antibiotic selection at SMHLJ.

5-117

Category: Infectious Diseases

Title: Implementation of an antimicrobial stewardship program using Transformational Care and Lean methodology

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Purpose: Antimicrobial stewardship is critical in light of increasing rates of resistance and few antibiotics coming to market. Appropriate use of antibiotics includes right selection, dose, and timing to improve clinical patient outcomes and decrease unintended negative consequences. In an effort to implement an antimicrobial stewardship program in two community hospitals, a cross-site team was created. The team used Transformational Care (TC) methodology to identify areas of opportunity and efficient solutions. TC is a management system that empowers front line staff to look at their own processes, diagnose inefficiencies and implement solutions. TC also incorporates Lean methodology tools for process improvement. The purpose of the team was to optimize the use of antibiotics including appropriate selection, dose and duration of antibiotics while minimizing adverse effects.

Methods: A cross-site team between two hospitals consisting of pharmacy leadership, clinical infectious disease pharmacists, infectious disease physicians, several other physicians, infection preventionists, a microbiologist, information technology pharmacists, TC directors and data analysts was created. All team members received 12 weeks of training on TC and Lean methodologies. To expedite implementation, the team initially met twice per week to identify process issues, pain points, and brainstorm solutions. Five antibiotics were identified as the initial targets based on potential for misuse and accounting for two-thirds of total antibiotic spend. Methodologies used included process mapping, prioritization of pain points based on impact and frequency, and prioritization of solutions based on ease of implementation and size of opportunity. Evidence-based adult empiric antibiotic guidelines and an order set were created along with a pocket guide containing the guidelines and antibiogram. Criteria for use for broad spectrum, high cost antibiotics were created. Pharmacy reviews including daily culture and susceptibility reports and patients on antibiotics over 5 days were implemented. Physicians and pharmacists were educated on efforts. Daily metrics identified to monitor ongoing progress included days of therapy (DOT), the number of patients on the top 5 target antibiotics, number of patients on the top 5 target antibiotics for greater than 5 days, and successful de-escalation recommendations. Cost per inpatient day is reviewed monthly and defined daily dose (DDD) is monitored quarterly. A performance management data tool (PMT) was created by the TC data analysts to review in daily pharmacy staff

huddles to allow ongoing review and feedback of efforts. Monthly reports were shared with senior leaders to provide updates on the teams progress and metrics.

Results: Pharmacists made a total of 1,966 interventions (discontinuations, de-escalations and regimen changes) since implementation. Average successful de-escalation recommendation rates were 86.9%. The following results compare data from fiscal year (FY) 2010 to FY2011 pertaining to the top 5 target antibiotics and are an average between both campuses: 10.7% decrease in DOT, a 1.5 day decrease (25.9%) in the number of patients on the top 5 antibiotics for greater than 5 days. Average decreases in DDD are as follows: daptomycin 5.3%, imipenem/cilastatin 4.2%, levofloxacin 70.1%, linezolid 32.1%, and piperacillin/tazobactam 9.4%. The antimicrobial stewardship program resulted in a decrease in top 5 target antibiotic spend per inpatient day by 26.4% and a decrease in total antibiotic spend per inpatient day of 14.2%.

Conclusion: TC methodology was successful in reducing inappropriate antibiotic usage and improving cost effectiveness of antibiotic usage. A majority of recommendations from the team are accepted. Antibiotic use, especially levofloxacin, has decreased substantially. Quarterly metrics to be monitored ongoing include the DDD and resistance rates. Future goals include implementation of data mining software to improve efficiency of antibiotic review and allow for increased outcomes data evaluation.

5-118

Category: Infectious Diseases

Title: Implementation of an antimicrobial stewardship program at a teaching institution in Sioux Falls, South Dakota

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Purpose: To gather data to support the initiation of an Antimicrobial Stewardship Program (ASP) at Sanford USD Medical Center.

Methods: Patients reviewed were adults over age 25, receiving three or more antibiotics, positive blood cultures, positive multi-drug resistant cultures (i.e. MRSA, VRE, etc), and several other parameters. Patients were reviewed by one pharmacy resident who met with an ID physician and wrote recommendations via physician communication sheets. Outcomes measured were time spent reviewing patients, meeting with ID physicians, and writing recommendations, recommendations made and accepted, and cost analysis resulting from changes in therapy. Secondary outcomes that were assessed were number of patients reviewed and obstacles in reviewing patients, such as timeliness of culture results reporting and ease of use of reports.

Results: Over six weeks 312 patients were reviewed and 59 recommendations were made. Of those recommendations 53% were accepted with the majority being discontinuation of antibiotics. An average of about four hours daily was spent reviewing patients, meeting with ID physicians, and writing recommendations. Cost savings was determined by whether discontinued regimens had been extended by two or five days, and a savings of $1,302.76 and $3,244.98 respectively. During the pilot period 41% of possible patients were reviewed. Culture reports were slightly retrospective in nature where results were from the day prior to the day of review.

Conclusion: There is the potential for an ASP to show benefit to patient care at this institution as well as evidence to support the addition of a pharmacist devoted specifically to an ASP. Also, culture reporting is an area that needs improvement to provide better care to patients.

5-119

Category: Infectious Diseases

Title: Retrospective analysis of Human Immunodeficency Virus (HIV) genotype testing in a large urban HIV clinic

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Purpose: Genotypic resistance testing is frequently performed for HIV infected patients. In the early era of highly active antiretroviral therapy (ART), patients failing a ART regimen would often develop mutations. Interpretation of these mutations was critical in determining an effective next regimen. However, newer drugs with improved efficacy are now in use. Patients failing new regimens appear to be failing regimens with a different pattern of mutations or no mutations at all. This poster describes a retrospective analysis of resistance tests performed at our clinic in the first two quarters of 2010 to determine what mutations are occurring and to evaluate their clinical implications.

Methods: A search was performed of the resistance test database to identify genotypic resistance tests performed in the first two quarters of 2010. The mutations identified where recorded. The clinic chart was reviewed and the purpose of the test was also recorded. For those patients that had mutations associated with drug resistance, the subsequent ART was identified and the success of that regimen was noted.

Results: A total of 77 HIV genotypic rsistance tests where reviewed. Mutations where identified in 30% (23/77) of the results. Of these, 47 tests were screening tests ordered prior to starting ART and 30 were for patients on failing regimens. On the 47 screening tests, 10 patients had mutations associated with drug resistance (2 in treatment nave patients) Of the 30 tests order for patients on failing regimens, 17 came back with wild type virus and 13 had mutations associated with drug resistance. The most common mutations where the K103N (9), M184V(9), T215Y(3). Protease inhibitor mutations were uncommon (2/17). Integrase inhibitor mutations where discovered in 3 out of the 7 integrase genotypes performed. Successful therapy was subsequently initiated 77% (23/30) of the patients with drug resistance mutations

Conclusion: Most patients in our clinic who were not responding to ART where failing with a wild type HIV virus (57%). The likely cause of this treatment failure was non adherence with the regimen. However, unlike the early ART era, the non adherence did not commonly lead to drug resistance. This appears to be related to improved ART potency and a smaller zone between treatment success and failure where selective pressure allows for mutations to occur. When resistance did occur, it most often happened in the non-nucleoside or nucleoside reverse transcriptase class. Protease inhibitor based therapy had a higher barrier to mutations. Mutations in treatment nave patient were uncommon. Although mutations are occurring less often in our patients, genotype testing still provides valuable information in selecting effective ART regimens. While a less commonly used with current ARTI,

knowledge of HIV genotype resistance tests is an important skill for those involved in the treatment of HIV positive patients

5-120

Category: Infectious Diseases

Title: A model using interrupt email for antibiotic stewardship review of piperacillin-tazobactam at a large metropolitan hospital

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Purpose: Antibiotic stewardship programs are designed to optimize antibiotic use to ensure patient safety, to prevent bacterial resistance, and to reduce cost. Stewardship programs have become one of the progressive devices in the armamentarium of available tools to overcome the erosion of effective therapies that provide cure of bacterial infection at the lowest possible cost. A frequently utilized approach for antibiotic stewardship is to require antibiotic pre-authorization from an infectious disease physician or clinical pharmacist with infectious disease training. This often delays approval and is time consuming due to a series of telephone conversations that are often required between the treating medical team, stewardship personnel, and the pharmacy. An alternative pathway was developed at a large New York City tertiary care hospital with limited personnel, in which piperacillintazobactam was de-restricted and reviewed for appropriateness of therapy with subsequent communication of recommendations to physicians / prescribers using an interrupt email system

Methods: An infectious disease trained pharmacist and infectious disease attending physician reviewed all piperacillin-tazobactam orders at 72 hours after initiation of therapy (delayed until the first working day if the review date fell on a weekend). Patients with an infectious diseases attending or consultation were exempted from review. If changes in therapy for piperacillin-tazobactam or other antibiotics were merited, an interrupt email was sent to the resident and attending physician caring for the patient via the hospitals electronic healthcare record / computerized physician order entry system (CPOE). Interventions were documented in the CPOE system by the clinical pharmacist. Data were collected, entered daily, and evaluated monthly. Stewardship suggestions were followed up upon and data were recorded regarding whether interventions were enacted. Baseline interventions before de-restriction of piperacillin-tazobactam were contrasted with the number of interventions after its de-restricting. Classification of interventions for piperacillin-tazobactam included: discontinuation, alternative therapy, duration of therapy, and change in dose.

Results: Since the de-restricting of piperacillin-tazobactam in November, 2008, an average of 170 patients were reviewed per quarter. Based upon infectious disease best practice principles we found that completely appropriate therapy ranged from 26% to 44%. On average 34 % (range 27% to 44%) of the time, antimicrobial modifications on antibiotics others than piperacillin-tazobactam or other clinical

suggestions were made. The average number of interventions per quarter over seven quarters was 72. This was an increase of 128% from baseline (n =56). Fewer interventions occurred in the 2nd and 3rd quarters 2009 when fewer patients were prescribed piperacillin-tazobactam. The intervention acceptance rate ranged from 71-79% per quarter. Acceptance by category included: 80% for discontinuation, 67 % for alternative therapy, 79% for duration of therapy, and 70% for dosage change.

Conclusion: Utilizing an interrupt message after review of a work-horse antibiotic at a large, metropolitan tertiary hospital with limited personnel resources for antibiotic stewardship we have developed a vigorous stewardship program. The uptake by prescribers was excellent and interventions other than those for piperacillin-tazobactam were made nearly 35% of the time. This system allows easy access to early empiric therapy, ease of communication, efficient time utilization, and the ability to educate prescribers during the email communication.

5-121

Category: Infectious Diseases

Title: Assessing the long-term impact of an antimicrobial restriction program on antimicrobial cost and susceptibilities

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Purpose: Antimicrobial stewardship programs are widely used within hospitals throughout the United States today. These programs are justified based on several factors including the rise of cost and the increase of antimicrobial resistance. Literature states, an estimated 25-40% of hospitalized patients receive antimicrobial medications attributing to nearly $200 to $300 million dollars in prescription costs annually. Antimicrobial overuse can also lead to increased resistance which in turn escalates the cost and increases morbidity and mortality. Our institution initiated an antimicrobial restriction program in 1993 to address these issues and its initial assessment showed increases in susceptibility as well as positive economic impacts. The effects of the program over ten years later have yet to been studied. The purpose of the study is to evaluate the beneficial impact of antimicrobial restriction program on antimicrobial susceptibilities.

Methods: A retrospective analysis comparing the institution susceptibility and drug expenses was performed. The purchase data reports for antibiotics were obtained from the information technology department for the period of 2006-2009 excluding external or ophthalmic agents. The susceptibility data was obtained from the clinical laboratory archives for 7 years, starting 2003 to 2009. Upward or downward patterns of resistance were then followed and recorded for the following: pseudomonas, enterococci, staphylococci, klebsiella, acineobacter. The drugs tested included: cephalosporins, aminoglycosides, fluroquinolones, and carbapenems.

Results: The antibiotic restriction program had a positive impact on decreasing resistance of carbapenems for pseudomonas and klebsiella and has had no major impact on decreasing resistance of cephaloporins and carbapenems to E.coli or klebsiella to cephalosporins, aminoglycosides, and fluroquinolones. However the impact on aminoglycosides and fluroquinolones to pseudomonas and Acineobacter have been inconclusive as the resistance generally increased in the years 2003-2005 and decreased in the years 2006-2009. The program has been ineffective in decreasing resistance of E.coli to fluroquinolones throughout this period. When compared to the year prior to restriction (1993), the susceptibilities studies show that the program has been more effective in the last 4 years, 2006-2009, in decreasing resistance for the majority of drugs studied. The program had a greater impact on gram positive organisms, such as enterococci and s.aureus, as the susceptibility rates for each organism to

vancomycin and linezolid remained relatively high. Low rates for oxacillin suggest that MRSA was high in the Ben Taub hospital during this time period.

Conclusion: The antimicrobial stewardship program overall has been largely effective in decreasing resistance to a majority organisms.

5-122

Category: Infectious Diseases

Title: Using Decision Support Technology to Enhance an Existing Antimicrobial Stewardship Program

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Purpose: Antimicrobial stewardship is an important component of an institutions medication safety program working to minimizing antibiotic toxicity, emergence of resistance, and selection of pathogenic organisms such as Clostridium difficile. A gap analysis of recommended antimicrobial stewardship program core elements as defined by the Infectious Diseases Society and Society for Healthcare Epidemiology of America was performed. The analysis identified that optimizing the use of culture and sensitivity data would enhance an existing stewardship program at a 719-bed teaching hospital. To address this gap, decision support technology integrating culture and sensitivity data from the hospitals laboratory system with the pharmacy system was used to provide actionable, electronic reports to de-escalate or broaden antibiotic therapy where appropriate.

Methods: A multidisciplinary team was formed including members from Infectious Diseases, Microbiology and Pharmacy. Antibiotic utilization data was reviewed and report criteria and parameters were discussed. The team recommended developing focused electronic reports to identify; 1) patients with a suspected urinary tract infection on empiric, intravenous broad-spectrum antibiotic therapy continued beyond the institutions recommended 3-day stop date, 2) patients initiated on non-carbapenem antibiotic therapy and final cultures results reveal the presence of an Extended Spectrum Beta Lactamase (ESBL) producing organism, and 3) patients started on empiric carbapenem therapy with final culture data negative for an ESBL producing organism. Pharmacy Information Technology designed and built the reports based on the criteria and parameters provided by the multidisciplinary team. A trial period identified areas where the reports could be refined and streamlined to efficiently identify patients. The reports are received by an infectious diseases clinical pharmacist specialist each morning by e-mail. The specialist reviews the patients medical record, microbiology data, and medication profile, and contacts the prescriber to provide recommendations.

Results: The electronic reports have provided an efficient means to use culture and sensitivity data to guide changes in antibiotic therapy. The reports have been used to de-escalate broad spectrum intravenous antibiotics to a narrower spectrum agent, change to oral therapy, or discontinue therapy. The reports have also been used to initiate a change to appropriate coverage for patients with an ESBL producing organism not on carbapenem therapy. During patient review additional opportunities for

intervention have been identified including dosage adjustments for renal compromise, dose maximization based on the organism present (e.g., Pseudomonas), and alternatives to restricted antibiotics. Discussions and encounters with prescribers have also offered opportunities to provide education on appropriate antibiotic use. Continued assessment will guide the development of additional reports.

Conclusion: Utilizing decision support technology to integrate culture and sensitivity data and antibiotic utilization data enhanced an existing antimicrobial stewardship program by providing patient focused, electronic reports to de-escalate or broaden antimicrobial therapy.

5-123

Category: Infectious Diseases

Title: Effect of education on hospital pharmacists' antibiotic knowledge

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Purpose: Antimicrobial stewardship is becoming an increasingly important objective of health systems to improve both patient and institutional clinical outcomes. Infectious diseases (ID) trained pharmacists are considered a core component of the interdisciplinary antimicrobial stewardship team. With the limited number of ID trained pharmacists available, hospitals are trying to maximize the correct use of antimicrobials with their current staff. A community hospital chose to require antibiotic education for all pharmacists as a part of their annual competency training. The project was designed to identify the impact of antimicrobial education on pharmacists' knowledge of antibiotics and to assess the pharmacists' learning needs and satisfaction of the educational programs.

Methods: The study group included all pharmacists working within the institution. Pharmacists excluded from the study were those who declined to participate in the competency assessment exams or were no longer employed by the institution. An internal medicine faculty member with a practice site at the institution provided basic antimicrobial education to all pharmacists. Antimicrobial education primarily consisted of spectrum of activity, empiric therapy, de-escalation, combination therapy, intravenous to oral conversion considerations, dosing adjustments, and appropriate time to start and discontinue therapy. The educational intervention was conducted over a 4 month period and included live continuing education (CE), self-learning e-mail reviews, question and answer in-services, and a live question and answer game show. The faculty member developed a 35 question competency assessment primarily consisting of short answer questions to evaluate the effects of the educational programming. Seventeen of 24 pharmacists consented to participate in a pretest prior to education and a posttest 9 months after the live CE. Pharmacists completed each test independently and without the aid of references. A score of at least 70 percent was required to be considered competent in the area of antimicrobials. A learning needs assessment and satisfaction survey was administered to all participants following their completion of the posttest. Statistical analysis for pretest and posttest results was evaluated through a paired t-test. Data are expressed as means with 95 percent confidence intervals.

Results: The mean difference in the 17 pretest and posttest scores was 29.56 percent, 49.68 and 79.24, respectively (95 percent CI, 23.08 - 36.03, P less than 0.01). Twelve of the 17 pharmacists completed the posttest with a score of 70 percent and did not require follow-up training. One hundred percent of participants agreed the antibiotic educational program helped them practice pharmacy better, and 82 percent of participants felt that antibiotic competency should be required for all hospital pharmacists.

Ninety-four percent of pharmacists felt that antibiotic education should be offered at least annually and the best methods of providing antimicrobial education are through live lectures with interactive patient cases or question and answers.

Conclusion: Educational intervention demonstrated a significant improvement in pharmacists' knowledge of antimicrobials. Hospital pharmacists prefer to learn antimicrobial information through live interactive lectures at least annually.

5-124

Category: Infectious Diseases

Title: Avascular necrosis associated to inverse transcriptase inhibitors: a case report

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Purpose: The aim of this study is to analyze the relationship between the onset of ONFH and certain drugs in a long-term HIV+ patient.

Methods: An online search with the MeSH terms [HIV] AND [FEMUR HEAD NECROSIS] was conducted to identify drugs likely causing ONFH. Possible pharmacological interactions were also considered. Former and current HAART (and other drugs used) of a long-standing HIV patient undergoing total hip replacement surgery was reviewed. Data sources: PubMed, hiv-druginteractions.org, past Medical Records and the Outpatient Pharmacy Unit database. Comprehensive pharmacotherapeutic review was performed in search for the drugs likely involved, focusing on their tolerance, adherence, duration, documented interactions and other possible risk factors. The Naranjo algorithm was used for determining the relationship between the onset of ONFH and the existing drugs.

Results: We identified a 44 years old male, with a 14 years long HIV status, currently receiving HAART (9 years since start) who met the inclusion criteria. Right and left ONFH diagnoses dating from March 2002 and 2003, respectively, undergoing bilateral total hip arthroplasty (THAP) on April 2005 (right hip) and July 2006 (left). Risk factors: untreated morbid obesity (BMI=36 Kg/m2) and moderate alcoholism. Other previous HIV-related pathologies: oropharyngeal candidiasis 12 years ago, favorably resolved. The current HAART (from February 2006 to date) was: Emtricitabine/ Tenofovir (FTC/ TDF) 1 tablet QD plus Lopinavir/Ritonavir (LPV/r) two tablets BID, but it has seen several changes since the beginning. Antiretroviral drugs found before the ONFH first diagnosis were: didanosine (ddI) (from July 2001 to November 2003), Lamivudine (3TC) (from July 2001 to May 2002 and from March 2004 to February 2006), Indinavir (IDV) (from July to October 2001) and finally Nelfinavir (NFV) (from October 2001 to May 2002). Other drugs used: trimethoprim-sulfamethoxazole (TMP/SMX), NSAIDs. Probabilities of 6 points (probable) for ddI and 3 points (possible) for both 3TC and NFV were assigned by the application of the Naranjo scale to the individual drugs. A documented pharmacokinetic interaction between TMP/SMX and 3TC (resulting in an increased exposure of lamivudine estimated over 40%, evidence: moderate) was found.

Conclusion: Osteonecrosis of the Femoral Head (ONFH), also known as avascular or non-septic necrosis, in HIV+ patients has been described as a rare but limiting arthropathy frequently associated to the use of highly active antiretroviral therapy (HAART), and particularly to retrotranscriptase inhibitors. However, the frequency of changes and the complexity of HAART in long term patients make it difficult to establish a clear cause-effect connection between both events. In addition, the link between some of the antiretroviral drugs and the onset of ONFH has not been consistently documented in the scientific literature. Here, we report a case study in which the HAART of a long term HIV+ patient was analyzed in search of evidence supporting the causality between both elements. The results of our analysis suggest the involvement of the HAART (specifically ddI) in the onset of the arthropathy, but also the need for larger studies to evaluate the role of potential pharmacological interactions and discard the influence of other risk factors such as the HIV+ status itself and certain comorbidities (obesity, alcohol), which influence on the disease still remain unclear.

5-125

Category: Infectious Diseases

Title: Effect of education on nursing knowledge and behaviors related to the use of vancomycin and aminoglycosides

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Purpose: Antimicrobial stewardship has become a commonly used strategy to improve clinical outcomes of patients receiving antimicrobials. A clinical pharmacy program at a community hospital sought to improve its antimicrobial stewardship and pharmacokinetics dosing programs through nursing education. Specifically, the clinical pharmacy program's goal was to improve nursing knowledge and behaviors related to timing of dose administration for vancomycin and aminoglycosides.

Methods: The study was approved by the institutional review board to review nursing knowledge and behavior outcomes. The study group included all staff nurses working on the nursing units with the largest volume of vancomycin and aminoglycoside use in the institution. First, behavior data was collected to investigate whether vancomycin or an aminoglycoside was given as scheduled or held until the result of the drug level was received. A random sampling of 40 qualifying patient drug levels was retrospectively reviewed. Patient inclusion criteria included the following: older than 18 years of age, residing on one of the study units, receiving vancomycin or aminoglycosides, and a serum drug trough level was drawn. The patients who were excluded were those receiving dialysis treatments requiring pulse dosing or those receiving an aminoglycoside with extended interval dosing. After baseline behavior data was collected, all staff nurses on the qualifying units were given the option to participate in an educational intervention following informed consent. The intervention included collection of patient demographics and a pretest with six fill in the blank questions concerning administration timing and drug level monitoring. Post educational intervention effects on nurses' knowledge of vancomycin and aminoglycosides was completed through a posttest 3 months after the pretest and education were completed. Effects on nursing behaviors were assessed through a random, retrospective review of 40 patient drug levels that met the same initial inclusion and exclusion criteria 5 months post education. Statistical analysis for pretest and posttest results was evaluated through a paired t test, and the Mantel Haenszel test was used for analysis of the nursing administration behaviors before and after education. Data are expressed as means with 95 percent confidence intervals.

Results: The mean difference in the 34 nursing pretest and posttest scores was 22.56 percent, 66.35 and 88.91, respectively (95 percent CI, -29.16 to -15.96, P less than 0.001). Before education, nurses

documented administering vancomycin and aminoglycosides as scheduled 80 percent of the time and improved to 92.5 percent post education (95 percent CI, 0.08 to 1.33, P equals 0.197).

Conclusion: Educational intervention demonstrated a significant improvement in nursing knowledge regarding administration and drug level monitoring of vancomycin and aminoglycosides. Nursing behaviors in the correct administration of vancomycin and aminoglycosides clinically improved, although the improvement was not statistically significant.

5-126

Category: Infectious Diseases

Title: Implementation of the antimicrobial stewardship program (ASP) with an antimicrobial order form and its impact of on the use of restricted drugs in a community hospital

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Purpose: To assess the impact of an antimicrobial order form on the use of daptomycin, linezolid and telavancin for the use of skin and soft tissue infections in the community hospital setting.

Methods: A Pharmacy and Therapeutics Committee approved antimicrobial order form addressing the utilization of restricted antibiotics -daptomycin, linezolid and telavancin - was designed for a 260-bed, level 1 trauma community hospital. An Antimicrobial Stewardship Team that included infectious diseases physicians, pulmonologists, pharmacists, nurses, microbiologists, infectious control specialists and information technology (IT) was formed to focus on 1) reducing inappropriate use of antimicrobial agents, 2) reducing the incidence of Clostridium Difficile associated diarrhea (CDAD) and 3) reducing the overall costs of antimicrobial therapy. The purpose of this team is to be responsible for not only the development of the ASP but also to provide the necessary education to the medical, nursing and pharmacy staff prior, during and after to the implementation of the program. Using the formulary restriction and prior authorizations strategy, these restricted antibiotics are required approval by either an infectious diseases physician or a pulmonologist prior to the initiation of therapy. All patients who were on more than two days of therapy of the restricted antibiotics within 3 months before and 3 months after the ASP implementation were evaluated. The numbers of restricted antibiotic orders before and after the studied periods were compared using the chi square test. A sub-analysis of data examined the use of restricted antimicrobials among patients admitted with a diagnosis of skin and tissue infections (SSTI). Medication use evaluation (MUE) of linezolid among this group was performed, with the emphasis on the inappropriate use of linezolid for empiric therapy of SSTI.

Results: The number of orders for daptomycin, linezolid, and telavancin placed in the three months prior to implementing ASP were 41, 113 and 10 respectively. In the three months following implementation, the number of daptomycin, linezolid and telavancin orders declined to 29, 43 and 1 respectively ($p<0.05$). The MUE on linezolid use showed the percentage of inappropriate linezolid orders drop from 70.8% to 46.5% ($p=0.07$).

Conclusion: The implementation of the formulary restriction and prior authorizations ASP has led to a decrease in the number of orders for restricted antibiotics and resulted in reduction in the inappropriate

use of these antibiotics. Further evaluations of patient outcomes are needed to determine the effect of this program on the quality of care.

5-127

Category: Infectious Diseases

Title: Evaluation of a pharmacist-directed vancomycin dosing and monitoring pilot program at a tertiary academic medical center

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Purpose: Consensus guidelines recommend vancomycin doses of 15 to 20 mg/kg every 8 to 12 hours in patients with normal renal function. The purpose of this study was to evaluate the effect of a pharmacist-directed vancomycin dosing and monitoring pilot program on the percentage of patients receiving targeted weight-based dosing recommendations.

Methods: This was a pre/post-evaluation study, approved by the institutional review board at our institution, comparing retrospectively reviewed vancomycin dosing practices hospital-wide between September 1 and September 30, 2010 to patients prospectively managed by a pharmacist-directed vancomycin pilot program between February 1 and April 26, 2011. All adult inpatients receiving intravenous vancomycin were included, unless patients had a creatinine clearance less than or equal to 60ml/min or indication for therapy was surgical prophylaxis or febrile neutropenia. The primary outcome was the percentage of patients who received optimal vancomycin dosing defined as greater than or equal to 30 mg/kg/day within twenty-four hours of initiation of therapy. Secondary outcomes included number of pharmacist interventions, length of therapy and incidence of nephrotoxicity while receiving vancomycin.

Results: A total of 319 patients were analyzed, 161 pre-implementation and 158 post-implementation. The percentage of patients who received optimal vancomycin dosing was significantly higher post-implementation of the pilot program, 96.8 versus 40.4 percent (P less than 0.001). Pharmacist-directed interventions post-implementation, resulted in 50 percent more patients being dosed optimally (P less than 0.001). Patients in the pilot program also had a shorter length of therapy (10.0 versus 8.4 days, P equals 0.003) and a lower incidence of nephrotoxicity (8.7 versus 3.2 percent, P equals 0.006).

Conclusion: This pharmacist-directed vancomycin pilot program significantly increased the percent of patients optimally dosed according to consensus guidelines within twenty-four hours of initiation of therapy. Given the results, efforts to expand this program to all patients at our institution are warranted.

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Category: Infectious Diseases

Title: Tigecycline-induced Pancreatitis: A Case Report

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Purpose: We report a probable case of tigecycline-induced pancreatitis in a 57-year-old Caucasian female admitted to the hospital due to a suspected systemic inflammatory response syndrome secondary to a urinary tract infection. Past medical history is significant for depression, hypothyroidism, hypertension, lupus, arthritis, fibromyalgia, perforated diverticulitis, and necrotizing fasciitis of the lower abdominal wall. The patient was started on intravenous empiric therapy with vancomycin and piperacillin/tazobactam. On day 9, urine cultures grew klebsiella pneumonia. The patient received three days of treatment with meropenem; however, therapy was switched to tigecycline due to sensitivities. Eight days later the patient experienced severe abdominal pain that required treatment with multiple doses of intravenous morphine throughout two days. Serum amylase and lipase levels were elevated (124 U/L and 214 U/L, respectively). It was suspected the patient had drug-induced pancreatitis and tigecycline was discontinued. Two days after discontinuation, the patients symptoms resolved. Serum amylase (40 U/L) and lipase (46 U/L) were within normal limits two days later. There was no reoccurrence of symptoms throughout the duration of hospital stay. A temporal and causal relationship between tigecycline and the onset of symptoms was established. The application of Naranjo algorithm revealed a probable tigecycline-induced pancreatitis. Clinicians should be aware of possible adverse events associated with tigecycline including pancreatitis.

Methods: N/A

Results: N/A

Conclusion: N/A

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Category: Infectious Diseases

Title: Opportunities to improve fluoroquinolone prescribing: A pilot study

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Purpose: Fluoroquinolones (FQ) are frequently prescribed because of their broad spectrum of activity, dosing convenience, and favorable safety profile. Overuse of these agents leads to decreased bacterial susceptibilities and therefore, decreased efficacy. At Scripps Mercy Hospital San Diego (SM) and Scripps Memorial Hospital La Jolla (SLJ), FQs are the most common prescribed class of antibiotics with levofloxacin (LVQ) being the highest in the class. Despite decreased susceptibilities to FQs over the past ten years, most notably in Gram negative organisms, FQ utilization continues to be high. The objective of this study is to investigate the efficacy of empiric levofloxacin use, based on microbiology results, at the 2 hospitals as well as de-escalation practices.

Methods: A retrospective review was conducted at two hospitals in San Diego - a teaching hospital (SM) and a community hospital (SLJ) - between October 2010 and April 2011. Patients were included if they received LVQ empirically, had positive cultures, and remained hospitalized until final cultures and sensitivities (C&S) were reported.

Results: A total of 204 patients met study criteria; 104 patients at SM and 100 patients at SLJ. Based on final microbiological results, empiric FQ therapy could have been avoided in 46% of patients at SM and 39% of patients at SLJ. The percentage of patients found to have an infection resistant to levofloxacin was 28% and 17% at SM and SLJ, respectively ($p<0.063$). De-escalation occurred in 28% at SM vs. 23% at SLJ, and de-escalation opportunities were missed in 20% at SM vs. 48% at SLJ ($p=0.01$).

Conclusion: At SM and SLJ combined, FQ therapy was not indicated in nearly half of patients. Additionally, both hospitals failed to de-escalate to narrower spectrum antimicrobial therapy when the opportunity arose at least 20% of the time.

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Category: Infectious Diseases

Title: Patient develops vancomycin resistant Staphylococcus aureus (VRSA) infection during vancomycin therapy

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Purpose: This patient (pt) case characterizes the 12th and 13th isolates of VRSA in the United States (US) and describes factors that may have contributed to the development of VRSA in this pt. VRSA is a rare occurrence in the United States and usually results from the transfer of the vanA resistance gene from Enterococci to S. aureus. Low levels of vancomycin (VAN) allow the gene transfer. VRSA isolates are generally resistant to multiple antibiotics (abx) which leave few treatment options. This pt was a 64 year old female with a past medical history including total knee replacement (10 years prior), hypertension, chronic kidney disease on hemodialysis (HD), and coronary artery disease. Pt received ampicillin (AMP) in the hospital for an infection of the prosthetic knee. The infection was with an AMP and VAN sensitive Enterococcus faecalis. The pts therapy was continued with VAN at HD at an extended care facility (ECF). The pt did not have VAN levels drawn at HD. During the prosthetic knee infection treatment the pt was readmitted to our hospital twice for cardiac events; VAN levels were drawn during the hospital stay and were subtherapeutic (6.7-11.7 mg/dL). During these hospital stays, the VAN dose and frequency of administration were altered to achieve target levels of 15-20 mg/dL and each time the pt was transferred back to the ECF, the levels were in the goal range. Subsequently the pt was admitted to our hospital with sepsis. Blood cultures and wound cultures from an incisional defect over the prosthetic knee were obtained. The hospital microbiology laboratory identified VRSA and VAN resistant E. faecalis (VRE) from the wound culture via MicroScan and communicated the information to the physician, pharmacy, nursing, and Infection Control. The microbiology laboratory performed subsequent tests on the VRSA to confirm VAN resistance via Etest. The VRSA had a MicroScan MIC of > 16 and no zone of inhibition on Etest. Additional susceptibility testing was done in house for daptomycin, rifampin, linezolid, oxacillin, trimethoprim sulfamethoxazole, tetracycline, and telavancin. The isolate was reported as sensitive to daptomycin, linezolid, tetracycline, and rifampin and resistant to, oxacillin, trimethoprim sulfamethoxazole and telavancin. Telavancin MIC was done by Etest and was 4. The culture was sent to the Centers for Disease Control and Prevention (CDC) for confirmation. There were 2 strains of VRSA confirmed. VRSA#1 had a VAN MIC of > 256 and VRSA#2 had a VAN MIC of >1024. These are the highest VAN MIC recorded in the United States to date. VRSA#1 was confirmed as resistant to oxacillin, clindamycin, erythromycin, and levofloxacin. VRSA#2 was confirmed to be resistant to clindamycin, erythromycin, and levofloxacin. VRSA#1 and VRSA#2 were sensitive to daptomycin, linezolid, rifampin, trimethoprim sulfamethoxazole, and tetracycline. Surprisingly, VRSA#2 was sensitive

to oxacillin. This is the first reported VRSA strain in the US that retains susceptibility to oxacillin. The pt was treated with daptomycin and rifampin and transferred to another facility for surgical revision of the prosthetic knee infection. The pt eventually succumbed to the infection 5 weeks after its identification. One risk factor which may have contributed to the emergence of VRSA in this pt is the persistently subtherapeutic VAN levels during outpatient therapy.

Methods: N/A

Results: N/A

Conclusion: N/A

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Category: Infectious Diseases

Title: Implementation of extended infusions of piperacillin-tazobactam in pediatric patients at a university teaching hospital

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Purpose: Antibiotic resistance is increasing and no new agents with new mechanisms of activity against gram-negative bacilli are in the antibiotic pipeline. One potential way to improve outcomes and curb antibiotic resistance is to optimize the pharmacokinetic and pharmacodynamic properties of the currently available antimicrobial agents. Over the past decade, research has shown that prolonged infusions of antibiotics with time-dependent bactericidal activity, such as piperacillin-tazobactam, provide improved antibiotic activity and studies have also shown better patient outcomes; however, most data are derived from the adult literature. A protocol for use of extended infusion PT was recently implemented for adult patients at our institution. This project looks at implementation of extended infusion piperacillin-tazobactam in our pediatric population.

Methods: Literature regarding extended infusion piperacillin-tazobactam in adults and pediatrics was compiled by the Infectious Disease pharmacist and Pediatric Infectious Diseases faculty; these data were shared with the pediatric medical faculty. Based on the input of these experts, the Antimicrobial Advisory Subcommittee and pediatric physician representatives decided that extended infusion piperacillin-tazobactam would not be implemented in the neonatal intensive care unit but that extended infusion piperacillin-tazobactam should be an option available for use in the rest of the pediatric population.

Results: Extensive physician, nurse, and pharmacist education was completed. The computer system entry was adjusted to allow physicians to order an extended infusion of pipercillin-tazobactam for pediatric patients. Smart pump libraries were adjusted to allow for the extended infusion rate (3 hours) as well as traditional rate (30 minutes). A compatibility chart was developed to assure that necessary compatibility information is available to nursing staff to address compatibility concerns. Daily inspection of the infusion pumps facilitated quality assurance analysis. Data collected in a retrospective chart review of pediatric patients who receive piperacillin-tazobactam as a prolonged infusion are being compared to data from pediatric patients receiving intermittent 30 minute infusions of piperacillin-tazobactam.

Conclusion: Proper education and monitoring lead to successful implementation of the extended infusion piperacillin-tazobactam as an option for pediatric patients. A smooth transition from strictly

thirty minute infusions to an option of 30 minute or 3 hour infusions is the result of the use of a multidisciplinary team approach.

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Category: Infectious Diseases

Title: Does In-Vitro Resistance of Streptococcus Pyogenes to Erythromycin Produce Clindamycin Resistance?

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Purpose: Throughout the last decade there has been a trend of increasing macrolide resistance to Streptococcus pyogenes (Group A Strep), which is responsible for severe, life-threatening infections including toxic shock syndrome and necrotizing fasciitis. Recent data in 2010 from Scripps Mercy Hospital in San Diego, California showed a rate of 20% macrolide resistance to S. pyogenes. This data prompted further investigation, the main concern being that macrolide resistance would produce cross-resistance in clindamycin. Our primary objective was to determine the prevalence of erythromycin and clindamycin resistance among clinical isolates of S. pyogenes in the San Diego area and determine the mechanism of resistance, whether that be through drug inactivation, efflux pumps or methylation.

Methods: 146 consecutive isolates of S. pyogenes were analyzed from five Scripps hospitals. The antimicrobial susceptibilities of the isolates were determined using double-disk diffusion testing (d-test). Analysis was performed using a two-sample test of proportions (2-tailed). A $p<0.05$ will be considered significant for all statistical analysis.

Results: 146 strains of S. pyogenes were analyzed for both erythromycin and clindamycin susceptibility. There was no statistically significant difference between the resistance patterns of erythromycin or clindamycin to S. pyogenes (28 vs 27, $p=0.88$). Overall, there were 27 positive d-tests, demonstrating that the main mechanism of resistance produced by S. pyogenes in the San Diego area was through methylation which causes resistance to both erythromycin and clindamycin.

Conclusion: S. pyogenes is resistant to both erythromycin and clindamycin in ~20% of strains in the San Diego area. If a patient is resistant to erythromycin there is a high likelihood it will also be resistant to clindamycin. With the increasing trend of macrolide resistance in S. pyogenes strains, the penicillin family remains the drug of choice in these infections and macrolide use should be reserved for patients with true beta lactam allergies.

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Category: Infectious Diseases

Title: Antimicrobial Stewardship program focuses on tigecycline utilization

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Purpose: With the rising of multiresistance, judicious antibiotic utilization is essential. Antimicrobial stewardship program, among other guidelines promote proper utilization of antimicrobials. Broad-spectrum antimicrobials are commonly used due to their versatility in treating a wide variety of microorganisms, but their indiscriminate use could lead to even more resistant organisms. Tigecycline is frequently use at our institution, sometimes inappropriately and during a prolonged therapy duration. This project was designed to evaluate the impact of prospective audit with direct clinical interventions in the utilization of tigecycline after implementing an antimicrobial initiative.

Methods: Utilization criteria was developed as a base for surveillance and clinical interventions. Tigecycline use criteria included: complicated skin and skin structure infections, complicated intra-abdominal infections, and community-acquired bacterial pneumonia only if patient met one of the following: allergy or intolerance to all standard alternative therapies; infection refractory to all standard alternative therapies; and documented infection due to multidrug-resistant organisms showing susceptibility to tigecycline only if no other options exist. Drug use criteria was presented to medical faculty as a clinical initiative after Pharmacy and Therapeutics and Executive Committees approval. A medication utilization evaluation was realized to identify tigecycline misuse. Evaluation included clinical indications and empiric utilization. It revealed a sixty-one (8/13) percent of inappropriate use. By January 2011, active daily audit started and direct clinical interventions with physicians feedbacks registered. All tigecycline orders were audited for clinical indication based on use criteria, and therapy duration. Clinical interventions included: recommendation of alternative therapy, and de-escalation. Data was collected for five months. Therapy duration was compared between the first two months of implementation and the last three months.

Results: There were forty patients who received tigecycline during the five month period analyzed. Thirty-eight percent of the patients had a positive culture for a multidrug resistant organism only susceptible to tigecycline. All of the patients were attended by an infectious diseases physician, although tigecycline therapy was initially ordered in some cases by the attending physician. Sixty-two percent of the patients had poly-microbial infections. De-escalation was recommended to thirty-eight percent of the cases and alternative therapy to eighty percent of the cases. Total recommendation acceptance was eighteen percent. Overall average therapy duration was eleven days. Duration of therapy in the first two months resulted in an average of fourteen days compared to seven days-average in the last three

months. This demonstrates a reduction of seven days in therapy duration. There was also an impact in tigecycline cost per PAPD. Cost per PAPD for the first two months was $3.54; compared to $1.08 the following three months.

Conclusion: Appropriate utilization of antimicrobials is required in times when antimicrobial pipeline is almost dry. We must focus on reducing inappropriate use of these precious medications and preserve their effectiveness. Direct prospective audits and physicians feedback can help in promoting appropriate utilization of broad-spectrum antimicrobials. Tigecycline clinical initiative faced some challenges like physicians resistance, which delayed our projected outcome. Recommendation acceptance was low. Initial interventions may have taken effect in the reduction of therapy duration seen in the last three months. Despite physicians resistance, improving antimicrobial utilization is an ongoing process.

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Category: Infectious Diseases

Title: Evaluation of extended infusion of piperacillin-tazobactam therapy

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Purpose: Piperacillin-tazobactam is often used to treat Pseudomonas aeruginosa infections. Piperacillin-tazobactam exhibits concentration-independent bacterial killing, where time above the minimum inhibitory concentration is important to optimize. Based on the favorable outcomes from the study by Lodise et al using extended infusion of piperacillin-tazobactam, an automatic conversion of piperacillin-tazobactam intermittent infusion to piperacillin-tazobactam extended infusion was implemented. The study objectives were to evaluate the length of stay, toxicity, and drug cost of extended infusion of piperacillin-tazobactam given every 8 hours over 4 hours compared to intermittent infusion of piperacillin-tazobactam given every 6 hours over 30 minutes in patients with invasive Pseudomonas aeruginosa infections.

Methods: Institutional review board approval was obtained from the institution; necessity of informed consent was waived. The pharmacy database was used to identify patients who received piperacillin-tazobactam. A retrospective chart review was performed. The control group received piperacillin-tazobactam intermittent infusion from July 2009 to June 2010 and the study group received piperacillin-tazobactam extended infusion from July 2010 to February 2011. Patients were included if they were at least 18 years old, had a positive Pseudomonas aeruginosa culture from a respiratory, abdominal, wound, or blood source, and received at least 48 hours of piperacillin-tazobactam within 72 hours of the culture. Patients were excluded if the Pseudomonas aeruginosa was intermediate or resistant to piperacillin-tazobactam. Patients were also excluded from the extended infusion group if they received greater than 1 day of intermittent infusion. Patient demographics, relevant laboratory and radiologic findings, and clinical data were collected.

Results: There were 32 intermittent infusion and 24 extended infusion patients. Baseline characteristics between both groups were not significantly different. While the mean total length of stay was shorter in the extended infusion group (10 days vs. 14.2 days), it was not statistically significant (p=0.114); similarly, the mean length of stay following positive culture was shorter in the extended infusion group (8 days vs. 11.25 days), but was not statistically significant (p=0.116). There was no statistically significant difference in antibiotic-related adverse events between the two groups (p=0.63). Extended infusion of piperacillin-tazobactam resulted in lower mean cost of drug per patient per stay.

Conclusion: Implementation of piperacillin-tazobactam extended infusion did not have a negative impact on length of stay nor toxicity on our patient population, while still lowering drug acquisition cost. Automatic conversion of piperacillin-tazobactam to extended infusion continues as a part of the antimicrobial stewardship program.

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Category: Leadership

Title: Developing a standardized training program for new pharmacists in a large community hospital

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Purpose: During a departmental expansion period, it was discovered that the 12-week orientation process was not conducive to training several pharmacists at once. The orientation process did not utilize multiple preceptors or a case based approach to competency assessment. This case describes methods by which an orientation curriculum was developed and implemented for new Clinical Staff Pharmacists in a large community hospital pharmacy.

Methods: A focus group of experienced pharmacists was formed in order to review the current orientation process and identify goals and objectives for the 12-week training period. A generic orientation calendar was created with specific focus areas for each week. The group also developed skill-based competency checklists and a general orientation notebook for all new pharmacists. A team of clinical specialists each selected a clinical topic and developed a curriculum to train pharmacist trainees in a group setting. Case-based competency tests for kinetics and anticoagulation monitoring were developed and the group created orientation surveys for all trainees to complete. Sharepoint, a data management system, was also utilized to organize and share all orientation materials. A Learning Clinical Coordinator position was also developed to assist with overseeing and ensuring the quality of orientation, competency assessments, continuing education for staff, and student and resident rotations.

Results: Twenty-eight Clinical Staff Pharmacists have successfully completed the revised 12-week orientation process with an eighteen month retention rate of eighty eight percent. Follow-up satisfaction survey results indicate that one-hundred percent of new pharmacists felt prepared to successfully achieve their job standards at the end of their orientation period.

Conclusion: Developing an orientation curriculum with specific skill-based objectives can ease the burden of orienting multiple pharmacists at one time and increase the consistency of training provided.

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Category: Leadership

Title: Relevance of Manager-in-Training (MIT) program in the development of future pharmacy leaders

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Purpose: The objective of this presentation is to explain the significance of an MIT program and how it can create successful pharmacy leaders.

Methods: Selection of a MIT candidate is based on specific criteria which include, but are not limited to, being a graduate of an accredited pharmacy educational institution, previous work experience in an acute care setting, and management experience. The process involves intense screening and interviews, by a panel of corporate and field-based directors. Once the candidate is selected, the MIT is placed in an appropriate hospital or market with qualified mentors. There, he or she begins focused goal oriented training in different modules, such as clinical, financial, regulatory, operations, automation and human resources. This training is completely hands on, with direct involvement of the MIT to work with their mentors and make decisions under their supervision. This training provides the MIT a wide range of experiences and growth opportunities which approximate real world challenges. After successfully completing the training over twelve to eighteen months, the candidate is placed in a director of pharmacy position at an appropriate sized hospital and begins an independent work while continuing to receive strong support from market and regional directors.

Results: Although the training period of twelve to eighteen months may seem short, the program and network of support at each level ensures the success of the candidate once they are working independently. Currently, more than eighty individuals have gone through our organizations program, and the majority of these are currently working as leaders in the pharmacy field.

Conclusion: As healthcare goes through revolutionary changes, we will continue to see more accountability shared with pharmacy services. This creates a need for more sustainable leadership. We must provide a safe environment and training tools to develop future leaders so that they can provide honest and effective leadership throughout the changes to come. After going through MIT program, new leaders find themselves to be at much advantage to take their new role as a leader as compare to candidates who have graduated from educational institutions with dual credentials such as business and pharmacy. The Manager-in-Training is a win-win situation where the employer initially invests in the leadership and managerial development of the MIT and later these well equipped leaders give back to the profession, providing success and stability to the employer.

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Category: Leadership

Title: Impact of a Student Pharmacist Leadership Retreat on Engagement in Organizations

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Purpose: Few initiatives are in place for pharmacy students at Northeastern University to develop leadership skills. Our objectives were to: develop a yearly student leadership retreat; assess student engagement in professional organizations and influencing factors.

Methods: Student leaders (class officers and leaders of various campus pharmacy organizations) from Northeastern Universitys School of Pharmacy were invited to attend an off-campus leadership retreat comprised of various team-building activities and discussion and activities based on Coveys 7 Habits of Highly Effective People. A pre-retreat survey was administered to assess student involvement in various student organizations, level of engagement within organizations at the university and surrounding communities and satisfaction with their level of involvement. A post-retreat survey was administered to ascertain student reflections regarding impressions and strategies learned from the retreat and their planned level of engagement in student organizations in the next year.

Results: Twenty-nine students attended the retreat representing five pharmacy organizations and all six class years. Pre-survey results reported student participation in a mean of 1.70.7 pharmacy organizations and 1.31.3 non-pharmacy organizations. Earlier class standing was associated with higher degree of involvement. The average number of pharmacy groups involved for first years was 2, second years was 1.4, third years was 1.5, fourth years was 1.57, fifth years was 1.25, and sixth years was 1.33. 93% of participants held an office in at least one organization and 76% reported satisfaction with their level of involvement. Student member involvement in student group activities and funding for outreach activities were listed as the largest barriers to organizations engagement in the school and community Participants reported an increase in enthusiasm for pharmacy organizations in the post-retreat survey, and a will to incorporate the 7 habits into their professional and personal lives. The post-retreat survey also revealed that students in years 1-3 wanted to be more involved in student groups and hold higher officer positions, while upperclassmen (years 4-6) were less interested in maintaining involvement in the next year.

Conclusion: A successful yearly leadership retreat can be conducted. Student leader participants at Northeastern University were satisfied with the overall engagement of student groups in the school and

community, and the most influencing factors for the success of student organizations were student member involvement and funding.

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Category: Leadership

Title: The changing role of the pharmacist involved in the pharmacy technician lead ward top up service

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Purpose: The role of the pharmacist as the academic support for the pharmacy technician lead ward top up service has been not well defined in the new Capital Regional Pharmacy in Denmark. According to contract, the pharmacists role is to develop and ensure the quality of the top up service. Due to lack, of clearly formulated aims, the results have been poorer than expected. The aim of this project is, by using leadership and development of a model for the pharmacist role, to help clarify the role of the clinical pharmacists involved in top up service at the Capital Regional Pharmacy.

Methods: All pharmacists and pharmacy technicians working with the top up service were invited to one of three consensus-conferences, where the future roles of the pharmacist as an academic support were discussed. This resulted in input from about 120 employees and the results were compiled and data analysed. Feedback and reorganisation of pharmacist role was presented to the pharmacists at a meeting and new cross regional working groups were formed.

Results: It was seen that the pharmacists role needed to be more clearly defined in the contract, and further attention needed to be paid to the inhouse training and competence development of the individual pharmacists. Sharing of knowledge across the Region needs to be within more formal systems, and finally the pharmacist needs more formalised training to support new activities in the clinics.

Conclusion: By exercising leadership and inviting employees to give input on the future role of the pharmacist involved in the top up service a new, clear concept has been developed, new opportunities for developing competences at work have been introduced, a stronger regional network among clinical pharmacists is a reality, and a professional backup system based on a common IT platform is being built.

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Category: Pediatrics

Title: Motivational Factors Influencing Pediatric Influenza Vaccination

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Purpose: To identify the montivational factors that influenced caregivers of children aged 6 months to 18 years to have their child immunized against influenza during the 2009-10 influenza season.

Methods: This study is a retrospective, descriptive survey of the caregivers for non-hispanic pediatric patients aged 6 months to 18 years who were vaccinated against seasonal influenza during the 2009-10 influenza season at the Jefferson County, AL Department of Health (JCDH). A survey instrument was constructed and underwent readability review by an experienced reviewer. The survey was designed to examine caregiver's motivations for having their child immunized against seasonal influenza, since this vaccine is not typically a part of routine pediatric well-child visits and requires the parent to seek immunization either outside of a scheduled healthcare encounter, or have their child immunized during a sick-child visit. Following readibility review, a pilot survey was conducted in JCDH pediatric clinic waiting areas to validate the instrument. The inclusion criteria for the study were: non-Hispanic children, aged 6 months to 18 years at the time of immunization, caregiver's age greater than 18 years, and receipt of the seasonal influenza vaccine between September 1, 2009 and April 30, 2010. 4310 pediatric patients met the inclusion criteria for the study, and based upon a calculated power of 85% assuming a 15% response rate, 1893 surveys were mailed in November 2010 along with postage-prepaid return envelopes.

Results: 186 completed surveys were returned. The response rate was lower than hoped at 9.8%; however, it is not inconsistent with similar survey research of the general public. Intial data analysis was performed using frequencies and Spearman Rho Correlation calculations to determine if there was a correlation between the various motivational factors for vaccination. Participants could select multiple motivational factors on the survey. The strongest motivational factor for pediatric immunization was the recommendation of a health care provider (66%). Spearman Rho correlation data show that there are a number of moderately significant variables among motivational factors which may influence caregiver's decisions to have their child immunized. These include phone call reminders, newspaper/magazine advertisements, commercials on radio, ads on television, signs at pharmacies, and recommendations by pastors and other spiritual leaders. In addition, a number of caregivers were motivated by more altruistic, public health reasons, including a desire to stop the spread of influenza and a desire to prevent the flu through vaccination. This was an unexpected finding, as we anticipated past infection

with influenza or past influenza immunization would be strong motivational factors. However, our research did not identify these as strongly correlative as motivational.

Conclusion: Previous studies examining why people choose to be immunized against influenza show that doctor recommendation, postcard reminder, friend recommendation, past vaccination, and close contact with someone who has the flu are all factors causing individuals to seek the flu shot. Our data show that the most important motivational factor for caregivers of pediatric patients is the recommenation of a doctor or nurse. This stresses the importance for healthcare providers to be strong advocates of vaccines in their practices. While only 6% of caregivers in our study recalled a pharmacist recommending the flu shot for their child, this may be a factor of the population surveyed (immunized at the health department) and certainly pharmacists could and should take a more active role in advocating pediatric influenza vaccination. In addition, our research intimates that patients are accutely aware that the flu shot is a good way to prevent the flu, and that caregivers may have felt a larger public health motivation to want to stop the spread of the flu. Because the survey examined individuals who received seasonal flu vaccine in the same year of the H1N1 outbreak and vaccine availability, we believe the perceived seriousness of the illness by the public may have influenced individiuals' more altruistic public health motivations, which has not been as clearly defined in previous studies. This requires further examination. In addition, further research to test motivational messages which can increase pediatric influenza immunization rates is needed.

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Category: Pediatrics

Title: Comparison of prophylactic antibiotics in pediatric patients with delayed sternal closure following cardiac surgery

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Purpose: Prophylactic antibiotics are used routinely in pediatric patients who return to the ICU with an open sternotomy following cardiac surgery. Limited information is available regarding selection and efficacy of prophylactic antibiotics. The purpose of this study was to compare a combination of vancomycin and gentamicin to cefazolin as prophylactic antibiotic regimens in pediatric patients undergoing delayed sternal closure.

Methods: The institutional review board approved this retrospective chart review. Included patients were admitted to the pediatric cardiac ICU from January 2004 to January 2006 and received either vancomycin and gentamicin or cefazolin as antibiotic prophylaxis following cardiac surgery with delayed sternal closure. Occurrences of positive cultures, laboratory values indicative of infection and renal function, and cost of therapies were compared. Fishers exact test or Students t-test analyses were performed to assess statistical significance.

Results: Of the 101 patients included in the study, 38 received cefazolin and 63 received vancomycin/gentamicin. Positive cultures occurred in 8 patients (21 percent) in the cefazolin group and in 13 patients (21 percent) in the vancomycin/gentamicin group (p equals 1). In the cefazolin group and in the vancomycin/gentamicin group, respectively, the maximum CRP was 7 and 9 (p equals 0.2), the maximum white blood cell count was 13.7 and 15.7 (p equals 0.08), and the maximum band count was 8 and 11 (p equals 0.03). Average serum creatinine on day prior to surgery was 0.82 in patients who received cefazolin and 0.78 in patients who received vancomycin/gentamicin (p equals 0.5). On the day after chest closure (or day of death if chest closure was not achieved) the average serum creatinine was 0.74 in the cefazolin group and 0.85 in the vancomycin/gentamicin group (p equals 0.3). The average furosemide dose while chest was open was 6.6 mg/kg/day in both groups. The average cost of antibiotic therapy per day was $0.17 for the cefazolin group and $0.41 for the vancomycin/gentamicin group (p less than 0.001). In addition, the average cost per day for antibiotic monitoring in patients who received vancomycin/gentamicin was $3.13.

Conclusion: Cefazolin or a combination of vancomycin and gentamicin are equally effective at preventing infections in pediatric patients with delayed sternal closure after cardiac surgery. The impact of either therapy on renal function also appears similar. The combination of vancomycin and gentamicin

requires more intensive monitoring, is more expensive, and may provide an unnecessarily broad spectrum of coverage for routine use in this patient population.

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Category: Pediatrics

Title: Hyperglycemia in the critically-ill pediatric patient

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Purpose: Hyperglycemia in non-diabetic, critically-ill adults has been shown to have higher morbidity and mortality rates. In addition, hypoglycemia (less than 60mg/dL), severe hyperglycemia (greater than 200mg/dL), and large fluctuations in blood glucose (BG) have been associated with higher morbidity and mortality. Relevant studies in pediatric patients have conflicting results. The objective of the study was to determine the incidence of hyperglycemia in non-diabetic pediatric patients admitted to the pediatric intensive care unit (PICU) as well as determine if there are associations with morbidity and mortality.

Methods: A retrospective chart review of all patients admitted to the Childrens Health System PICU between August and November 2010. Patients who were between 1 month and 18 years of age, had a PICU stay greater than 24 hours, on mechanical ventilation, and/or received an inotrope/vasopressor, and had two consecutive BG values greater than 140mg/dL were included. Additional data collected included demographics, admission diagnosis, number of glucose measurements less than 60 and greater than 140mg/dL, minimum, average, and maximum glucose levels, treatment for hyperglycemia, concomitant medications, length of PICU/hospital stay, length of time on mechanical ventilation, and survival rate.

Results: During the study period, 441 patients were admitted to the PICU; 28 patients met the inclusion criteria. Average age was 8.1 6 years, average weight was 32 24kg, and 17 (61%) were male. The median pediatric risk of mortality (PRISM III) score was 12. Major diagnoses included respiratory illness (n = 10) and trauma (n = 9). Median PICU and hospital length of stay were 4 and 6.5 days, respectively, and median number of ventilator days was 2. The minimum, average, and maximum blood glucose for all study patients were 95, 154 and 241 mg/dL, respectively. 68% of patients had a BG greater than 140mg/dL; only three of these patients received treatment with continuous insulin infusions. Five patients had glucose levels less than 60mg/dL during their PICU stay, none of whom had received insulin. Although not statistically significant, patients who received inotropes/vasopressors or expired had a trend towards lower average glucose than those who did not.

Conclusion: A small number of PICU patients in this study period experienced hyperglycemia. The majority of the patients in this study did not receive treatment for their hyperglycemia of critical illness.

Because 68% of patients with hyperglycemia were either respiratory or trauma patients, frequent monitoring of glucose levels in these populations is suggested. Future research is needed to predict target glucose levels in PICU patients and appropriate glucose monitoring.

5-142

Category: Pediatrics

Title: Analysis of acute otitis media treatment trends in pediatric patients

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Purpose: In 2004, the American Academy of Pediatrics and the American Academy of Family Physicians released guidelines on the diagnosis and management of acute otitis media. This guideline provided criteria for diagnosis, addressed pain management, discussed initial observation as a treatment option for uncomplicated cases, and made antibiotic recommendations for cases where an antibiotic was warranted. The purpose of this study was to utilize data from NAMCS and NHAMCS to analyze the management of acute otitis media in private office based clinics, emergency departments, and hospital-based clinics before and after the publication of the AAP and AAFP guidelines.

Methods: The National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) for the years 2002-2008 were used to look at the management of patients 6 months to 12 years of age who were diagnosed with acute otitis media. The data were then used to compare management of otitis media before and after the publication of the 2004 guidelines where the recommendation of observation without the use of an antibacterial agent was added. The primary outcome of interest was the number of times observation was chosen over the prescription of an antibacterial agent. Secondary outcomes of interest included how often amoxicillin was chosen as the antibiotic prescribed and whether there was a difference in antibiotic prescribing rates based on clinic or payer type.

Results: The average number of visits with the diagnosis of acute otitis media per month declined following the publication of the guidelines (from 1,162,837/month to 834,560/month), but came back up in the 2007-2008 time period (970,454/month). The overall percentage of visits in which an antibiotic was not prescribed originally increased following the release of the guidelines (from 13% to 16%), but returned to below pre-guideline levels in 2007-2008 (12%). In visits where an antibiotic was prescribed, amoxicillin was prescribed 57.5% of the time overall (55% before the guidelines, 59% in both time periods following the guidelines).

Conclusion: Although there was a slight increase in the management of acute otitis media without antibiotics in the 30 months immediately following the release of the American Academy of Pediatrics and American Academy of Family Physicians clinical practice guidelines, this fell back to at or below pre-guideline levels in the 2007-2008 time period. The largest change in the percentage of visits where no antibiotic was prescribed was seen in the private office based clinics and the patients with private insurance. When an antibiotic was prescribed, amoxicillin was the most common antibiotic chosen.

5-143

Category: Pediatrics

Title: Suspected propylene glycol toxicity in two pediatric patients receiving intermittent intravenous and oral lorazepam

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Purpose: These two cases present patients who after receiving high doses of both intermittent intravenous lorazepam and oral lorazepam for a prolonged period exhibited signs and symptoms of propylene glycol toxicity. Patients under the age of 4 do not have a fully developed alcohol dehydrogenase enzyme system and as a result, can be at higher risk of toxicity from propylene glycol, an agent metabolized by this pathway. Patient 1 was a 5 kilogram, 7 month old former 28 week gestational age male with severe lung disease and pulmonary hypertension who was admitted from the pulmonary hypertension clinic. Over a period of ten weeks, the lorazepam had been titrated up to a total 10 week dose of 85 milligrams (17 milligram per kilogram) of intermittent intravenous lorazepam infusion and 1,052.5 milligrams (210.5 milligram per kilogram) of lorazepam suspension. During the last week of receiving the lorazepam suspension, the dose had been titrated to 11 mg by mouth every 6 hours, or 2.2 milligrams per kilogram per dose. At this time, the patient had begun to exhibit signs of metabolic acidosis, with arterial pH of 7.3, PCO2 60mmHg, base excess of 19, and serum osmolalitity of 385. The patient received 235 grams of propylene glycol over the course of a week. In the absence of propylene glycol levels but in the presence of other risk factors, he was changed to lorazepam tablets which were subsequently crushed, dissolved and the appropriate dose drawn up into an oral syringe and administered. Upon initiation of this method, arterial pH, PCO2 and base excess normalized. This patient continued his lorazepam regimen with this method of crushing and dissolving tablets without any associated complications. Patient 2 was a 7 kilogram, 5 month old former 35 week gestational age male who was initially admitted for sepsis and pneumonia. In 6 weeks he received a total cumulative intermittent intravenous lorazepam dose of 758.8 milligram (126.5 milligram per kilogram) and 102 milligrams(17 milligrams per kilogram) of lorazepam suspension. During the last week of receiving lorazepam, the dose had been titrated to 11 mg by mouth every 6 hours, or 1.8 milligrams per kilogram per dose. During this time period, he became acidotic with an arterial pH of 7.16, a PCO2 of 87 mmHg and had a base excess of 8. Propylene glycol levels were not obtained but it is estimated that this patient received 514 grams of propylene glycol in the fifteen days prior to these metabolic events. This patient was also switched to tablet formulation and had an increase in arterial pH to 7.34, and a drop in the PCO2 and base excess. There have been few case reports for propylene glycol toxicity associated with intermittent intravenous and oral lorazepam. More studies are needed to see if these methods of delivery are clinically significant enough to warrant monitoring of propylene glycol levels in patients on such high doses of these formulations.

Methods: N/A

Results: N/A

Conclusion: N/A

5-144

Category: Pharmacokinetics

Title: Comparison of the in vitro binding of two colesevelam formulations to bile acids

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Purpose: Colesevelam is a bile acid sequestrant approved in the United States for reducing low-density lipoprotein cholesterol levels in patients with hyperlipidemia and for improving glycemic control in adults with type 2 diabetes. Colesevelam is available in both tablet (625 mg/tablet) and powder for oral suspension formulations (5.0 g/packet [75% active]). Here we report the results of an in vitro equivalency study which compared colesevelam tablets with colesevelam powder for oral suspension.

Methods: Equilibrium and kinetics testing was performed to evaluate the binding reaction between three bile acids (glycocholic acid, glycochenodeoxycholic acid, and taurodeoxycholic acid) and colesevelam derived from tablets versus colesevelam derived from the powder for oral suspension formulation. Both the equilibrium and kinetics reactions were conducted in a dissolution apparatus at 37 plus or minus 0.5 degrees Celsius using the USP Apparatus 2 set at 200 rpm. For the equilibrium reactions, aliquots of the test solutions (with bile acid concentrations of 0.1, 0.3, 1, 3, 7, 10, 20, and 30 mM) were collected, filtered after 24 hours, and analyzed by high-performance liquid chromatography (HPLC). The equilibrium reactions were conducted with and without bile acid pretreatment. For the kinetics reactions, aliquots of the test solutions (with bile acid concentrations of either 0.3 or 3 mM) were collected, filtered at several time intervals over a 24-hour period, and analyzed by HPLC.

Results: The equilibrium results for the tablet and powder for oral suspension formulation of colesevelam were similar. Furthermore, the equilibrium results for each colesevelam formulation were similar with or without pretreatment with bile acids. The linearity of the Langmuir plots was strong for all three bile acids. In addition, the bile acid binding isotherms were similar. The binding capacities of both colesevelam formulations were similar across a range of bile acid concentrations. The kinetics reactions indicated that the binding of colesevelam to bile acids was rapid for both formulations with almost no unbound bile acids remaining after the first few minutes of the reaction. Furthermore, the binding of colesevelam to bile acids was nearly identical for the tablet and powder for oral suspension formulations, with relatively low percent RSDs across all testing intervals. When the kinetic data were graphed, the results obtained with the tablet formulation of colesevelam were super-imposable with that obtained with the powder for oral suspension formulation.

Conclusion: The equilibrium and kinetics data indicate that the tablet and powder for oral suspension formulation of colesevelam are equivalent.

5-145

Category: Pharmacokinetics

Title: Pharmacokinetic analysis of carboplatin in cancer patients with renal failure

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Purpose: To clarify the applicability of Calvert formula in cancer patients with renal failure received carboplatin-based chemotherapy, we determined ultrafiltrated carboplatin concentration and analyzed pharmacokinetic parameters.

Methods: We analyzed pharmacokinetic parameters of carboplatin in two ovarian patients who were undergoing hemodialysis and received carboplatin-based chemotherapy. The first course dosage of carboplatin was determined based on Calvert formula. Glomerular filtration rate estimated by creatinine clearance was 5 mL/min in patient 1 and 0 mL/min in patient 2, then, the calculated carboplatin dosage were 150 and 125 mg, respectively, because the target AUC was set up at 5 mgmin/mL in the both patients. Heparinized blood samples were collected 1,2,3,4,8,10,and 24 h after starting the 1 h carboplatin infusion. Blood samples were centrifuged immediately and ultrafiltrated. The free carboplatin in the ultrafiltrated samples were analyzed by using HPLC system. Hemodialysis was performed for 4 h, starting 3 h after the end of carboplatin infusion. The actual AUC values of carboplatin in the ultrafiltrate were calculated by trapezoidal method. The carboplatin dosages in the following courses were determined by proportional calculation using the AUC value previously obtained.

Results: The AUC values in patient 1 and patients 2 after the first infusion of carboplatin were 4.1 and 3.3 mgmin/mL, which were 18% and 34% lower than the target AUC value of 5 mgmin/mL, respectively. In the case of patient 1, revised carboplatin dosages in the second course was increased to 183 mg based on the actual AUC value obtained in the first course. And the AUC value in the second course was also increased and almost closed to the target AUC value. In the patient 2, similarly to the patient 1, revised carboplatin dosage was increased to 189 mg in the second course, and the AUC value was increased to 5.9 mgmin/mL. The estimated AUC value in the first course without hemodialysis was 12.4 mgmin/mL (patient 1), and 13.8 mgmin/mL (patient 2). No remarkable side effect was found in the both patients throughout the carboplatinbased chemotherapy in combination with the hemodialysis.

Conclusion: In the present study, we examined the applicability of Calvert formula to determine the carboplatin dosage in renal failure patients. The calculated dosage might be too excess, because the estimated AUC values in the absence of hemodialysis were over two times higher than the target AUC value. Calvert formula has been established by analysis of the patients who had normal or subnormal

renal function. Although it has been still unclear that this equation is applicable to the cancer patients who have severely decreased renal function, the calculated dosage of carboplatin by using this formula in renal failure patients would be too excess without hemodialysis. However, by the monitoring of carboplatin blood level in combination with hemodialysis with fixed schedule such as starting 3 h at the end of infusion of carboplatin for 4h, the AUC value could be adjusted to reasonable value. In conclusion, monitoring of carboplatin blood level might provide the safe and proper chemotherapy even in the cancer patients with severely decreased renal function.

5-146

Category: Pharmacokinetics

Title: Hydroxy-itraconazole pharmacokinetics varied between immunocompromised patients taking fixed dosage of itraconazole with oral solution formulation

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Purpose: Itraconazole (ITZ) is a broad-spectrum antimycotic triazole used for both the prophylaxis and treatment of invasive fungal diseases. It is metabolized to its active hydroxy-ITZ (OH-ITZ) and then to inactive keto-ITZ. The use of ITZ oral solution formulation in immunocompromised patients is preferred as higher ITZ plasma concentrations are achieved than with the capsule formulation. The variability of OH-ITZ pharmacokinetics in those patients has not been fully characterized, and hence fixed dosage of ITZ was administered. The aim of this study was to evaluate the OH-ITZ pharmacokinetics.

Methods: Forty-six immunocompromised patients were enrolled. ITZ oral solution was administered as a single 200 mg dose for at least 12 days. The plasma concentrations of ITZ, OH-ITZ, and keto-ITZ 12-hours after administration were determined by UHPLC-UV or HPLC-MS/MS. The interindividual variability and factors fluctuating pharmacokinetics of ITZ and its metabolites were evaluated.

Results: The means plus or minus standard deviations of ITZ, OH-ITZ, and keto-ITZ were 833 plus or minus 468, 798 plus or minus 454, and 3.94 plus or minus 2.68 ng/mL, respectively. Greater correlation coefficient was observed between plasma concentration of ITZ and OH-ITZ (r equals 0.90) than between OH-ITZ and keto-ITZ (r equals 0.44). The plasma concentration of OH-ITZ was inversely correlated with plasma concentration ratio of keto-ITZ to OH-ITZ (r equals minus 0.52). Its concentration was also significantly correlated with serum concentration of albumin (r equals 0.37) and estimated glomerular filtration rate (r equals minus 0.36).

Conclusion: The OH-ITZ pharmacokinetics was variable among patients due to saturated generating reaction from ITZ, serum concentration of albumin, and renal function. Prevention from antimycotic infection may be accomplished by considering those factors fluctuating OH-ITZ pharmacokinetics.

5-147

Category: Pharmacokinetics

Title: Impact of CYP3A5 Genetic Polymorphisms on Cross-reactivity of Blood Tacrolimus Levels Measured by Chemiluminescent Immunoassay in Kidney Transplant Recipients

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Purpose: Tacrolimus is metabolized principally to 13-O-desmethylate (13-DMT) and 31-O-desmethylate (31-DMT) by cytochrome P450 (CYP) 3A. The 13-DMT is the most abundant metabolite in circulation after administration of tacrolimus. The 31-DMT but not 13-DMT showed the cross-reactivity with tacrolimus in chemiluminescent immunoassay (CLIA). The aim of this study was to evaluate the influence of CYP3A5 genetic polymorphisms on the cross-reactivity of blood tacrolimus levels measured by CLIA in kidney transplant recipients.

Methods: Fifty Japanese kidney transplant recipients receiving tacrolimus (Prograf) in Hamamatsu University Hospital were enrolled. The predose levels (C12) of tacrolimus measured by CLIA and HPLC-MS/MS were compared. The C12 of 13-DMT and 31-DMT was determined by HPLC-MS/MS. CYP3A5*3 was determined using PCR-RFLP procedure.

Results: Medians of tacrolimus C12 measured by CLIA and HPLC-MS/MS were 4.1 and 3.1 ng/mL, respectively. Tacrolimus C12 measured by CLIA was significantly higher than that by HPLC-MS/MS. The dose-normalized C12 of tacrolimus was significantly higher in the CYP3A5*3/*3 group than in the *1/*3 group. The C12 ratio of 13-DMT to tacrolimus was also significantly lower in the CYP3A5*3/*3 group than in the *1/*3 group. In contrast, CYP3A5*3 did not alter the dose-normalized C12 of 13-DMT. There was no significant difference in cross-reactivity of tacrolimus C12 measured by CLIA between the CYP3A5 genotypes. However, CYP3A5 caused greater overestimation by CLIA in patients with tacrolimus C12 of less than 3 ng/mL. Most enrolled patients had the C12 of 31-DMT below the lower limit of quantification (< 0.1 ng/mL).

Conclusion: CYP3A5 genetic polymorphisms affect the cross-reactivity of blood tacrolimus levels measured by CLIA in kidney transplant recipients. CLIA values should be carefully interpreted in kidney transplant recipients with CYP3A5*1, especially in those who maintain a low concentrations of tacrolimus.

5-148

Category: Pharmacokinetics

Title: Usefulness of antiretroviral therapeutic drug monitoring in clinical practice: five years of experience

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Purpose: Antirretroviral (AR) therapeutic drug monitoring (TDM) is a controversial approach which needs to show its usefulness in clinical practice to optimize AR therapy. The purpose of this study was to evaluate retrospectively the contribution of TDM of AR as a complementary tool to dosage adjustment in HIV+ patients from a five-year period.

Methods: The analysis was conducted from 2006 to 2010 in 365 HIV-infected subjects from the outpatient unit of the University Hospital of Salamanca. Initially all patients were receiving protease inhibitors (PI) and/or non-nucleoside reverse transcriptase inhibitors (NNRTI) at standard doses.. One blood sample at steady-state, usually at the end of the dosage interval (Cssmin), was obtained during each visit to the Hospital. PI (indinavir, saquinavir, atazanavir, lopinavir, nelfinavir and darunavir) and NNRTI (efavirenz and nevirapine) concentrations were assessed quantitatively with HPLC-UV. Pharmacokinetic parameters were estimated individually using Bayesian algorithms, with PKS software (Abbot-Diagnostic, Chicago, USA). These individualized parameters were used for dosage adjustment only when the clinical response or the presence of adverse drug events, (ADE) in the patient was unsatisfactory. The IP and NNRTI plasma Cssmin obtained were classified according to the therapeutic range (TR) usually accepted for these drugs: below the lower limit (BTR), within (WTR), or above the upper limit (ATR). The clinical results were evaluated according to the number of CD4+ lymphocytes, the plasma viral load (PVL), and ADE evaluated with international scales. Therapeutic success was considered when CD4+ > 200, with undetectable PVL and the absence of ADE.

Results: A total of 4,445 AR plasma drug concentrations from 365 patients were obtained. The results of the correlation between AR plasma concentrations and clinical response were as follows: 1) 89.3, 80.2 and 60.9 % of patients with WTR showed undetectable PVL, CD4+ >200 cel/mL, and the presence of ADE, respectively, 2) 72.9, 62.7 and 43.2% of patients with BTR showed undetectable PVL, CD4+ >200 cel/mL, and the presence of ADE, respectively and 3) 89.0, 82.0 and 85.7% of patients with ATR showed undetectable PVL, CD4+ >200 cel/mL, and the presence of ADE, respectively. During the first year, only 47% of the patients had WTR concentrations, these increasing to 76.7% after 5 years, mainly as a consequence of dosage adjustment and an improvement in AR treatment adherence. Thus, the

percentage of patients with BTR and ATR concentrations were reduced from 17.3 and 35.7 to 10.1 and 13.2, respectively. Along the study period, dosage adjustments were made in 123 patients, of which 23 involved a reduction in the dose and in the rest an increase in the same.

Conclusion: A high number of patients do not reach therapeutic concentrations with the standard doses of antiretroviral agents. There is a certain correlation between clinical efficacy and AR plasma concentrations, which is the basis of TDM. TDM allowed a 78.4% increase in the percentage of patients with concentrations within the therapeutic ranges. TDM can be considered as a complementary tool in the dosage optimization of AR therapy in HIV+ patients.

5-149

Category: Pharmacokinetics

Title: Evaluation of the predictive ability of different renal function estimation formulas on the estimation of elimination kinetics of ganciclovir

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Purpose: To evaluate the differential predictive ability of different formulas for the renal function estimation on elimination rate constant, in patients that were treated with intravenous ganciclovir.

Methods: Observational and cross-sectional study, in patients treated with intravenous ganciclovir and with available records of serum drug levels, during a period of six years (2004-2010), in a third-level hospital. Demographic and laboratory data, dose/body-weight and ganciclovir Cmin were recorded. Renal function was estimated according to the following formulas: Cockcroft-Gault, MDRD6, MDRD4-IDMS and CKD-EPI. The elimination rate constant (Kel) was calculated by using a mixed model integrating ganciclovir serum concentration-time data from each patient and available population pharmacokinetic data. The predictive ability –the coefficient of determination (CD)- of the different formulas for the estimation of renal function and the correlation between these formulas were evaluated by using a model of lineal regression.

Results: Sixty-nine patients were included in the analysis. Demographic data were: media age 54 years, 64% male, 100% caucasian. The media values for dose/body-weight, Cmin, Kel and serum creatinin were [media (SD)] 7.0 mg/kg (4.0), 2.3 µg/mL (4.19), 0.051 h-1 (0.031) and 0.93 mg/dL (0.64), respectively. The estimated renal function, according to the different formulas were: 80.5 ml/min (35.9) –Cockcroft-Gault-, 70.3 ml/min/1.73m2 (37.3) –MDRD6-, 124.9 ml/min/1.73m2 (107.2) –MDRD4-IDMS-, and 84.3 ml/min (40.1) –CKD-EPI-. The regression analysis showed that Kel varies significantly with all renal function estimators (P>0.001, in all cases). Nevertheless, the coefficient of determination –the ability to predict- varies amid the different formulas, since for Cockcroft-Gault is 0.338 (33.8% of Kel variability is explained), for MDRD4-IDMS is 0.334 (33.4%), while for CKD-EPI is 0.472 (47.2%) and for MDRD6 is 0.526 (52.6%). All formulas are well associated among them (correlation coefficient > 0.8 in all cases). The worst association was registered among Cockcroft-Gault and MDRD6 (correlation coefficient 0.839), and the best one among MDRD4-IDMS and MDRD6 (0.941).

Conclusion: Renal function, estimated following different formulae –Cockcroft-Gault, MDRD6, MDRD4-IDMS, and CKD-EPI- explains the variability of the elimination –Kel- kinetics of intravenous ganciclovir. However, the predictive ability varies among the different formulae used ranging from 33.4% to 52.6%,

being the best estimator MDRD6. Additionally, the correlation among the different formulas are significant, being Cockcroft-Gault the poorest correlated.

5-150

Category: Pharmacokinetics

Title: A novel method to rapidly and precisely forecast serum aminoglycoside and vancomycin dosages and concentrations

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Purpose: Use of staff pharmacists to evaluate serum vancomycin (V) and aminoglycoside (A) doses and promote rational pharmacokinetic (PK) dosages in adults is desirable; but training time, need for computer access, consistency and time needed to calculate dosages are potential barriers. A rapid, reproducible method that produces identical results as on-line programs without use of a computer has not yet been described.

Methods: A table array nomogram was prepared using rearranged equations for a one-compartment PK model commonly used for A and V. Table headers are CrCl with corresponding calculated k elimination and half life (population values), and common dosing intervals (Tau) of 6, 8, 12,24, 36, 48 and 72 hours. The equations were arranged in a manner to allow forecasting of anticipated maximum (max) and minimum (min) serum concentrations for any dose (mg/kg) and dosing interval by simple multiplication. This method was previously proven as an accurate method for A. This nomogram can also be used to forecast dose and Tau needed to obtain a specified min for V.

Results: The nomogram was constructed and determined to produce identical results with a widely used on-line web site (GRPH). The method can be mastered in less than an hour and individual calculations made in less than a minute. In contrast to GRPH, this method allows direct input of CrCl and dosing weight and allows modification of population values without forced assumptions based on unproven calculation methods. It also provides dosage recommendations for standard dosage intervals for A and V without iteration, and also allows direct calculation of dosage needed for a desired min for V.

Conclusion: This rapid, novel non-computer based dosing method for calculating max and min A and V offers advantages that might be useful for staff based PK dosing teams.

5-151

Category: Pharmacy Law / Regulatory / Accreditation

Title: Attitudes of Florida pharmacists toward implementing a state prescription drug monitoring program (PDMP) for controlled substances

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Purpose: As of May 23, 2011, 35 states had an operational prescription drug monitoring program (PDMP), and 13 additional states including Florida in 2009 had passed legislation to implement a PDMP. PDMPs, electronic databases that track and collect designated data on controlled substances and other commonly abused medications, are intended to serve as a tool for health care practitioners when prescribing and dispensing controlled substances to reduce drug abuse and diversion. From January-June 2010 in Florida, the top 3 prescription drugs causing the most deaths included the controlled substances oxycodone (28%), alprazolam (17%), and methadone (13%) out of 2,579 prescription deaths, all of which would be subject to reporting in Florida's PDMP when implemented. Because pharmacists are the health care professionals most affected by PDMP reporting requirements, evaluating their attitudes about PDMP implementation is important. The purpose of this study was to assess Florida pharmacists' attitudes toward implementing a PDMP in the state.

Methods: The institutional review board approved this cross-sectional study conducted in Florida between February 2010 and June 2010 prior to the implementation of the proposed PDMP. A random sample of 5,000 of approximately 26,000 pharmacists licensed in Florida was invited to participate in a voluntary and anonymous 10-question self-administered mail survey of which 4 survey items assessed pharmacists' attitudes toward implementing a PDMP in the state.

Results: Of the 5,000 pharmacists contacted by mail, 911 (18.2%) completed the survey, of whom 837 responded to the items assessing opinions about PDMPs and provided practice site information. A majority of pharmacists across all practice settings agreed or strongly agreed with the statements that a PDMP should be implemented in Florida (chain 84.1%, hospital 74.2%, independent 78.0%, and other 71.1%) and that a PDMP would decrease the incidence of doctor shopping if implemented (chain 80.7%, hospital 67.1%, independent 71.7%, and other 63.3%). A majority of pharmacists across all practice settings disagreed or strongly disagreed with the statements that they would be discouraged to dispense controlled substances (chain 61.5%, hospital 50.0%, independent 60.2%, and other 63.8%) and that PDMP implementation would be an invasion of patients' privacy (chain 80.3%, hospital 67.7%, independent 67.2%, and other 69.4%).

Conclusion: In a small-sample survey, a majority of Florida pharmacists across all practice settings were in favor of implementing a PDMP in Florida. This is the first study to examine Florida pharmacists'

attitudes toward PDMP implementation, and the results invite future analyses of PDMP outcomes such as decreased drug abuse, reduction in mortality, and less doctor shopping.

5-152

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: The Cost Effectiveness of Rescue Bariatric Surgery After Primary Laparoscopic Adjustable Gastric Band Slippage [Abstract]

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Purpose: Obesity is a prominent health issue with increasing relevance, reaching epidemic proportions. In 2008, it was estimated that roughly 1.5 billion adults ages 20+ were overweight, with over 200 million men and around 300 million women being obese worldwide. Many medical conditions are attributed to obesity, including DM2, HTN, hyperlipidemia, CHD, MI, stroke, and increased risk for endometrial, breast, and colon cancers. Due to the rise in obesity, there has also been an increase in the use of bariatric surgeries. The American Society for Metabolic and Bariatric Surgery estimated that approximately 220,000 people with morbid obesity in the U.S. underwent bariatric surgery in 2009, a 15-fold increase since 1998. Considering each procedure costs approximately $20,000-30,000, this may indicate a profound economic impact. One of the most commonly used bariatric surgeries is laparoscopic adjustable gastric banding (LAGB). A number of complications may occur due to LAGB with rates ranging from 15-50%. Reported rates of band slippage, a common complication, may be as high as 24%. Symptoms of the slippage may be mild or severe. Symptoms may be severe enough to require lap band removal without any further substitution, lap band resizing/replacement in order to modify band placement, or conversion to laparoscopic Roux-en-Y gastric bypass (LRYGB). There is currently wide variation in the treatment of LAGB failure, and no standard has been adopted. Purpose: The objective of the evaluation was to assess the cost-effectiveness of laparoscopic gastric rebanding, laparoscopicgastric band removal, and LRYGB as rescue surgery for failed initial LAGB.

Methods: Estimates for the economic evaluation were derived from randomized controlled trials as well as published cost effectiveness analyses. Parameters included probabilities, costs, clinical effectiveness, and complications of using LAGB vs. LRYGB as rescue therapy after band slippage. The decision analysis for determining the incremental cost-effectiveness ratios (ICERs) compared the outcomes of patients who received rescue LAGB vs. LRYGB with early, late, and no complications. The outcomes were labeled as successful (>50% weight loss) or unsuccessful (<50% weight loss) after each intervention. In the sensitivity analysis, costs of the interventions were adjusted by 25% and 50% to evaluate the degree of change to the respective ICERs.

Results: Neither LRYGB nor LAGB replacement are cost-saving compared to removal, but they are both more beneficial for weight loss. The total costs of LAGB and LRYGB were $23,486.35 and $30,956.85, respectively. Total effectiveness for LAGB was 56% of patients achieving greater than 50% excessive weight loss and 80% achieving greater than 50% excessive weight loss from LRYGB. The incremental cost-effectiveness ratio was $31,127.08 per successful surgery gained.

Conclusion: Both options provide clinical and economic benefits to correct the failure even though both options have significant costs associated with them. By correcting the slippage, additional weight loss is encouraged, thereby decreasing additional costs of obesity. More analyses are needed to evaluate the optimal circumstances for either rescue surgery, and to analyze the quality-adjusted life years associated with the rescue interventions.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Analysis of relative factors associated with suspecting infection in patients after open-heart surgery

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Purpose: To determine the risk factors associated with suspecting infection in patients after open-heart surgery.

Methods: A retrospective case control study was done in patients who underwent cardiac surgery from Sept. 2009 to May 2010 in Guangdong General Hospital, with 400 patients in suspected infection group and randomly selected other 800 patients without suspected infection as control group. All variables were analyzed by univariate analysis, Chi-square test and logistic regression.

Results: Univariate analysis revealed that age, preoperative Left ventricular end diastolic dimension, preoperative albumin, preoperative serum creatinine, preoperative blood glucose, preoperative day, perfusion doctor of cardiopulmonary bypass, kind of surgery, operation time, cardiopulmonary bypass time, blood loss, red blood cell transfusion, plasma transfusion, day 2 glucose postoperation, mechanical ventilation time, ICU time, day 1 white blood cell, day 2 white blood cell, day 3 white blood cell, dialysis, pulmonary effusion, Pleural effusion, chylous effusion related to suspected infection following cardiac surgery. Logistic multivariate regression analysis showed that age, preoperative serum creatinine, preoperative blood glucose, preoperative day, perfusion doctor of cardiopulmonary bypass, kind of surgery, ICU time, day 1 white blood cell, day 3 white blood cell were independent risk factors for suspected infection.

Conclusion: Infection after cardiac surgery is closely related with a variety of perioperative risk factors. Our data suggest that patients planning to accept cardiac surgery should be more comprehensively assessed and monitored, stratified infection risk. And more specific criterions need for diagnose infection.

5-154

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: A Review of the Pharmacist Cancelling Dangerous Prescriptions Process at the MMUH

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Purpose: When clinical pharmacists review drug charts prescribing errors noticed are communicated to the team and resolved. Situations arise where potentially dangerous prescriptions merit further action in addition to contacting the team or when a team cannot be contacted. In such situations the drug, if administered, could result in significant patient harm. In 2009, a standardised process for pharmacists cancelling potentially dangerous prescriptions was approved by the Medical Executive, MMUH. Pharmacists can act immediately when confronted with potentially dangerous prescribing errors, thus safe-guarding the patient. The process included standardised training procedures for the clinical pharmacists, and the introduction of additional documentation procedures. Feedback of cancelled dangerous prescriptions to the Risk Management and Drug Safety Committees identify if further safety initiatives are required. To review the Pharmacist cancelling dangerous prescriptions process since implementation in 2009 to 2010.

Methods: To review: The database of cancelled prescriptions and identify trends. Barriers to clinical pharmacists cancelling dangerous prescriptions Clinical pharmacists feedback on the training procedures.

Results: From March 2009 until December 2010, 25 dangerous prescriptions were cancelled: Six oral methotrexate prescriptions were cancelled. Other drug categories cancelled included: o Psychotropic drugs (5) o Analgesics (4) o Cardiovascular (3) o Antimicrobials, antiepileptics, oral hypoglycemics, erythropoietin stimulating agents, azathioprine, steroids and desmopressin were each cancelled once. Four prescriptions cancelled were the injectable route, the remainder by the oral route. 9 pharmacists cancelled prescriptions on 12 different wards. All grades of pharmacists had cancelled prescriptions. One chief 2 pharmacist had cancelled 12 prescriptions. Reasons for pharmacists who had not yet occasion to cancel prescriptions included: a. Incompletion of the training process. b. Doctors are readily available to cancel prescriptions, for example specialty wards. c. Pharmacists cannot cancel prescriptions on the electronic system used in HDU & ITU. d. No reason for cancellation had arisen. Clinical pharmacists found the training and prescriptive documentation procedures essential. The main benefit of the training processes was the input of experienced staff in identifying prescriptions that posed a direct danger. In many instances the prescriptions identified as dangerous during training were not considered dangerous in the procedure.

Conclusion: The process for pharmacists cancelling dangerous prescriptions has been successfully implemented in the MMUH. The high frequency of methotrexate errors has been successful and has lead to additional drug safety initiatives in the hospital. The barriers to clinical pharmacists undertaking the process have been identified, and clinical pharmacist feedback on training and documentation obtained. The process will be modified as necessary and further monitored.

5-155

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Development and Implementation of a Nutritional Chart in the Mater Misericordiae University Hospital

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Purpose: Non-drug items being prescribed on the general drug chart had been identified as causing problems including: The drug chart becomes congested. Expectation by nursing staff for pharmacy to supply these items, though the responsibility is with other staff/departments. This may lead to: Omissions in non-drug aspects of the patients treatment. Nurses endorse the administration section of the drug chart with Drug Not Available in the Hospital. Lack of required follow up on these items. Nutritional products comprised the majority of non-drug items prescribed on the general drug chart. Correspondence to the Drugs & Therapeutics Committee, MMUH recommended that the Department of Clinical Nutrition & Dietetics, in collaboration with the Pharmacy Department, could develop a separate chart for nutritional products. Objective To develop a nutritional chart in the Mater Misericordiae University Hospital.

Methods: Review of the process for charting and administration of nutritional products in the MMUH. Quantification of nutritional products charted on general drug charts. Development of a nutritional chart.

Results: The Pharmacy Department purchase nutritional products. Dietitians have responsibility for their stock management at ward level. Nutritional products are not prescription drugs. In the MMUH: o Doctors charted oral nutritional supplements on the general drug chart. o Dietitians recommended enteral feeds using a pre-formatted one page document that was placed at the patients bed. X A review on five medical wards (n=118 patients) highlighted that 44 (37%) of patients had nutritional supplements prescribed in the drug chart. In two wards more than 50% of patients were prescribed nutritional supplements. The average number of oral nutritional supplements per patient was 2 (range 1 V 6 per patient). A nutritional chart was developed and passed by the Drugs & Therapeutics Committee, Nursing Executive Committee & the Medical Executive Council, MMUH. The nutritional chart was piloted on four wards and multidisciplinary feedback obtained. Minor modifications of the nutritional chart where made prior to introduction.

Conclusion: A nutritional chart has been implemented in the MMUH. The chart combines the oral nutritional supplements with the enteral tube feeds (NG/NJ/PEG). The nutritional chart: Removes oral nutritional supplements from the general drug chart. Formalises the process for the charting and administration of enteral nutritional products. Facilitates Dietitians in the recommending, charting, supply and monitoring of nutritional products for patients in the hospital.

5-156

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Statin Optimisation in Type 2 Diabetes Mellitus Outpatients

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Purpose: Patients with Type 2 Diabetes Mellitus (T2DM) have lipid abnormalities that place them at a higher risk of cardiovascular disease (CVD). The statistical association between cholesterol and CVD has been well established in large-scale epidemiologic trials. Numerous international groups give guidance on target lipid levels to reduce cardiovascular risk e.g. the Joint British Societies (JBS2), the American Diabetic Association (ADA) and NICE in the UK. In-house MMUH recommendations8 are also available.Aim/ Objective: To analyse lipid management of MMUH T2DM outpatients with reference international and local recommendations. To determine if lipid optimisation is routinely achieved. To update local guidelines, if necessary, based on international best practice.

Methods: Date collection forms were produced and piloted. Pre-clinic analysis of the lipid levels of all T2DM patients attending the MMUH Diabetes Outpatients over an 8-week period was performed. A further post-clinic review determined if statin therapy had been optimised to achieve treatment goals. Statistical data analysis was carried out using SPSS.

Results: 265 charts were analysed (53.5% male; 46.3% female) 57% failed to achieve ADA, JBS2, NICE and local MMUH targets pre-clinic attendance. Primary observation: 13.9% of patients failed to attend annual clinic review. Post clinic review: 17% had statin therapy optimised as per JBS2 and NICE guidelines. 21% were optimised as per ADA and MMUH guidelines. Strategies implemented to achieve optimisation included statin dose increase, additional lipid-lowering medications or switching of therapy. Atorvastatin was the most frequently prescribed statin. Dosing analysis did not reveal an optimal dose for all patients. Optimisation failure was linked to statin intolerance, deranged liver function tests, outdated blood results, patient compliance and physician factors. Statistical analysis showed no difference in achieving lipid targets, between those prescribed lipid-lowering medication and those without therapy.

Conclusion: In order to remedy non-attendance at annual clinics a GP letter was drafted recommending primary care strategies to optimise lipid levels. Encouragingly, of the 57% that failed to achieve guidelines: 17% (according to JBS2/ NICE) and 21% (according to ADA/MMUH) had their statin therapy optimised at out-patient clinics. Therefore no changes to local MMUH guidelines were deemed to be necessary.

5-157

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Antiretroviral regimen complexity as a predictor of adherence

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Purpose: It is well established that extremely high adherence to HAART is required for a successful virological and clinical response in HIV-infected patients. Despite the introduction of once daily antiretroviral regimens with a low pill burden, long term adherence remains a challenge, particularly in subgroups such as patients with drug addiction. We aimed to determine levels of adherence and identify factors associated with suboptimal adherence in treated, HIV-infected patients attending a busy European inner-city HIV outpatient clinic.

Methods: In a prospective cohort study, adherence was assessed in HIV-infected patients on antiretroviral therapy by self-report (ACTG adherence questionnaire). Relationships between suboptimal adherence (defined as <95%) and 49 covariates, including demographics, treatment factors, Centre for Epidemiological Studies Depression (CES-D) score and comorbidities were assessed using simple regression. Variables significant ($P < 0.05$) in univariate analyses were evaluated using multivariate logistic regression.

Results: 130 subjects (median [IQR] age 38 [11]; 27% female; 33% African origin; 27% IDU, 30% heterosexual and 20% MSM) were recruited. 83% were on once daily ARV and 16%, 34%, 48% and 2% were on regimens comprising one, two, three and four ARV products respectively. Median CD4+ was 389 [285] cells/L. 91% had HIV RNA < 50 copies/ml. Median adherence was 92% [range 0-100%] and 28% had suboptimal adherence. In univariate analyses, recent illicit drug use, on methadone, higher CES-D score, taking a higher number of ARV products, greater pill burden, missed clinic appointments and lower CD4+ were associated with suboptimal adherence. In multivariate analysis, missed clinic appointments [OR 1.45; 95% CI (1.16, 1.81)], a higher CES-D score [OR 1.14; CI (1.01-1.28)] and being on a higher number of antiretroviral products [OR 3.45; CI (1.46, 8.54)] were all independent predictors of suboptimal adherence.

Conclusion: This is the first study to identify medication complexity, as measured by the number of antiretroviral products, rather than pill burden or dosing schedule as the most important predictor of adherence in a contemporary cohort of HIV-infected patients. Single pill, fixed dose combinations (FDC)

may improve adherence and these data support further development of FDC especially for those with drug addiction and psychological issues in which current FDC medications may not be suitable.

5-158

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical intervention audit-Why bother?

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Purpose: Clinical pharmacy services have been provided to all wards in the Mater Misericordiae Univeristy Hospital (MMUH) since 1994. Clinical pharmacists frequently make reactive interventions, which can be defined as any action by a pharmacist that directly results in a change to a patients management or therapy. However, time and resource constraints have limited the auditing and assessment of these interventions The purpose of this study was to: categorise day-to-day interventions performed by MMUH clinical pharmacists; produce a robust, easy-to-use Clinical Intervention Audit Tool; pilot the tool and estimate annual clinical pharmacist intervention numbers; compile reports based on information obtained in the audit and to establish what information could be gained from routine intervention recording.

Methods: Literature review. Cross-sectional study to identify pharmacists top interventions. Design and pilot data collection form. Collection of data by each clinical pharmacist for one day during a designated four-day data collection period Analyse and evaluate the data using Microsoft Excel.

Results: The collection tool developed was based on the observation of clinical pharmacists top interventions, which included: checking patient details, prescription and administration problems, medication enquiries and patient counselling, stock issues and monitoring. The tool can generate reports such as the top drugs, classes of drugs and specialties involved in pharmacists interventions. The total number of interventions for 113 patients was 546; the average per patient was 4.83. The annual number of interventions was extrapolated to be 77,744 based on discharge statistics from 2008. 183 interventions related to prescription & administration involving 108 different drugs. Anti-infectives and anticoagulants were the drug classes that required most intervention. Orthopaedics was the specialty that required most prescription & administration interventions.

Conclusion: Information generated from recording clinical pharmacists interventions is highly valuable and should be performed on a routine basis. It provides information on the impact of clinical pharmacy services on local prescribing and drug administration practices, the educational needs of staff and underscores the need for continuous clinical audit.

5-159

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: An audit of antifungal prescribing in haematology patients, Mater Misericordiae University Hospital

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Purpose: Invasive fungal infections (IFIs) caused by moulds and yeasts are a major cause of morbidity and mortality in immunocompromised patients. A number of new antifungal agents have been developed in the last decade. These expensive agents are used routinely in haematology patients in the prophylactic, empiric and targeted treatment settings. Comprehensive evidence-based guidelines on the diagnosis and management of IFIs have been published in recent years. The guidelines for the use of anifungals in haematology patients in MMUH were limited.To assess antifungal prescribing practices in haematology patients in MMUH and identify areas of non-adherence with international best-practice with a view to implementing evidence-based guidelines to promote appropriate and cost-effective antifungal prescribing

Methods: This retrospective audit included all haematology patients who received any form of antifungal therapy from January-June 2008 and all those who received empirical or targeted therapy from June-December 2008. All aspects of antifungal therapy were reviewed including indication, dose, dosage form, route of administration, frequency of administration, timing of initiation and duration of therapy. Data was collected using a specifically designed Data Collection Form to record information obtained from patient medical notes and drug charts.

Results: 54 haematology patients were included in the audit. These patients received 150 courses of antifungal therapy including 90 prophylactic, 38 empiric and 22 targeted treatment courses. Areas of prophylactic therapy which were associated with non-adherence were indication (58%), dose (29%) and dosage form (13%). Areas of empirical therapy associated with non-adherence were indication (10%) and timing of initiation of treatment. In the targeted treatment setting, the duration of antifungal therapy was extended beyond that recommended in a small number of cases. The total cost associated with inappropriate use amounted to 43,560 in 2008

Conclusion: Evidence-based guidelines have been produced in conjunction with Clinical Microbiology and Haematology for the use of antifungal agents in the prophylactic, empirical and targeted treatment setting. These guidelines were implemented at ward level in December 2009. Further study will serve to

complete the audit cycle in order to assess the impact of the guidelines on antifungal prescribing, associated costs and most importantly haematology patient care.

5-160

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Club Orange- the bits inside made the ciclosporin levels high

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Purpose: We present a case of probable interaction between ciclosporin and Club Orange. A heart transplant patient, who had previously had satisfactory trough levels, had a steep rise in ciclosporin levels when her oral intake changed entirely to club orange soft drink (in excess of 1.5L per day) due to a norovirus infection. Her levels rose from a baseline of 158 nanograms/ml to a peak of 464 nanograms/ml over a period of three days despite ciclosporin doses being held. When the orange drink was stopped her ciclosporin levels returned to normal. Her serum creatinine remained stable throughout. The aim of this report was to investigate any link between raised ciclosporin levels and the intake of the orange juice based beverage

Methods: Literature Review

Results: Numerous studies and case reports link grapefruit juice ingestion with raised ciclosporin levels. Presently, it is considered that the most likely components of grapefruit juice to be responsible for these effects are the furanocoumarin derivatives bergamottin and 6, 7-dihydroxybergamottin (DHB). There is one case report in the literature of raised ciclosporin levels in a patient who took his doses with a similar orange soft drink. However a subsequent single dose study in healthy volunteers failed to show any interaction. Club Orange contains 11% orange Juice from concentrate, Currently juice from Shamouti (Jaffa) and Valencia oranges are used. These varieties of oranges both contain bergamottin and DHB.Ciclosporin levels are usually reduced by diarrhoeal illness.

Conclusion: We believe that intake of club orange was responsible for the rapid threefold rise in ciclosporin levels in our patient. A rechallenge was considered unethical. We have shown a plausible mechanism for this interaction. Although this is only the second time that such an interaction has been reported, we consider that the absence of any alternative explanation, and the fact that dechallenge led to a decline in levels means that the interaction is the probable explanation. We consider that the high volumes consumed were a contributing factor. This case underlines the importance of considering interactions with food when trying to explain fluctuations in ciclosporin levels. We advised the patient to avoid this, and similar citrus based products in the future.

5-161

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of alvimopan on length of stay in small and large bowel resections

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Purpose: Alvimopan, a mu-receptor antagonist, is indicated to speed the recovery of bowel function in patients undergoing small or large bowel resections. Alvimopan was added to the formulary of a large, tertiary care institution with the expectation that it would decrease length of stay due to its impact on bowel recovery. The decrease in length of stay would offset the additional cost incurred by the pharmacy.

Methods: Using the UHC outcomes database, three populations of patients in DRGs relating to small and large bowel surgeries were compared: a study group of patients that received alvimopan, a control group during the same time period that did not receive alvimopan, and a historic control of patients during the same timeframe in the year prior, in which alvimopan was not available. These groups were compared for length of stay, complications and mortality.

Results: In the UHC system, a total of 1112 patients were identified in the selected DRGs with 177 cases in the study group, 354 in the control group, and 581 in the historical control group. Mean length of stay was significantly less for patients in the study group, 6.05 days versus 13.12 days and 12.51 days in the control and historical control group respectively. The alvimopan group also had fewer complications with only 20.9% experiencing a complication as compared to 43.79% for the control group and 44.92% in the historical control group.

Conclusion: The use of alvimopan was shown to significantly decrease length of stay and patients using who received the drug had fewer complications overall. Although the cost of alvimopan to the pharmacy is significant, these costs are offset by the decreased length of stay.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Examining the patient-centered decision making attributes towards blood transfusion among individuals with chronic kidney disease (CKD)

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Purpose: Examine the patient engagement towards blood transfusion among individuals with chronic kidney disease (CKD) currently not on dialysis.

Methods: An online survey was conducted from a nationally representative patient panel in 1Q2011. All respondents were aged 18 years and older and diagnosed with CKD by a physician. Participants were asked about their blood transfusion history, information seeking behaviors, and knowledge about blood transfusion.

Results: Of 416 respondents, 59 percent (n equals 246) were female; 40 percent (n equals 165) were aged greater than 65 years. 35 percent (n equals 144) had stage 4 and 58 percent (n equals 240) stage 3 CKD. 54 percent (n equals 226) were anemic. 43 percent (n equals 179) had received blood transfusion, whereas, 57 percent (n equals 237) had no transfusions. Among previously transfused, only 50 percent indicated they shared in treatment decision with their doctor, whereas 40 percent indicated their doctor or someone else had made the decision for them. Among those who indicated someone else made the decision, 82 percent indicated that they like to make a shared decision. Among not transfused, only 40 percent are clear about their treatment choice for blood transfusion and over 75 percent would like to share decision to have blood transfusion with their doctor. Among not transfused, 30 percent agree that they are unsure about receiving blood transfusion and less than two-thirds (60 percent) are likely to stick with their decision to get a blood transfusion. About 39 percent of not transfused said it is hard to decide if benefits outweigh risks and 38 percent said that decision is hard for them to make.

Conclusion: There is a substantial lack of patient engagement towards shared-decision making in blood transfusion. Individuals most likely to receive blood transfusion expressed the most uncertainty about their decisions and are least informed about choices, benefits, and risks. These findings suggest that a significant portion of individuals facing a blood transfusion feel disempowered and are interested in engaging in shared-decision making with their physicians.

5-163

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Assessing risk and determining beyond use dating (BUD) in common sterile ophthalmic preparations

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Purpose: Ophthalmic compounding plays an important role in meeting the individualized needs of physician practices and patients. Its importance has been heightened by the lack of availability of commercial products and patient intolerances and sensitivities. Issues of contamination, quality of product and a lack of enforceable requirements and standards lead to the U.S Pharmacopeia (USP) revised general chapter 797, known as USP 797. USP 797 also addresses storage and beyond use dating of compounded sterile products. The purpose of this poster is to explore the assignment of Beyond Use Dating (BUD) to ophthalmic extemporaneous preparation based on risk level in compliance with USP 797.

Methods: A gap analysis was done to assess environment and personnel training and education for compliance with USP 797. As part of the gap analysis, over 27 common ophthalmic sterile products were reviewed for USP 797 compliance. Risk levels were assessed and assigned to the products. The Beyond Use Dating of each preparation was determined and assigned based on the risk level. Other factors such as stability of formulation and absence of preservative protection were considered in assigning the Beyond Use Dating. The packaging and aliquot of volume dispensed were formulated and were based on Beyond Use Dating of the preparation.

Results: Over 27 sterile ophthalmic compounds were classified according to their level of risk. The assignment of Beyond Use Dating (BUD) was based on the understanding of the premise of sterility, and the safe storage of the compounded product.

Conclusion: The above method can be helpful in determining beyond use dating for the intravitreal, subcongunctival, retrobulbar and topical formulations of ophthalmic sterile products, based on their risk level to ensure patient safety and compliance with USP 797.

5-164

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Life extension in hormone refractory prostate cancer: a cost-effectiveness analysis of docetaxel and sipuleucel-T

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Purpose: Prostate cancer is among the most common and deadly forms of malignancy affecting men in the United States with an estimated 217,730 new cases and 32,050 deaths in 2010. Initial therapy with surgery or radiation may offer a cure to some, but 20-30 percent of patients experience disease recurrence requiring further therapy. Androgen-deprivation therapy is most commonly utilized following disease recurrence and, however effective it may be, disease progression still occurs in most patients leading to the development of hormone refractory prostate cancer (HRPC). Upon the development of HRPC, the median survival time for those who are candidates for docetaxel-based regimens, previously the only approved agent for HRPC that provides survival benefits, is approximately 19 months. The recent FDA approval of the costly immune-stimulating agent, sipuleucel-T, has precipitated debate among payers, practitioners, and patients, regarding the relative value of prolonging life by months. There are currently three options for the treatment of HRPC that extend patient survival time. The last, abiraterone was approved after completion of this study. This analysis was performed to examine all costs associated with docetaxel plus prednisone and sipuleucel-T to determine a relative cost per additional life-month gained during the 30 weeks or 90 days of treatment, respectively, as well as an incremental cost-effectiveness ratio (ICER).

Methods: A cost-effectiveness analysis, utilizing a decision model, from the third party payer perspective was designed to examine two HRPC treatment regimens: docetaxel plus prednisone and sipuleucel-T. An extensive literature search was performed and patients were stratified based on the treatment received. The patient population, treatment regimens, and incidence of adverse effects were determined from clinical trials. Costs of medications, administration of therapy, and the treatment of adverse effects were determined using national databases and average wholesale prices (AWP). Only relevant costs covered by third-party payers were included in the final analysis. A series of sensitivity analyses were performed to evaluate uncertainties and assumptions in the model and estimate potential variations in outcomes.

Results: Docetaxel plus prednisone and sipuleucel-T have been found to extend life by 2.4 and 4.1 months, respectively. The mean weighted cost of docetaxel plus prednisone was found to be $34,441,

resulting in a cost per life-month gained of $14,350. The mean weighted cost of sipuleucel-T was found to be $93,781, resulting in a cost per life-month gained of $22,876. Relative to docetaxel plus prednisone, sipuleucel-T had an incremental cost-effectiveness ratio of $34,912 per additional life-month gained.

Conclusion: This cost-effectiveness analysis may aid in selecting a regimen for HRPC, based on payer-specific willingness to pay for each additional life-month gained. The results of this analysis suggest that sipuleucel-T may be a cost-effective option when payers are willing to pay the $34,912 per additional life-month gained over docetaxel plus prednisone.

5-165

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Examining the patient-centered decision making attributes towards blood transfusion among individuals with cancer

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Purpose: Examine the patient-centered decision making attributes towards blood transfusion among individuals with recurrent or metastatic cancer.

Methods: An online survey was conducted from a nationally representative patient panel in 1Q2011. All respondents were aged 18 years or older and diagnosed with cancer by a physician. Participants were asked about their blood transfusion history, information seeking behaviors, and knowledge about blood transfusion.

Results: 206 individuals responded to survey. 65 percent (n equals 133) were female and 25 percent (n equals 52) were over 55 years. 55 percent (n equals 114) were anemic and 45 percent (92) not anemic. 62 percent (n equals 128) had received blood transfusion, whereas, 38 percent (n equals 78) had no transfusions. Among previously transfused, about 6 5 percent indicated they shared in treatment decision with their doctor, whereas 14 percent indicated their doctor or someone else had made the decision for them. About 65 percent of transfused are clear about their treatment choice for blood transfusion compared to 45 percent of not transfused. Over two-thirds of transfused and not transfused would like to share the transfusion decision equally with their doctor. Among not transfused over 30 percent agree that they are unsure about their decision to get a blood transfusion and less than two-thirds agree that they are aware of the choices about whether or not to get a blood transfusion. About 50 percent of not transfused said it is hard to decide if benefits outweigh risks and similarly, 50 percent said that decision is hard for them to make.

Conclusion: There is a lack of shared-decision making towards blood transfusion. Individuals most likely to receive blood transfusion expressed uncertainty about decision-making and are least informed about choices, benefits, and risks. These findings suggest that a portion of individuals facing a blood transfusion felt disempowered from the decision-making process.

5-166

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Age-stratified analysis of preoperative hemoglobin levels and characteristics of total hip replacement surgery patients

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Purpose: Recent estimates suggest that the majority of primary hip replacement surgeries in the US were performed in individuals aged 65-84 years, however, these surgeries have increased greatly in recent years for individuals aged 45-64 years. This retrospective analysis aimed to describe the preoperative hemoglobin levels and other characteristics, including demographic and clinical characteristics, in patients aged less than 65 years as compared with those patients aged 65 years or older who received total hip replacement (THR) surgery.

Methods: Electronic medical records from a large US integrated health delivery system were analyzed for the period 01/2004 to 09/2010. Adult patients who had THR surgery record and at least one hemoglobin reading were studied. Patients with hip or knee revision (before or during surgery), bilateral surgery, or emergency room visit on the surgery admission date were excluded. Hemoglobin levels measured 45 days prior to but excluding day of surgery were analyzed by descriptive statistics and compared for those aged less than 65 years versus those patients aged 65 years or older. In patients with multiple hemoglobin measurements, the earliest observed hemoglobin measurement (defined as the one collected furthest in time from the date of surgery) was analyzed. Other clinical and demographic characteristics in the 90 days before or the day of surgery were described and compared for groups.

Results: The study population consisted of 1,578 THR patients. There were 713 patients who were aged less than 65 years (mean age 53.0 years) and 865 patients who were 65 years or older (mean age 74.9 years). Statistically significant differences were observed for the group aged less than 65 years versus the 65 years or older group with regard to gender (47.0 versus 60.7 percent female, respectively), retirement status (12.2 versus 83.6 percent were retired, respectively), and insurance type (91.7 percent versus 74.9 percent had their surgeries covered by commercial insurance, respectively) (all P values less than 0.001). Mean Quan-Charlson Comorbidity Index was 0.38 for the aged less than 65 years and 0.67 for the 65 years or older group (P value less than 0.001). Statistically significant differences for the aged less than 65 years versus the 65 years or older were observed with respect to mean earliest preoperative hemoglobin level (14.1 g/dL versus 13.5 g/dL, respectively) as well as the proportion of the

population with an earliest hemoglobin level that was less than 13 g/dL (22.9 percent versus 33.6 percent, respectively) and less than 12 g/dL (6.7 percent versus 12.4 percent, respectively) (all P values less than 0.001).

Conclusion: This electronic medical record database analysis of a population of THR patients suggests that there may be differences between patients aged less than 65 years versus those aged 65 years or older for several preoperative demographic and clinical characteristics, including hemoglobin levels. Additional research is warranted to better understand these findings as well as the implications of these differences in characteristics on preoperative management and post-operative outcomes for THR patients.

5-167

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of public smoking bans on adherence to a smoking cessation therapy, varenicline

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Purpose: Smoking is responsible for over 400,000 deaths annually in the United States and is considered the leading cause of preventable death. A variety of different interventions have been employed to combat tobacco addiction including public policy such as state-specific public smoking bans. While public smoking bans have been associated with decreased smoking rates little is known as to the actual drivers for cessation. The purpose of this study is to assess the cross-sectional association of adherence to a smoking cessation therapy, varenicline, in the presence of public smoking bans.

Methods: Retrospective, de-identified varenicline pharmacy claims were obtained from a large midwestern pharmacy benefit manager (PBM) and analyzed for medication adherence after being stratified for adjudication in a state with a full public ban on smoking or those with no or partial ban. States were considered to have a full public ban if smoking is prohibited in all general public areas. In contrast, states were considered to have no or partial public ban if smoking is allowed in some or all public places such as bars, restaurants, public outdoor areas, etc. Varenicline was chosen as a study medication because it is prescription only and claims are readily retrievable in a PBM database. Special challenges are noted for other smoking cessation therapies such as nicotine replacement products which are generally available over the counter and thus may not be available through a PBM claims database and for bupropion sustained release whose use may be difficult to differentiate between smoking cessation and depression. Ninety day washouts were employed to determine patients new to therapy for inclusion in the study. The primary outcome measured was average total days of therapy. Study methodology was approved internally. Institutional review board approval was not needed given the retrospective, de-identified nature of the data.

Results: Pharmacy claims for varenicline were analyzed for the study period of April 1, 2009 through September 30, 2010. After washouts, a total of 8,961 patients were included in a state-specific full public smoking ban cohort comprised of 27 states and 7,546 included in the no or partial ban cohort consisting of 23 states. The majority of patients in both cohorts received less than a 30 day total supply of varenicline despite the recommended minimum dosing period of 12 weeks (46.2% for full ban and 48.3% for no/partial ban). Overall, patients in the full smoking ban cohort were associated with longer average days of therapy compared to those in the no/partial ban cohort for 4 out of 5 measures (<30 day supply, 46.2% versus 48.3%, p=0.006; 31 to 60 days, 36.7% v 35.4%, p=0.097; 61 to 90 days, 10.1% v 8.0%, p<0.0001; 91 to 180 days, 6.8% v 5.8%, p=0.01; and >180 days, 1.7% v 1.2%, p=0.013).

Conclusion: A higher level of adherence to varenicline was demonstrated in states with a full public ban on smoking. Greater adherence to smoking cessation therapies such as varenicline may contribute to the lower smoking rates seen in states with public smoking bans.

5-168

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Relative importance of residency application features for onsite residency interview selection

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Purpose: Given the inadequate supply of pharmacy residency positions to meet training demand, residency applicants must position themselves to be competitive in the recruitment process. We sought to determine the factors residency program directors consider when inviting residency applicants for an onsite interview.

Methods: Residency program directors (RPDs) from a single state were invited to participate in an IRB exempt electronic survey following the March 2011 national residency match. In the 18 point questionnaire, respondents ranked the relative importance of 27 applicant features within the major domains: academics/credentials, application features/program fit, involvement, professional experience, research/teaching experience, and previous residency training (for PGY2 programs). Ranks were indicated in an ordinal fashion. For example, in a domain with 5 individual features, 1 represented the most important feature, and 5 the least. The relative weight of each major domain was also reflected in a percentage format (e.g., academics/credentials worth a relative 20% of an applicants overall score). Participants were able to note additional application domains in an open ended text field. Descriptive statistics (e.g., mean plus/minus standard deviation) were used to evaluate the findings.

Results: Fourteen of the 25 survey respondents (76% response rate) directed PGY1 programs. The 3 most important application domains for PGY1 programs were: application features/program fit (27.29 plus/minus 12.95), involvement (20.36 plus/minus 4.99), and academics/credentials (19.29 plus/minus 4.32). The applicants PGY1 residency training (26.00 plus/minus 8.76), application features/program fit (25.00 plus/minus 25.59), and research/teaching experience (16.50 plus/minus 6.26) were weighted most heavily by PGY2 directors. The highest ranked individual application features in each domain from all 25 respondents were: pharmacy GPA (2.44 plus/minus 1.36), perceived program fit (2.04 plus/minus 1.17), leadership roles (1.56 plus/minus 1.08), pharmacy student rotations (1.56 plus/minus 0.77), professional presentations (2.68 plus/minus 1.14), and reputation of PGY1 program (1.54 plus/minus 0.69). Features also highly ranked include: honors/awards received (2.76 plus/minus 1.05), verbal/written communication skills (2.16 plus/minus 0.90), pharmacy organizational involvement (1.88 plus/minus 0.53), and pharmacy work experience (1.60 plus/minus 0.50). The lowest ranking feature in each domain, excluding the Other option, included: certifications (5.12 plus/minus 1.33), letters of recommendation (2.92 plus/minus 1.04), nonpharmacy organizational involvement (3.36 plus/minus

0.76), nonpharmacy work experience (2.88 plus/minus 0.44), grantsmanship (5.32 plus/minus 1.57), and reputation of PGY1 program director (3.54 plus/minus 0.52).

Conclusion: PGY2 program directors placed greater emphasis on previous experience, including research/teaching, than those from PGY1 programs when selecting residency applicants for onsite interviews. Understanding the relative importance RPDs place on application features can assist residency candidates in effectively portraying their qualifications and credentials.

5-169

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: IV waste evaluation and implementation of process improvements designed to decrease waste in a Veterans Affairs hospital

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Purpose: The financial and ecologic impact of intravenous product waste is significant. With adherence to specific waste disposal guidelines, the financial impact that hospitals face is beyond the cost of supplies and staffing hours. This study was designed to quantify the amount of preventable waste of intravenous products (IVs) currently prepared by the Cincinnati Veterans Affairs Inpatient Pharmacy, to evaluate discontinued / changed orders associated with wasted IVs to determine process errors leading to IV waste, to evaluate the economic impact of current waste levels, including salary, waste management, and medication cost, and to design and develop a system to effectively decrease the quantity of intravenous products wasted, to decrease facility cost, and to decrease the environmental impact of IV waste.

Methods: This system evaluation study was granted exemption status by the investigational review board and met the facility research and development conditions. Data collection consisted of pilot data obtained during a 3 month study period to quantify the amount of intravenous waste, to assess the disposition of IVs that are returned to the pharmacy, and to evaluate the time parameters associated with the existing IV management process. A flow chart of the current practice was developed and utilized to identify potential areas to lessen waste. A process was developed to identify and track the physician ordering process and to recognize trends in the ordering process to facilitate the most effective time management production of IV products. All data was evaluated and used to implement process improvements including restructuring workflow, dividing IV batch preparation into two separate distribution periods, and implementing a process to return and reuse unused IV medications.

Results: The cost associated with IV waste during the initial study period was $299 per day on average. Process improvements led to a decrease in the cost of IV waste to $88 per day on average. The percentage of daily IVs wasted decreased by 20%, when comparing the initial study period with the post process improvement period. Time measures improved with the process improvement implementation including a 53% decrease in time from label print to return, a 43% decrease in the average time from label print to physician order activity, and a 67% decrease in the time to processing returned IVs from the time of order activity. After the implementation of the process improvement, the total cost associated with IV waste decreased by 71% from $107,648 per year to $31,954 per year.

Conclusion: Primary factors contributing to excessive IV waste are the untimely production of IV products relative to the physician ordering cycle, the lack of tight accountability of available IV products, the untimely response to order changes, and the lack of a proactive process for the return and reuse of available products. Overall, the revision of the existing process to include a non-fluctuating, standardized procedure in the labeling, preparation and return of unused products was an effective best practice initiative to decrease IV waste, facilitate the reuse of available products, and lessen the economic impact at this facility.

5-170

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Economic evaluation of screening for major depressive disorder in patients with HIV on highly active antiretroviral therapy (HAART)

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Purpose: The annual expenditure of antiretroviral medication for one HIV+ individual is $10,500, which has a strong impact on our healthcare system. There are a plethora of factors that contribute to less than ideal HAART adherence; however, depression is considered the fourth strongest predictor of nonadherence. Meanwhile, there is a high incidence of comorbid depression in the HIV+ population. This data in the current literature led to our hypothesis that identifying and effectively treating depression in HIV+ patients will improve HAART adherence and clinical outcomes. An economic evaluation was performed to determine the cost of screening for depression in this population.

Methods: Our model followed a hypothetical cohort of HIV+ individuals between the ages of 18 to 64 years over a one year time span. Patients theoretically underwent depression screening with the Beck Depression Inventory (BDI) in an outpatient setting, verification of a positive or negative screen, and received antidepressant therapy (ADT). The probabilities of each of these occurrences were identified in the literature. We conducted a literature search of PubMed/MEDLINE and Cochrane Review to identify articles published between 1999 and 2011. An ideal adherence threshold of 95% was applied, as patients achieving this level of adherence have been shown to have significant increases in CD4 count and decreases in HIV-RNA viral load. A societal perspective was used in our cost analysis. Thus, costs associated with patient time, physician time, nurse time, and the BDI tool, were included in screening costs. Major Depression Disorder (MDD) treatment costs include the direct cost of treatment, as well as the inpatient expenses for a person with HIV on ADT. The cost of undetected, undiagnosed MDD includes suicide-related, workplace, and inpatient expenses. The cost per patient per year of treating HIV includes HAART, other medications, hospital visits, outpatient procedures, and physician/clinic expenses. All costs were inflated to 2010 US dollars using the Medical Consumer Prince Index (CPI-U). All model variables were subjected to sensitivity analysis due to the limited sources of data in the literature. For model variables that were derived from a sole source in the literature, the range was taken from the 95% confidence interval. When multiple values were identified in the literature for a model variable, a weighted mean was applied to obtain the base case value, and the upper and lower bounds were obtained by adjusting the base case by 20%. We applied a triangular distribution to each variable.

Results: The cost of not screening for depression totals $8,705.02, while the cost of screening of depression totals $8,560.53. This results in a net savings of $144.49 per patient per year when screening is implemented. The findings of the one-way sensitivity analyses were consistent with the base case result across most model variables. Sensitivity analysis results suggested that the proportion of patients with undetected depression has the greatest potential to further increase the cost-savings of yearly screening relative to no screening.

Conclusion: From a societal perspective, improving HAART adherence by treating MDD not only saves money by decreasing inpatient and outpatient costs, it alleviates patient and caregiver burden, and decreases workplace costs. The results of this economic analysis have the ability to guide clinical and policy decisions regarding availability and utilization of mental health services in HIV outpatient clinics.

5-171

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Age-stratified analysis of preoperative hemoglobin levels and characteristics of total knee replacement surgery patients

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Purpose: : Recent estimates suggest that the majority of primary knee replacement surgeries in the US were performed in individuals aged 65-84 years, however, these surgeries have increased greatly in recent years for individuals aged 45-64 years. This retrospective analysis aimed to describe the preoperative hemoglobin levels and other characteristics, including demographic and clinical characteristics, in patients aged less than 65 years as compared with those patients aged 65 years or older who received total knee replacement (TKR) surgery.

Methods: Electronic medical records from a large US integrated health delivery system were analyzed for the period 01/2004 to 09/2010. Adult patients who had TKR surgery record and at least one hemoglobin reading were studied. Patients with hip or knee revision (before or during surgery), bilateral surgery, or emergency room visit on the surgery admission date were excluded. Hemoglobin levels measured 45 days prior to but excluding day of surgery were analyzed by descriptive statistics and compared for those aged less than 65 years versus those patients aged 65 years or older. In patients with multiple hemoglobin measurements, the earliest observed hemoglobin measurement (defined as the one collected furthest in time from the date of surgery) was analyzed. Other clinical and demographic characteristics in the 90 days before or the day of surgery were described and compared for groups.

Results: The study population consisted of 2,984 TKR patients. There were 1,065 patients who were aged less than 65 years (mean age 56.9 years) and 1,919 patients who were 65 years or older (mean age 73.8 years). Statistically significant differences were observed for the group aged less than 65 years versus the 65 years or older group with regard to gender (64.6 versus 60.6 percent female, respectively), retirement status (20.1 versus 83.0 percent were retired, respectively), and insurance type (93.5 percent versus 77.0 percent had their surgeries covered by commercial insurance, respectively) (all P values less than 0.05). Mean Quan-Charlson Comorbidity Index was 0.53 for the aged less than 65 years and 0.68 for the 65 years or older group (P value less than 0.001). Statistically significant differences for the aged less than 65 years versus the 65 years or older were observed with respect to mean earliest preoperative hemoglobin level (13.9 g/dL versus 13.5 g/dL, respectively) as well as the proportion of the

population with an earliest hemoglobin level that was less than 13 g/dL (21.9 percent versus 31.7 percent, respectively) and less than 12 g/dL (6.9 percent versus 11.0 percent, respectively) (all P values less than 0.001).

Conclusion: This electronic medical record database analysis of a population of TKR patients suggests that there may be differences between patients aged less than 65 years versus those aged 65 years or older for several preoperative demographic and clinical characteristics, including hemoglobin levels. Additional research is warranted to better understand these findings as well as the implications of these differences in characteristics on preoperative management and post-operative outcomes for TKR patients.

5-172

Category: Preceptor Skills

Title: Utilization of the Clifton StrengthsFinder 2.0 as a Preceptor Development Tool

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Purpose: To enhance preceptor awareness of their own strengths and in so doing, allow them to perform better not only as pharmacists but as preceptors.

Methods: All clinical staff and managers were given a copy of StrengthsFinder 2.0 by Tom Rath and were required to do the online strengths assessment during the months of January-February 2011. Each preceptor sent their top five themes to the coordinator of this program, who tallied the assessments. Seminars were conducted at three separate sites within the health system during March and April to review the preceptors talents and to discuss ways in which these talents could be put to better use. After participation in the seminar, all preceptors were asked to complete a survey of the program. Data collected included: benefits of the exercise, review of the program, and future direction for both preceptor and resident development.

Results: Survey responses were received from 73% (19/26) of the participants. Of the respondents, 84.2% (16/19) felt that both knowing their strengths and the seminar were beneficial. All of the participants enjoyed the program, but only 68.4% (13/19) found the program useful in stimulating ideas on how to more effectively work with colleagues. Fourteen of 17 (82.4%) participants recommended conducting this program for all new preceptors, while 17 of 18 (94.4%) participants recommended running the program for all incoming residents. Participants were asked to choose the themes they felt would be most valuable in a pharmacy resident. The top responses were: communication (89.5%), learner (89.5%), responsibility (89.5%), achiever (68.4%), discipline (63.2%), empathy (52.6%), adaptability (47.4%), intellection (47.4%) and positivity (47.4%).

Conclusion: As a result of this survey, this program will be offered on a yearly basis to all new preceptors and incoming residents during the month of July. The seminar will be refined to include more information on how to apply ones strengths in their day-to-day professional activities. Preceptors and residents will be given opportunities to participate in activities to further develop their individual strengths. Finally, the resident application process will be modified to include a means of assessing those themes deemed to be desirable (by the preceptors) in potential candidates.

5-173

Category: Preceptor Skills

Title: Impact of a pharmacy resident led lecture series on pharmacy student clinical knowledge

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Purpose: Fourth year pharmacy (P4) students are transitioning didactic learners that sometimes struggle with the clinical application of specific content areas. Simultaneously, pharmacy residents request teaching experience and often lack the opportunity to repeat and rework a lecture. The purpose of this study was to assess the clinical knowledge before and after a pharmacy resident led lecture in areas identified by P4 students as needing review during the experiential experiences.

Methods: One resident per week presented a one hour interactive lecture to P4 students on a voluntary basis. A five question multiple choice quiz was administered before and after the lecture. The topics presented were modes of dialysis, acid-base disorders, electrolytes, and infectious diseases. P4 students completed written evaluations of the residents to help improve their presentations skills.

Results: From November 2010 to April 2011, a total of 15 lectures were given with a total attendance of 105 P4 students. The average increase in score from pre- to post-test was 2.6, 2.4, 1.9, and 1.2 points for modes of dialysis, electrolytes, acid-base disorders, and infectious diseases respectively. The proportion of students scoring 80 or 100% overall was 23.8 and 93.3% ($p<0.001$) on the pre- and post-test, respectively.

Conclusion: A resident led lecture series increased the comprehension of difficult to grasp concepts. Benefits of the program to residents include increased presentation confidence and the opportunity to repeat presentations.

5-174

Category: Preceptor Skills

Title: Where the rubber meets the road: learnings of a successful preceptor training program 5 years later

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Purpose: With the increased demand for student and resident experiential sites, appropriately trained preceptors are essential for successful learning experiences. Typically, pharmacists receive no formal training in pharmacy school to be effective preceptors and opportunities for this training vary from organization to organization, and from worksite to worksite. According to ASHP and ACPE Standards, the goal of this program would be to provide ongoing training in the necessary skills and understanding pharmacists need for a successful learning experience.

Methods: Our region includes 12 PGY1 Pharmacy Practice and 2 PGY1 Managed Care residency programs spread over a wide geographic area. Preceptor trainings were implemented in 2006 to train both seasoned as well as new preceptors, and were offered both regionally and locally. Initial topics included: defining roles, systems-based training, teaching techniques, addressing learning styles, preparing and tailoring the experience for student-centered learning, dealing with challenging students, motivating students, providing feedback and evaluation, and keys for success. Training materials (video vignettes, group breakout sessions, sample course descriptions, evaluation forms, and schedules) were presented in interactive, accredited, education sessions. Topics expanded to drug information resources and the ASHP Residency Learning System.

Results: Feedback from the participants was positive. Video vignettes, discussions surrounding appropriate methods of teaching, and personality type identification were reported as useful and applicable to real-life situations. Programs were modified and improved according to the feedback and suggestions. These programs were presented at least annually and included pharmacists, residents and technicians from the inpatient, outpatient and ambulatory care practice settings.

Conclusion: There is a need to offer pharmacist training programs on effective precepting to meet the demands for pharmacy student and residency training sites and to satisfy the requirements from ASHP and ACPE for appropriately trained preceptors. To ensure a successful and relevant training program, we collaborated with local schools of pharmacy and our veteran preceptors. A structured training program has resulted in prepared preceptors who will train better residents and pharmacists for the work force. These skills can be used for pharmacy students and residents, and applied when training new employees (clerks, technicians, pharmacists), as well as, educating health care professionals and patients.

5-175

Category: Preceptor Skills

Title: Teaching Certificate Program at the University of Maryland School of Pharmacy

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Purpose: The University of Maryland School of Pharmacy offers a Teaching Certificate Program to Post Graduate Year (PGY) PGY1 and PGY2 residents and fellows in the Greater Baltimore-Washington DC area. The purpose of the Teaching Certificate Program is to develop pharmacists as educators and preceptors. After completion of this certificate program, participants are prepared to plan and execute didactic and experiential learning activities using sound principles of educational theory.

Methods: Participants in this certificate program must complete several requirements. During the fall semester, participants take Educational Theory and Practice - a 2-credit online seminar course that introduces key concepts regarding instructional system development including audience analysis, sequencing and design, teaching methodology, and programmatic evaluation. There are four required teaching experiences each participant must complete: 1) planning and execution of a lecture in a required or elective course; 2) leading a small group discussion in a required or elective course; 3) developing a formal presentation for continuing education credit (Pharmacotherapy Rounds); and 4) precepting a student pharmacist on an experiential rotation. Each participant in the Teaching Certificate Program is assigned a faculty mentor to guide the residents progress throughout the program, to critique teaching materials, and provide constructive feedback. Participants are also required to write a teaching philosophy statement and maintain a teaching portfolio. Participants meet with their faculty mentor several times during the residency year, and the mentor prepares two progress reports for the Residency Program Director.

Results: During thte 2009-2010 residency year, 13 of 14 enrollees successfully completed the Teaching Certificate Program. In the 2010-2011 residency year, 20 of 25 enrollees successfully completed the program. There were 12 faculty mentors in the initial year, and 21 mentors the second year.

Conclusion: The Teaching Certificate Program at the University of Maryland is a rigorous program that prepares participants to use evidence-based methods to teach students, colleagues, and patients in classroom and clinical settings.

5-176

Category: Preceptor Skills

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

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Purpose: The need for pharmacy leadership is critical for the continued growth of our profession and is dependent on the development of todays 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 students 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 indentify 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.

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.

5-177

Category: Preceptor Skills

Title: Development of an APPE medication reconciliation rotation

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Purpose: To develop a workable process using APPE students to obtain a current and accurate home medication list for patients admitted to an 836 bed tertiary care referral center.

Methods: In early 2010 pharmacy leadership met with faculty from a local school of pharmacy to discuss offering an elective APPE medication reconciliation rotation. A brief description of the program was presented and the school agreed the rotation would be a valuable experience for the student. Prior to the first rotation, the department of pharmacy worked with the hospital's information technology (IT) department to develop a systems orientation and training program and obtained approval for students to have access to reports needed during the rotation. An outline of the daily process was sketched out and numerous forms developed. To obtain consent for home medication release for Veterans Administration (VA) patients, the release form was obtained. Rotation notebooks were created and provided to each student.

Results: Twenty-two APPE students were selected and completed the 5-week elective medication reconciliation rotation. The first rotation began June 1, 2010 with eight rotations provided during the 2010-2011 academic year.

Conclusion: Because this was a new program, many challenges presented. The initial program preceptor defaulted with the assignment going to the pharmacy director. Obtaining access to programs and reports for non-employees was a lengthy process and the time to manage the students was substantial. With each group of students, something was learned which kept the process in a constant state of evolution. Process weaknesses included communicating changes to the nurse, getting changes in the patient's chart, updating the electronic home med list, and having an updated electronic list at discharge. Approximately 3000 patient med lists were reviewed. The number of medications per patient was 6.5 and approximately 43% of the meds required clarification.

5-178

Category: Preceptor Skills

Title: Development of a team-taught academic-focused advanced pharmacy practice experience (APPE) as a way to accomodate an increase in the number of students requiring APPE placement

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Purpose: Each faculty member in the Department of Pharmacy Practice at the Massachusetts College of Pharmacy and Health Sciences Worcester/Manchester (MCPHS-W/M) was asked to increase the number of students precepted on advanced pharmacy practice experience (APPE) rotations for the 2011-2012 academic year. The development of a team-taught elective academic APPE was identified as a way to accommodate an increase in the number of students requiring APPE rotation placement and to avoid overly burdening clinical partners. The goals of this elective academic-focused APPE were: 1) to use a team-taught approach where faculty rotate the presentation of seminars so that the impact of additional work load associated with the rotation is minimized; 2) to provide students with the opportunity to experience a pharmacy faculty perspective; 3) to ultimately increase the number of students who may be interested in pursuing academia as a career.

Methods: Eight faculty members collaborated to develop a six-week academic-focused APPE that highlighted topics that include the evolution of pharmacy education, instructional design and class preparation techniques, scholarship of teaching, assessment techniques, ethics, professionalism, leadership, aspects of service, and curricular and programmatic assessment. Participating faculty will faculitate students (up to 3 per faculty member) for this academic APPE and, at the same time, facilitate a clinical APPE rotation for an additional 3 students.

Results: Each week, students will participate in two seminars led by faculty and complete one online session posted by faculty. Faculty members will rotate the facilitation of the seminars in order to decrease the workload impact on individual faculty. In addition, students will meet weekly with their assigned faculty preceptors and with other students to work on assigned projects. Using the information gained in the semi-weekly seminars, students will complete assignments and activities that will be compiled into a teaching portfolio. During the final week of the rotation, students will present a lecture on an assigned topic. Grading rubrics have been developed for each of the assignments and activities to provide formative and summative feedback to the students.

Conclusion: A six-week team-taught academic-focused APPE is a way to accommodate an increase in the number of students requiring APPE placement without significantly impacting Pharmacy Practice faculty

workload. Additionally, this type of APPE experience provides PharmD students in their last professional year exposure to academia. A total of 24 academic APPE slots (3 per each of the 8 faculty) are available.

5-179

Category: Preceptor Skills

Title: Design of an online component to enhance student learning in an academic-focused advanced pharmacy practice experience

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Purpose: Technology integration into teaching may allow for enhanced learning in an academic-focused advanced pharmacy practice experience (APPE). As the basis for an academic APPE is not patient-care oriented, students may use outlets other than the traditional face-to-face setting for experiential learning. Additionally, online learning may further enhance an academic APPE that is simultaneously held at schools utilizing synchronous distance learning technologies, such as our program at the Massachusetts College of Pharmacy and Health Sciences Worcester/Manchester (MCPHS W/M). This report describes the design of an online component for students on an elective academic APPE in the final year of the Doctor of Pharmacy curriculum at MCPHS W/M.

Methods: A team-taught, six-week, academic APPE was developed by eight pharmacy practice faculty members, which includes topics ranging from learning theory and classroom management to curricular assessment and accreditation. The majority of this rotation is delivered via face-to-face encounters and activities. To complement the face-to-face portion of the APPE, the equivalent of a 3-hour per week online course was created to enhance the weekly content. The online component was created in the learning management system used at MCPHS W/M.

Results: The online component for the academic APPE includes discussion forums, posted readings, web-based didactic materials, and informal space for reflective student blogging. Each 3-hour weekly online session is intended to be completed in an asynchronous fashion, and the content parallels the face-to-face coursework. Online formative and summative assessment is completed via rubrics that examine domains such as student participation and quality of response.

Conclusion: The addition of an online component to an academic APPE is intended to enhance the quality of learning for students on this rotation. The asynchronous nature of the online module allows for student flexibility and professor freedom to respond to and engage in week-long discussion. The discussion board or blogging forums allow for digital repositories of student reflection.

5-180

Category: Preceptor Skills

Title: Implementation of a structured residency/fellowship research development program

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Purpose: Participation in a pharmacy related research project is required for residency programs accredited by the American Society of Health-System Pharmacists. Residents and Fellows often have little or no prior research training and/or experience. We developed a program to provide residents, fellows, preceptors and program directors guidance and formal oversight to ensure successful completion of the research projects.

Methods: In 2007, the University of Maryland Residency and Fellowship programs created a Residency and Fellowship Research Committee (RFRC) to provide a structured approach and improve the quality of research projects. The program requires preceptors to submit all research project proposals to the RFRC, including a brief description of rationale, hypothesis, methods, current Institutional Review Board (IRB) status, and role of trainee in the project. The RFRC reviews the proposals to assess feasibility and scientific merit. After the review, feedback on research proposals is then provided to the preceptor with suggestions for modifications as needed. At the beginning of the residency/fellowship year, trainees review the list of potential projects and rank three projects that they are interested in conducting. Trainees are then assigned a project and research mentor, and are required to attend introductory lectures on IRB policies and procedures, study design, biostatistics, and manuscript and abstract development. After the projects are assigned, trainees submit a detailed written synopsis of their proposal to the committee for review. Within 4 weeks of acceptance, trainees present their methodology to RFRC and program preceptors for feedback; then proceed to IRB submission. Trainees are required to present their findings at a campus-wide research day, followed by submission of their manuscript suitable for publication to the RFRC. To facilitate meeting deadlines, a research timeline is provided to the trainees at the beginning of the year and the chair of the RFRC tracks the progress of the trainee throughout the year. This timeline includes dates and times of required presentations, a deadline for IRB submission and other requirements. A manuscript review committee is available to critically review all trainee manuscripts prior to final submission.

Results: Forty-six trainees have participated in this program, including ten trainees currently involved in this program for the first time. Of the 36 trainees who have graduated from our program, eight projects

have been published in peer-reviewed journals. One research related manuscript has been submitted to a peer-reviewed journal for publication and is under review.

Conclusion: We describe a structured residency/fellowship research program that has been used successfully to assist residents and preceptors with the design, implementation, and dissemination of their research. Future assessment of the impact of this program should be continued.

5-182

Category: Preceptor Skills

Title: Post-graduate pursuit of academia after participation in an elective

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Purpose: The Rounds with Pharmacy Residents elective course was developed to provide a forum for residents to facilitate student pharmacists-prepared, evidence-based, patient care plans and to encourage student-resident interaction.

Methods: An IRB-approved questionnaire with 22 survey items was developed to evaluate the residents perceptions on elective workload, preparedness for impending career needs after completion of residency and likelihood of pursuing academic positions. Survey used a 5-point Likert scale (strongly disagree to strongly agree) for 15 items and open-ended format for 7 items. The elective was offered yearly over a two-year period and residents were asked to complete the electronically-available survey at the end of the semester.

Results: Survey response rate was 67% (14/21). Fourteen PGY-1 and six PGY-2 residents and one fellow taught the elective. Most respondents enjoyed participating in the elective (93%) regardless of time spent with case preparation (~8.57 hours); additionally, interacting with student pharmacists provided insight and exposure to practice-related education. The respondents strongly agreed or agreed that the experience (93%) and knowledge (86%) gained would contribute to their future success in pharmacy practice. Most reported a willingness to participate in future teaching opportunities (86%), such as experiential teaching (100%), didactic teaching (78%), and provision of educational seminars (58%). Three respondents indicated their desire to become full-time faculty members and upon post-graduate training completion, two PGY-2 residents secured faculty positions and four PGY-1 residents secured PGY-2 or 2-year fellowship positions.

Conclusion: Post-graduates participating in the elective felt that the opportunity to teach student pharmacists provided them valuable exposure to teaching and student-resident interaction. Skills gained during the teaching of this elective may be used in any area within pharmacy, ultimately benefiting the profession.

5-183

Category: Preceptor Skills

Title: A novel elective to encourage pursuit of post graduate training

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Purpose: The Rounds with Pharmacy Residents course is a resident-managed 2-credit, elective developed to provide third-year professional student pharmacists exposure to post-graduate training opportunities, create a forum for residents to facilitate student-prepared patient care plans and encourage student-resident interaction. Our aims were to 1) expose students to a high-impact learning environment expected during a comprehensive practice experience (advanced pharmacy practice experiences (APPEs) and post-graduate training (PGT)) and 2) increase resident-student interaction.

Methods: An IRB-approved questionnaire with 26 survey items was developed to evaluate students perception on the value of the elective, workload, preparedness for impending APPEs, and likelihood in pursuing PGT opportunities. Survey used a 5-point Likert scale (strongly disagree to strongly agree) for 14 items and open-ended format for 12 items. Over a two-year period, students participating in the elective were asked to complete the electronically-available survey at the end of the semester. Descriptive and inferential statistics were used.

Results: Survey response rate was 69% (9/13) and 12 of the 13 students had already completed their elective requirements prior to participation in this elective. Students indicated they strongly agreed that the course was enjoyable (89%) with enhanced learning due to the active-learning teaching style (89%). Although time spent on weekly class preparation and final case presentation was 7.6 hours (3.8 SD) and 11.1hours (8.4 SD), respectively, all students strongly felt that the assignments prepared them for advanced practice experiences and they would recommend the elective to their peers. Interaction with residents positively influenced them to pursue PGT (89%, strongly agreed) and at the end of the semester, all students had plans to pursue PGT. Six of seven graduates (86%) who had completed the elective pursued residency opportunities, compared with 24% ($p=0.001$) of the 2011 Class ($n = 178$). Of these, 43% of elective students versus 15% of the general student population secured positions.

Conclusion: Students participating in this elective, geared to mimic the intensity of post-graduating training, found the class useful and enjoyable. Exposure to residents had a positive influence on students willingness to pursue PGT. Since these opportunities are in high-demand, provision of this type of elective serves to prepare student pharmacists for impending advanced experiences.

5-184

Category: Psychotherapy / Neurology

Title: Evaluation of an inpatient long-acting antipsychotic treatment algorithm

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Purpose: To assess a recently revised treatment algorithm involving long-acting antipsychotic injections at UAB Hospital.

Methods: Patients initiated on a long-acting antipsychotic agent from October 20, 2010 to March 15, 2011 were included in this study. The primary objectives were to assess prescriber compliance with the guidelines and assess the overall utilization and expenditures for the long-acting antipsychotic injectable agents. Secondary objectives were to assess the safety and efficacy of haloperidol decanoate and paliperidone palmitate when initiated among inpatients and assess outpatient outcomes among this patient population following hospital discharge.

Results: Sixty-eight patients were prescribed a long-acting antipsychotic injection for initiation of therapy. Due to patient refusal, only 65 patients were administered injections. Of those 65 patients, 20 were initiated on haloperidol decanoate, 20 on paliperidone palmitate and 25 on risperidone long-acting injection. Twenty-eight patients (41.2%) were initiated on therapy according to the algorithm. When comparing 6 months prior to and following implementation of the algorithm, the average monthly usage of paliperidone greatly increased, as well as a slight increase in the usage of haloperidol, while risperidone usage decreased. Four patients experienced adverse effects, 2 on paliperidone palmitate, 1 on haloperidol decanoate, and 1 risperidone long-acting injection, and 57 patients showed a response to therapy.

Conclusion: Less than half of patients initiated on a long-acting antipsychotic injection were done so in accordance to the algorithm. While the specific recommendation of which long-acting antipsychotic agent to initiate was not strictly adhered to, majority (87.7%) of patients initiated on any of the three long-acting antipsychotics monitored showed improvement or resolution in psychotic symptoms. Monthly usage and expenditures on average increased for paliperidone and haloperidol, but decreased for risperidone. Overall expenditure for antipsychotic injections and combined oral and injection therapy were slightly higher following initiation of the algorithm. Only 4 patients experienced an adverse reaction, and 57 patients showed a response to therapy in improvement or resolution of symptoms. There was a slight difference between the agents with response to therapy.

5-185

Category: Psychotherapy / Neurology

Title: Use of thyroid stimulating hormone to screen patients admitted for psychiatric evaluation at a community hospital

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Purpose: Thyroid stimulating hormone (TSH) is frequently ordered as a baseline screening study in psychiatric patients admitted to the hospital with changes in behavior. Frequently, the patients have no signs or symptoms of thyroid disease other than a change in behavior. A review was conducted to see if routine utilization of a TSH on admission was a cost effective means of screening psychiatric patients for thyroid disease.

Methods: During an eight week period, all patients admitted to an adult inpatient psychiatry unit at a community hospital were reviewed to see if TSH was ordered as a screening laboratory study. Patients were excluded from review if they met any of the following criteria: age less than 18 years, known history of hypothyroidism or hyperthyroidism, gastric bypass surgery, receiving levothyroxine, liothyronine, lithium or amiodarone prior to admission and previous psychiatric admission at our institution during the study period.

Results: One hundred thirty patients were admitted and 98 patients met the criteria for evaluation. The patients were differentiated into two groups: 65 patients (66.3%) had a TSH ordered and 33 patients did not have a TSH ordered. Of the 65 patients with TSH ordered, 96.7% were within normal limits. A comparison of the two groups demonstrates no significant difference in patient length of stay: 9.65 days (mean) for TSH ordered, 9.55 days (mean) for no TSH ordered (p=0.95). Extrapolating the data to 52 weeks, whereby TSH is ordered for 66.3% of patients, the total cost for TSH studies at our institution would be $62,738, with 96.7% of the studies within the normal range ($60,667).

Conclusion: The routine use of TSH as a screening tool for patients admitted to an inpatient psychiatric unit in the absence of signs and symptoms consistent with hyper or hypothyroid disease should be addressed. A protocol is in the process of being developed at our institution to select which patients being admitted to the inpatient psychiatry unit should have TSH ordered.

5-186

Category: Psychotherapy / Neurology

Title: Dose Effect of Oral Haloperidol and Fluphenazine on Psychiatric Readmission Rates

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Purpose: Haloperidol and fluphenazine are the two most used first generation antipsychotics. Both medications are regarded as equipotent in acute treatment. Previously, the authors studied readmission rates of oral haloperidol and fluphenazine and noted that readmission rates were higher with fluphenazine. The purpose of this study was to determine the effect of the dose of oral haloperidol and fluphenazine on hospital readmission rates. A secondary objective was to evaluate if the two antipsychotic medications were equipotent in preventing readmissions when controlling for the dose.

Methods: Readmission data from 2324 admissions discharged on haloperidol and 499 on fluphenazine between January 1, 2006 and June 30, 2009 were retrospectively reviewed. Chi square and binary logistic regression were used to obtain relative readmission rates at three, seven, ten, and fourteen days. The study was approved by the university Institutional Review Board.

Results: Patients discharged on fluphenazine had a statistically significant increase in readmissions as compared to patients discharged on haloperidol at three, seven, ten, and fourteen days even when covaried for 1) medication dose category (5, 10, 15, 20, and 30 mg) 2) admission status (voluntary or involuntary) 3) diagnosis (schizophrenia, schizoaffective, bipolar or other disorders) and 4) patient potential for readmission measured by the average prior hospitalizations per year. Further analysis showed that at the low dose range (5 and 10 mg) fluphenazine is less effective in preventing readmissions than haloperidol. Such differences were limited at higher doses.

Conclusion: The results herein suggest that haloperidol and fluphenazine do not seem to be equally efficacious in preventing readmissions at low doses. The results also indicate that fluphenazine should be prescribed at doses higher than 10 mg to reduce admissions shortly after discharge.

5-187

Category: Psychotherapy / Neurology

Title: Evaluation of intravenous calcitonin in the treatment of headache

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Purpose: The pathophysiology of headache is complex and poorly understood. Multiple agents of various mechanisms are used to alleviate intractable headache, each with potential adverse effects. This case series will describes treatment of 16 patients admitted with intractable headache with intravenous calcitonin. Calcitonin is already known to be an effective analgesic in other pain syndromes including phantom limb pain, bone pain, neuropathic pain, and reflex sympathetic dystrophy. The most predictable adverse effect of calcitonin is nausea and vomiting, which is alleviated by pretreatment with promethazine and diphenhydramine; both agents can be used individually and exclusive of calcitonin for the treatment of intractable headache. The effectiveness of the calcitonin based treatment regimen was evaluated by comparing admission and discharge pain scales, length of stay, and percent decrease in pain rating as compared to baseline. Twelve of sixteen patients (75 percent) had a greater than 50 percent decrease in pain rating scale at discharge as compared to admission. This case series demonstrates that intravenous calcitonin shows potential as an effective agent in the treatment of status migrainosus and other types of intractable headache. The novel role of calcitonin in this patient population warrants further study.

Methods: n/a

Results: n/a

Conclusion: n/a

5-188

Category: Psychotherapy / Neurology

Title: Prazosin for post traumatic stress disorder related recurrent distressing dreams in adolescents

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Purpose: Post traumatic stress disorder is a debilitating anxiety disorder experienced by individuals exposed to a traumatic event. Although the prevalence varies, 20 to 50 percent of children and adolescents exposed to physical violence or sexual abuse may develop post traumatic stress disorder symptoms, often with comorbid behavioral and other psychiatric disorders. Sleep disturbances, part of the re-experiencing and hyperarousal symptoms, are experienced by up to 87 percent of those with post traumatic stress disorder, and often persist despite psychotherapy or treatment with pharmacologic agents. Increased central nervous system adrenergic reactivity is hypothesized to disrupt rapid eye movement sleep in persons with post traumatic stress disorder and promote the emergence of trauma related nightmares. Sleep disturbances are especially common among children and adolescents presenting with a history of sexual abuse, and are characterized by nightmares, sleep talking, enuresis, as well as early, middle and late insomnia. Negative consequences of sleep disturbances in children and adolescents include increased aggression, irritability, as well as worsening of affect and behavioral dysregulation, ability to focus, and frustration tolerance. Pharmacotherapy for post traumatic stress disorder in children and adolescents, particularly post traumatic stress disorder associated recurring and distressing dreams, is not well established. Prazosin is a centrally acting alpha one antagonist marketed for hypertension and the treatment of urinary outflow obstruction secondary to benign prostatic hyperplasia. Prazosin is highly lipophilic, easily passing through the blood brain barrier to act on central nervous system alpha one receptors. A number of placebo controlled trials examining the use of prazosin in adults, primarily combat veterans with posttraumatic stress disorder, have demonstrated its efficacy in the attenuation of sleep disturbances and improvement in sleep quality when added to ongoing post traumatic stress disorder treatment. There is a paucity of data on the use prazosin in the treatment of children and adolescents with post traumatic stress disorder. However, a limited number of case reports have noted improvement in post traumatic stress disorder related behavioral symptoms and nightmares in adolescents treated with 1 to 4 mg/day. Prazosin is not FDA approved for use in children but has been used in the treatment of pediatric hypertension at doses up to 15 mg/day.

Methods: Prazosin was added to the current medical and psychotropic medication regimen of six hospitalized adolescents with a baseline score of greater than or equal to 3 on the recurrent distressing

dreams item of the Clinician Administered Post Traumatic Stress Disorder Scale for Children and Adolescents.

Results: All patients achieved a greater than or equal to 50 percent reduction on the recurrent distressing dreams item of the Clinician Administered Post Traumatic Stress Disorder Scale for Children and Adolescents after the addition of prazosin.

Conclusion: Prazosin therapy may be an option for adolescents experiencing post traumatic stress disorder related recurrent distressing dreams.

5-189

Category: Psychotherapy / Neurology

Title: Assessing Etiologies and Treatment Options of Insomnia In Lebanon

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Purpose: The objective of the study was to identify the various etiologies of insomnia in Lebanese population and evaluate the most common pharmacological and non-pharmacological therapy used.

Methods: In April 2011, all adults visiting selected community pharmacies in different areas in Lebanon were interviewed by pharmacists to determine whether they suffer from insomnia or not. The questionnaire was designed to collect information related to patient medical, family and social history, lifestyles, insomnia characteristics and duration, pharmacogical and non-pharmacological treatment options utilized and its overall efficacy. The study was approved by the institutions committee on human subjects in research (CHSR).

Results: Out of 916 adults screened during the study period, 536 (58.52%) patients have been identified with insomnia. The mean age of the insomnia group was 46.88 years with a 53% of women. Insomnia duration varied from 2-3 days (5.22%), less than 3 weeks (10.82%) and more than 3 weeks (83.95%) Study group reported using several therapy options to relieve insomnia, among which pharmacological approach (57.23%), herbal remedies (33.5%), other non-pharmacological options and vitamins (18.27%). It is to mention that 26.12% of patients did not use any approach to relieve insomnia, while 3.54% combined several options together. The use of pharmacological options were classified as: benzodiazepines (68.2%), zolpidem (15.7%), antihistamines (14.9%) and miscellaneous (13%). Interestingly, physicians prescriptions were obtained for only 73.56% of patients who received pharmacological therapies.

Conclusion: These findings revealed high insomnia rates in the Lebanese population with increased use of benzodiazepines. There might be a potential use of prescription drugs and anxiolytics without prescriptions.

5-190

Category: Psychotherapy / Neurology

Title: Phenytoin toxicity manifesting as hypothermia in an elderly patient with severe dementia and schizophrenia

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Purpose: A 90 year old veteran presented with hypothermia (91.3 F), hyperkalemia (6.2 mmol/L), and acute on chronic renal failure (creatinine 3.8 mg/dL, up from 2.9mg/dL). Patient has past medical history of seizures, diabetes, hypertension, chronic obstructive pulmonary disease, benign prostate hypertrophy, chronic kidney disease, severe dementia, and schizophrenia. Patient is a resident in a long term care facility. Patient has been prescribed phenytoin for history of seizures for over 14 years. Phenytoin dose upon admission was 75mg PO BID, this dose has been unchanged for 6 years. Only change in medication or dosages was the addition of a 5 day course of sulfamethoxazole/trimethoprim that ended 4 days prior to admission. Patient's average body temperature the week before admission was 96.7 F. On Day 1 of admission, patient had a phenytoin level of 16 mcg/mL, creatinine of 3.8 mg/dL, albumin of 2.9 gm/dL. Patient was treated with piperacillin/tazobactam and vancomycin for suspected healthcare-associated pneumonia. Average temperature was 93.8 F. On Day 2, patient's phenytoin level was 14.3 mcg/mL and creatinine was 3.6 mg/dL. Phenytoin was continued. Thyroid function tests were within normal limits and adrenal insufficiency was ruled out. Average temperature increased to 96.7 F. On day 3 of admission, patient continued on piperacillin/tazobactam, vancomycin, and phenytoin. Average temperature decreased to 94.2 F. On day 4 of admission, vancomycin was discontinued. Phenytoin free level returned at 2.5 mcg/mL; free phenytoin level was drawn on the second day of admission. Phenytoin was discontinued and levatiracetam was initiated. Average temperature was 93.9 F. On day 5 of admission, patients creatinine decreased to 3.2 mg/dL and average temperature was increased to 95.5 F. On day 6 of admission, patient's average temperature continued to increase to 96.3 F. On day 7 of admission, repeat phenytoin level had decreased to 10.8 mcg/mL. Piperacillin/tazobactam was discontinued. Average temperature was 96.3 F. On day 8 of admission, patient's average temperature increased to 97.1F. Patient was discharged back to the long term care facility with palliative care services on day 9. As this case demonstrates, toxic phenytoin levels may have lead to the patients hypothermia. Patients average body temperature decreased until phenytoin was held and levels started to decrease. This case also highlights many important considerations with phenytoin use. The need to adjust phenytoin levels for low albumin and degree of renal dysfunction, as well as the potential for drug interactions to affect the phenytoin level. All previous case reports of phenytoin toxicity induced hypothermia were in patients with mental retardation. This is the first case reported of phenytoin toxicity inducted hypothermia in a patient with severe dementia and schizophrenia. It is important for providers to be aware of the possibility of atypical symptom presentation of phenytoin toxicity in the form of hypothermia.

Methods: N/A

Results: N/A

Conclusion: N/A

5-191

Category: Psychotherapy / Neurology

Title: Potential aripiprazole induced acute dystonic reaction in a ten year old

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Purpose: Dystonia is defined as prolonged abnormal contractions of muscle groups which may occur within the first few days after the initiation of a potentially offending agent. Acute dystonia is more likely to occur with the use of high potency and higher doses of the first generation antipsychotics as stated by aripiprazoles package labeling. It is also more likely to occur in males and in the younger age groups. A ten year old male with a diagnosis of attention deficit hyperactivity disorder, oppositional defiant disorder and rule out bipolar affective disorder is described. He was admitted to an inpatient child and adolescent psychiatry unit with a chief complaint of sad mood. He was having oppositional defiant behavior and impulsivity in the home and school. Physical examination and laboratory information disclosed no acute pathology at admission. Prior to admission he was on clonidine, aripiprazole 2 mg, dexmethylphenidate, venlafaxine extended release and albuterol inhaler. These were discontinued except for the aripiprazole and albuterol. Lorazepam 0.5 mg was ordered every four hours as needed for agitation. The patient had only received one dose of the aripiprazole the night prior to admission. The morning after the second dose was administered he experienced a very strong acute dystonic reaction resulting in torticollis. He was given one dose of benztropine 2 mg intramuscularly at that point and the aripiprazole was discontinued. Benztropine 1 mg orally was ordered for every morning subsequently for three days. The dystonic reaction resolved that day without any return of symptoms. Vital signs at the time of the reaction and following it remained within normal limits. The patient was discharged three days after the reaction on guanfacine and albuterol inhaler. This case reminds the health care practitioner that even though the atypical antipsychotics may have fewer incidence of extrapyramidal adverse effects when compared to the typical agents in the adult population, this may or may not be true in the adolescent population based on the limited study data and utilization data currently available.

Methods: N/A

Results: N/A

Conclusion: N/A

5-192

Category: Quality Assurance / Medication Safety

Title: Utilization of a Medical Simulation Center to Test a New Process for Barcode Scanning of Chemotherapy Infusions

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Purpose: To describe utilization of a medical simulation center to test a new process for barcode scanning of chemotherapy infusions for potential human factor errors and to validate error control strategies recommended from performance of a healthcare failure mode effects analysis (HFMEA).

Methods: A multidisciplinary project team was formed to implement a new process for barcode verification and electronic documentation of administration of chemotherapy infusions and injections. The team employed a Define, Measure, Analyze, Improve, Control (DMAIC) methodology to develop the new process and performed a healthcare failure mode effects analysis (HFMEA) to determine potential risk points. Based on the results of the HFMEA, several error control strategies were recommended and implemented to reduce the risk of error. The process was then tested in a medical simulation center with staff members not part of the project team. Testing was performed in a one-day, 4-hour session and consisted of staff participating in five pre-scripted scenarios designed to test the efficacy of error controls in place and to elicit staff response to unanticipated/unexpected occurrences in the process. Testing scenarios targeted high-risk elements of the process, including the necessity to relabel infusions when the barcode scan was unsuccessful due to a change in the order number in clinical information systems. Post-simulation inteviews were conducted with participants.

Results: Testing of the process validated the efficacy of error control strategies based on the performance of the FMEA, including use of standardized pre-formatted medication lists in the pharmacy clinical information system to reduce risk of transcription error, and mandatory two RN badge scan during barcode verification prior to administration. Several changes to the process were made, including clarification of the process for retiming of chemotherapy infusion orders to reduce the number of barcodes not scanning successfully. Feedback from post-simulation inteviews of staff was used to develop staff training tools prior to implementation.

Conclusion: Utilizing a medical simulation center to test a new process for barcode scanning of chemotherapy infusions validated error control strategies implemented, identified high-risk elements of

the process which required further control, and assisted in development of staff training tools prior to implementation.

5-193

Category: Quality Assurance / Medication Safety

Title: Implementation of computerized cumulative dose tracking to reduce the risk of acetaminophen overdose in hospital patients

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Purpose: Acetaminophen, widely used as an analgesic and antipyretic, has an increased risk of hepatotoxicity in doses which exceed 4,000 mg per day. Voluntary medication error reporting and focused audits at Cleveland Clinic revealed that hospital patients were frequently receiving daily doses of acetaminophen which exceeded 4,000 mg. The vast majority of these cases involved the hydrocodone-acetaminophen combination (hydrocodone 5 mg/acetaminophen 500 mg per tablet), however, additional cases were noted with various combinations of medication, including acetaminophen, oxycodone-acetaminophen, and butalbital-acetaminophen-caffeine. In response to these concerns, Cleveland Clinic has implemented computerized cumulative dose tracking as well as an alert for doses which exceed 4,000 mg per day in the electronic medication administration record in an effort to reduce the risk of acetaminophen overdose.

Methods: Prior to implementation of the computerized cumulative dose tracking and dose alert, pre-implementation data was collected in a focused audit to determine the frequency of daily acetaminophen doses which exceeded 4,000 mg. This audit was based on recorded dispenses of acetaminophen-containing products from automated dispensing cabinets. Using this data, audits of electronic medication administration records were completed for all patients whose dispense quantities met or exceeded 4,000 mg of acetaminophen on any given date. Following the pre-implementation audit, computerized cumulative dose tracking was implemented for all acetaminophen-containing products. The dose tracking informs the health care provider of the total dose of acetaminophen which has been administered during the previous twenty-four hours and is displayed within the order in the electronic medication administration record. Additionally, an alert is displayed to the health care provider whenever a medication administration is documented which has resulted in an acetaminophen dose which has exceeded 4,000 mg during the previous twenty-four hours.

Results: During the fourteen-week pre-implementation audit, it was found that an average of 8.57 patients per week had received greater than 4,000 mg of acetaminophen within 24 hours. Daily doses of acetaminophen for these patients ranged from 4,100 mg to 7,000 mg (mean = 5,046 mg). Many of these patients were repeatedly overdosed within 24 hours or over the course of several days. Following implementation of the electronic cumulative dose tracking and dose alert, a four-week post-implementation audit found an average of 3 patients per week who had been given greater than 4,000 mg in twenty-four hours. Daily doses of acetaminophen for these patients ranged from 4,500 mg to 5,150 mg (mean = 4,808 mg), with only one observed occurrence of repeated overdose.

Conclusion: Implementation of computerized cumulative dose tracking and dose alert has resulted in a lower frequency of acetaminophen overdose in hospital patients. However, the risk of acetaminophen overdose has not been completely eliminated and further intervention may be necessary.

5-194

Category: Quality Assurance / Medication Safety

Title: Education on the management of high risk-high alert medications

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Purpose: The Joint Commission (TJC) requires that health care organizations identify high risk-high alert (HR-HA) medications used within their institution and develop guidelines for their safe administration. Accordingly, risk reduction strategies should be implemented to avoid serious adverse events that can occur with HR-HA medications. The purpose of this study is to describe how our institution recognized the need for education on the identification and safe administration of HR-HA medications, and how we increased nursing awareness of the medications and safety guidelines.

Methods: Through a joint venture of the pharmacy department and nursing education, a survey was created to collect data on the management of HR-HA medications by the nursing staff. The survey was divided in two parts. The first part measured the nurses' ability to identify HR-HA medications in their area of practice. The second part required the nurses to explain the steps necessary to ensure safety when administering a HR-HA medication. The survey was conducted in an interview format between the surveyor and the nurse. A plan for education was designed and was to be implemented post-survey results. The plan entailed the development of an acronym for the identification of HR-HA medications. The acronym ACE IN THE WHOLE associated each letter of the acronym with HR-HA medications. The plan also described key risk reduction strategies for the storage, ordering, dispensing, administration and monitoring of HR-HA medications. Educational flyers were developed and were posted on all patient care areas. A series of educational sessions were conducted. After extensive promotion and education, a follow up survey was performed to re-evaluate nursing awareness and knowledge about HR-HA medications to a minimum of ninety percent.

Results: The initial survey was carried out in February 2010. A total of sixty-six nurses were interviewed about HR-HA medications. Ninety-seven percent could correctly identify HR-HA medications in part one based on our institution's criteria, and eighty-four percent could speak to safety when administering these medications in part two. From March through June 2010, education was subsequently offered to all nurses hospital-wide to improve knowledge on the topic of HR-HA medications and to focus on the deficiencies identified through the survey interviews. A follow up survey of sixty-seven nurses took place in July and August 2010. Ninety-eight percent could correctly identify HR-HA medications and ninety-six percent could speak to safe administration processes. The objective of ninety percent knowledge was reached.

Conclusion: Medication safety has evolved into a primary focus in health care. Education is essential in order to ensure safe practices when administering HR-HA medications. TJC recognizes the life-threatening risks associated with HR-HA drugs and high priority should be given to safeguarding their use. Each organization needs to develop its own system for the safe management of HR-HA medications and ACE IN THE WHOLE is our tool. Our institution continues to review and update our HR-HA medication list to promote safe medication management.

5-195

Category: Quality Assurance / Medication Safety

Title: Multidisciplinary review team reduces harmful medication errors

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Purpose: Avoiding harmful medication errors is a top priority in all hospitals. Significant advances in technology have been aimed at reducing these errors. While the implementation of bedside bar-coding at our hospital reduced the occurrence rate of harmful errors by 21 percent after one year of utilization, harmful errors continued to occur for a variety of reasons. To evaluate and reduce these harmful errors a multidisciplinary team was developed to analyze error reports and identify process improvement opportunities.

Methods: The medication error review team consisted of Pharmacists, staff Nurses, Nursing leadership, and Quality/Risk Management. The team included nursing representation from both inpatient and outpatients units of the hospital including areas where bedside bar-coding is not currently utilized. The team was developed as part of the hospitals multi-disciplinary shared governance structure. The inclusion of a staff nurse and their manager allowed for accountability on the part of the staff Nurse and also allowed the nurse manager to hear first hand the process issues in their units contributing to harmful errors and what barriers to improvement may need to be removed. Prior to each monthly meeting, all reported medication errors are reviewed by the Pharmacy Operations Manager and Director of Quality & Risk Management. During this review, errors are categorized for severity and any underlying process error. Errors attributed to process breakdowns are taken to full committee for review and discussion. When process issues are identified that led to or contributed to a medication error, the members of the team develop alternative solutions when applicable, provide education to their peers, monitor and report the progress of process changes back to the team and routinely communicate the activities of the team to their units. This communication of the teams actions to their peers was seen as an important component to encourage reporting of errors. The team nurses also provide a mechanism for their peers to indirectly report on error prone processes that have yet to cause an error.

Results: As a result of the teams review of process issues and the improvements implemented the occurrence rate of harmful medication errors at our hospital was reduced 48 percent in 2010 compared to 2009 which was the first full year with bedside bar-coding in place. While the rate of harmful errors was decreased, the overall rate of all medication error reports in 2010 increased by 31 percent compared to the prior year. Additionally, during this same time period, the utilization rate of the smart

pump medication library increased 10 percent overall for all units combined. Most significant was an increase of 15 percent in the Medical Surgical unit.

Conclusion: The multidisciplinary medication review team at our hospital was successful in reducing harmful medication errors even further than the implementation of bedside bar-coding alone. This approach allowed for a thorough evaluation of process breakdowns and the successful implementation of improvement activities across multiple departments to prevent further harm. While the thorough evaluation of errors conducted by the team and the process improvement plan put into action, reduced the occurrence rate of harmful errors, the involvement of the communication and feedback by the team nurses to their peers also led to an increase in error reporting.

5-196

Category: Quality Assurance / Medication Safety

Title: Pharmacist prospective medication order review from an emergency department in a community teaching hospital

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Purpose: Due to its unique environment, patients receiving medications in the Emergency Department are more vulnerable to medication errors. To add a layer of safety in the medication use process, pharmacist prospective review was identified as an error prevention strategy for medications prescribed to patients in the Emergency Department setting.

Methods: A proposal and timeline for implementation of pharmacist prospective review for all medication orders prescribed for use in the Emergency Department was submitted to and accepted by the Emergency Department Operations Group. On the date of go-live, the Automated Dispensing Cabinets were switched to profile-only, necessitating the approval of a pharmacist before the medication was available for administration. The number of pharmacist-verified orders, total number of orders and documented pharmacist interventions were measured and compared to pre-implementation data.

Results: In the six weeks before implementation, pharmacists reviewed 1,234 orders prospectively out of a total 7,799 orders (15.8%). In the six weeks following implementation, pharmacists reviewed 6,661 orders out of a total 7,091 (93.9%). In the 4th quarter FY09 (April, May, June) pre-implementation, pharmacists documented 77 interventions, including 3 major events adverse drug events prevented, regarding orders for patients in the Emergency Department. During the same time the following year post implementation, pharmacists documented 238 total interventions, including the prevention of 8 major Adverse Drug Events.

Conclusion: Pharmacist prospective review of medication orders in the Emergency Department is beneficial to patient safety by adding a verification process in a setting identified as vulnerable to medication errors.

5-197

Category: Quality Assurance / Medication Safety

Title: Development of an institutional scorecard to track warfarin treatment

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Purpose: The Joint Commissions National Patient Safety Goal for anticoagulation has presented healthcare organizations (HCOs) a formidable challenge. As HCOs develop programs to address this Patient Safety Goal one particularly vexing question is how to longitudinally monitor warfarin treatment. To date, no national benchmarks or scorecards have been established for this narrow therapeutic index drug. The purpose of our project was to develop an institutional scorecard to monitor warfarin treatment.

Methods: A daily report listing all hospital inpatients with International Normalized Ratios (INRs) > 4 was developed by our Pharmacy Information Technology Team. We collected the following data on patients with INRs > 4: basic demographics, whether the elevated INR occurred before or after admission to the hospital, prescribing physician, whether the patient experienced bleeding, whether an antidote (blood products and/or vitamin K) was administered and root cause(s) for the elevated INR. This data was compiled on a monthly basis beginning in January 2011.

Results: To date, we have collected data through May 2011. Our monthly data reveals a total of 236 patients receiving warfarin each month, 23.8 (10.1%) INRs > 4 with 13.4 (5.7%) occurring prior to admission and 10.4 (4.4%) in inpatients. The high INR led to admission in 4.6 (1.9%) patients per month and 4.8 (2%) patients per month had signs and symptoms of bleeding. Almost half of the patients with INRs > 4 received blood products and/or vitamin K as antidotes. Twenty-one (40.3%) of 52 patients who received vitamin K received it in concurrence with the Chest guidelines.

Conclusion: Our institutional scorecard allows us to follow warfarin treatment in our HCO in a longitudinal manner. We believe this tool will assist us in identifying opportunities to improve treatment and track the impact of our interventions designed to optimize the use of this narrow therapeutic index drug. This scorecard approach may be useful to other HCOs interested in developing a fairly simple mechanism to follow the use of this important drug.

5-198

Category: Quality Assurance / Medication Safety

Title: Evaluation of rapid response team calls: are calls medication induced?

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Purpose: Medical emergency teams also known as rapid response teams, have been implemented in hospitals worldwide. Root causes of rapid response team calls may be related to adverse events of medications administered during a patient's hospitalization. Analysis of this information may indicate that some rapid response team calls could have been prevented. The objective of this study was to determine the causes of rapid response team calls at Hunterdon Medical Center and identify calls secondary to adverse drug events.

Methods: A retrospective review analyzing medical records of patients who had rapid response team calls at Hunterdon Medical Center during January 2010 to December 2010 was conducted. Patients were included if they were admitted to Hunterdon Medical Center and received at least one dose of any medication administered prior to a rapid response team call. Patients were excluded if they were less than eighteen years of age, outpatients, or on maternity, behavioral health, and same day surgery units. The following data was collected of each patient: demographics, past medical history, primary diagnosis, medications, dose and administration times of medications. Medication records were assessed for possible medication induced rapid responses. Rapid response team calls were considered due to medications if the rapid response team was called within eight hours of receiving a high risk medication with side effects that could result in a rapid response team call.

Results: The number of possible medication induced rapid response team calls were analyzed and presented. A total number of sixty nine rapid response team calls were included in the study. Forty five of the rapid response team calls out of the sixty nine were included based on the inclusion criteria which resulted in twenty one rapid response team calls likely attributable to medications. Out of these twenty one rapid response team calls, eleven may have been preventable due to interventions made by pharmacy. Furthermore, this study showed the top three medication classes likely to result in a rapid response team call were: narcotics, insulin/diabetic medications, and combination of antihypertensive medications.

Conclusion: This study will help bring awareness to healthcare professionals to identify potential adverse drug events that may precipitate a rapid response team call. Additionally, procedural changes will be evaluated to alter medication administration in order to ensure patient safety.

5-199

Category: Quality Assurance / Medication Safety

Title: An effective system to reduce dispensing errors in a medical center with high volume prescriptions

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Purpose: Prevention of medication errors is a top priority worldwide. High volume of prescriptions is dispensed everyday at a pharmacy of medical center in Taiwan. In 2010, each pharmacist at this medical centre on average dispensed 78.8 prescriptions per day. As a result, medication errors can occur frequently. The aim of this study is to develop an effective system to reduce dispensing errors.

Methods: In order to analyze dispensing errors that occurred during the study period from January 2010 to December 2010, a team of twelve pharmacists was assembled. This quality control monitoring team consisted of the chief leader of the dispensing division and pharmacists from all divisions of pharmacy. There is at least a representative from each division who participated in the daily operations of each division and can provide insight into the reason for the dispensing errors. The quality control team set up an electronic database collecting system that all dispensing errors can be recorded easily by checking pharmacists. It was mandatory for the dispensing pharmacists to feedback within a month of dispensing on the reason for the error to occur. The team members met after work on a regular basis once a month to review the dispensing errors of the previous month and develop risk reduction strategies that targeted the recurrent errors. These strategies were then proposed to the head of the pharmacy department and all division managers to approve for implementation. Risk prevention strategies that were implemented include: providing pharmacists with information about recurrent dispensing errors in department meetings, developing certification modules and competency assessment to evaluate pharmacists dispensing skills, using tall man letters to reduce errors associated with look-alike/sound alike drug name, using different symbols and lettering for drugs with multiple strengths and formulation, providing pharmacists with information on appearance of packaging, and incorporating information technology (such as barcode technology) to minimize human error associated with misidentifying the patient or correct medication selection.

Results: After analyzing the records of dispensing errors, the results showed that the implemented measures assisted pharmacists with the dispensing process and reduced dispensing errors. Comparison between the first quarter of 2010 and the last quarter of 2010, it was observed that incorrect formulation error reduced from 13 cases per million to 7 cases per million and patient misidentification error reduced from 3.7 cases per million to 1.7 cases per million. The dispensing pharmacists expressed

that the failure prevention techniques were effective to reduce errors. For example, one recurrent dispensing error is dispensing Ergotamine/caffeine tablets instead of the prescribed Ergonovine. The trade name of Ergotamine/caffeine tablet is Ergocafe which is similar to Ergonovine. The quality control team added tall man letters on the drug label to highlight drug name difference: ErgoNOVINE and ErgoCAFE. Since implementing this strategy, this wrong drug error did not reoccur. The prevention strategies was also able to eliminate a common wrong formulation error: acetylcysteine 100 mg powder and acetylcysteine 600 mg dispersible tablet.

Conclusion: Dispensing errors can lead serious consequences, such as patient harm, and should not be treated lightly. The continuous review and evaluation of the problems is crucial. The development and implementation of risk prevention strategies proposed by the quality control monitoring group can reduce the trend of dispensing errors and the patient safety can be greatly enhanced.

5-200

Category: Quality Assurance / Medication Safety

Title: From guideline to clinical practice: implementation of antibiotic lock therapy guideline in a community teaching hospital

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Purpose: Catheter-related bloodstream infections (CRBSI) are a major cause of morbidity and mortality, especially among patients receiving hemodialysis, parenteral nutrition and chemotherapy. The standard treatment of patients with CRBSI entails administration of systemic antibiotics, as well as removal of the infected catheter. In selected patients with infections due to long-term catheters, it is highly desirable to salvage the catheter, if possible, since replacing a new catheter is an inconvenient, time-consuming and expensive procedure. When central venous catheter salvage is necessary, antibiotic lock therapy is an alternative as suggested in the updated management of blood stream infection guideline by Infectious Disease of Society of American (IDSA). However, lack of clinical knowledge of this infrequently prescribed procedure, in addition to the inefficient communication among different clinical providers, has led to significant medication errors. The purpose of this study is to develop a systematic approach in implementation of antibiotic lock therapy and to identify opportunities for further improvement.

Methods: A multidisciplinary health care team was convened to systemically evaluate the existing literature and to design the tools as well as processes for antibiotic lock therapy guideline at Hospital of St. Raphael since April 2010. This team consisted of infectious disease physicians, representatives from the pharmacy department, nursing administration, risk management, and information systems support. Collaborative discussions were conducted to identify the indications of use, key components needed to determine dosage of antibiotic lock therapy, as well as nursing administration techniques. Computerized physician order entry (CPOE) screens and standardized product labeling were also developed to prevent potential medication errors.

Results: We determined that the lack of knowledge on five key components including dead space of different devices, lumen number of different devices, heparinized or non-heparinized diluents, dispensing syringe, and frequency of antibiotic lock therapy was the major source of medication errors related to antibiotic lock therapy. Volumes of antibiotic lock therapy were standardized based on types of devices. Platelet count greater than 100,000 per microliter was decided to be a safety parameter for use of heparin as diluents. A stepwise approach guideline was also developed to provide guidance and to ensure efficient collaboration between clinicians, pharmacists and nurses.

Conclusion: A guideline was implemented at the Hospital of St. Raphael to avoid medication errors in antibiotic lock therapy. When new or infrequently used procedures are implemented in clinical practice, an institution specific guideline based on careful literature review will assist the health care providers, including physicians, pharmacists and nurses and minimize medication errors.

5-201

Category: Quality Assurance / Medication Safety

Title: Enhancing Medication Error Reporting and Analysis

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Purpose: Voluntary reporting is a crucial strategy an organization uses to identify medication errors and opportunities for process change. Several organizations have transitioned from paper-based reporting to electronic reporting system to improve information capture, structure data, and provide timely analysis. A risk management led conversion from paper to electronic was completed in March 2009 using existing paper format and vendor supplied templates. A 32% decrease in reporting was noted during the first year of electronic medication error reporting.

Methods: A multidisciplinary team was formed under the leadership of the medication safety officer to identify the root cause of the decrease in reporting and formulate actionable changes. A survey of staff was completed to identify the user perceptions and specific reasons for the decrease in reporting. A complete process redesign was developed using available literature, staff input, expert opinion, and human factors engineering. Specific changes included: decrease page length, reorganized questions to improve flow, minimized mandatory fields, integration with NCC MERP classification, interfaces with existing drug databases, and application of skip logic. A mock-up system was built for staff to beta test the changes to the data entry screens and to assess further refinement based on staff experience. The updated electronic medication error reporting system was implemented in April 2010.

Results: Upon implementation of the changes to the medication error reporting system, a 53% increase in error reporting was noted in the first year. The net increase in reporting generated 816 additional medication error reports. Additional reporting generated an increase in investigations, root cause analysis, and overall process change to improve patient care.

Conclusion: Converting from a paper-based reporting system to electronic reporting system can present new challenges if not planned accordingly. Involving front-line staff and a multidisciplinary approach provides adequate feedback when designing a new system. Targeted changes to user interface and logic of the data entry screen can have a significant impact on usability and overall medication error reporting.

5-202

Category: Quality Assurance / Medication Safety

Title: Description of a pharmacy technician and student-intern driven medication reconciliation process and evaluation of medical provider acceptance of recommendations to reorder critical medications

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Purpose: Description of a pharmacy technician and student-intern driven medication reconciliation process and evaluation of medical provider acceptance of recommendations to reorder critical medications.

Methods: Patients admitted to Northwest Medical Center had medication histories taken on admission. A specially trained pharmacy technician or student intern reviewed these histories, with emphasis placed on critical medications as defined by the Pharmacy and Therapeutics Committee. Recommendations to re-order these critical medications were made to medical providers. All patients, excluding those under 18 years of age or current enrollment in the prison system, admitted during the months of May-June 2010 were reviewed for acceptance of critical medication recommendations through information recorded in the pharmacy electronic medical record system.

Results: One hundred seventy-eight (178) recommendations were made on 132 patients requiring recommendations. All medical providers accepted 102 (57%, p-value=0.008) of the recommendations made. Hospitalists were more likely than physician specialists or surgeons to accept recommendations made (62.5%, p-value<0.001). Recommendations made regarding thyroid products were accepted the greatest majority of the time (82.1%, p-value<0.001); anticonvulsants (63.2%, p- value=0.194), medications classified as other (55.6%, p-value=0.480), and antidepressants (54.8%, p- value=0.321), were also accepted a majority of the time. Vitamin K antagonists did not have recommendations accepted a majority of the time (31.8%, p-value=0.034).

Conclusion: Medical providers accepted a majority of recommendations to reorder critical medications made by pharmacy technicians or student interns.

5-203

Category: Quality Assurance / Medication Safety

Title: Medication histories performed by pharmacy technicians in the emergency department

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Purpose: Medication reconciliation is an important patient safety practice that appears simple in concept, but is difficult to implement and operationalize. Perhaps the most prominent barrier to effective medication reconciliation is obtaining a reliable medication history from the patient. In most emergency department models, medication histories are taken by a triage nurse; both published reviews and our own experience have shown that these medication histories are often incomplete, inaccurate, or both. Reasons for this may include lack of formal training in nursing programs for taking medication histories, and lack of time for traige nurses to follow up with secondary sources such as family members, retail pharmacies, or physician offices to obtain missing information. Medication histories taken by pharmacists have been shown to be of higher quality, but most hospitals lack the resources to deploy a pharmacist to complete medication histories on every patient admitted. The purpose of this project was to demonstrate that pharmacy technicians could be trained to obtain medication histories that were more complete and accurate than those routinely obtained by emergency department nursing staff.

Methods: Pharmacy technicians received three hours of didactic training from a pharmacist and an emergency department nurse on performing medication histories, using the emergency department electronic medical record, and interacting with patients. Technicians also completed several hours of experiential training under the supervision of an emergecy department nurse, and a written and practical competency examination. Pharmacy technicians were deployed to the emergency department to take medication histories on admitted patients between the hours of 11:30am and 6:30pm seven days a week. Patients admitted between the hours of 6:30pm and 11:30am had their medication history obtained by an emergency department nurse. Random samples of histories obtained by both groups were compared for number of histories completed without error, number of errors per history completed, and number of histories that included the date and time of the dose last taken. The institutional review board waived the need for informed consent.

Results: Between September 2010 and May 2011, 509 (365 completed by nurses and 144 completed by pharmacy technicians) medication histories taken in the emergency department were reviewed. Fifty eight percent of the medication histories taken by nurses were completed without errors compared to ninety three percent of those completed by the pharmacy technicians. In the nurse group, there were

314 errors identified for an error rate of 0.86 errors per history completed compared to 10 errors overall for the pharmacy technician group for an error rate of 0.07 per history completed. Only 9% of the nurse histories had the date and time the medication was last taken documented compared to 75% for the pharmacy technician group.

Conclusion: Medication histories obtained by pharmacy technicians in the emergency department were more complete and more accurate than those taken by emergency room nurses. This data supports the deployment of pharmacy technicians to the emergency department, and possibly other areas, as a cost effective alternative to pharmacists performing medication histories.

5-204

Category: Quality Assurance / Medication Safety

Title: Oral inhaler common canister program: disinfection of canister with isopropyl alcohol and monitoring for contamination

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Purpose: An oral inhaler common canister program was initiated by respiratory therapy and pharmacy in four adult acute care facilities. Even with exclusion of isolation patients and patients on a ventilator, there were concerns that contamination could occur between patients if the procedure for canister disinfection was not strictly followed. A canister swab monitoring process was developed.

Methods: In consultation with the infection control nurses and an infectious diseases physician, a policy and procedure for disinfection of the common canister was developed. The canister boot was to be thoroughly wiped with 70 percent isopropyl alcohol before and after patient administration. A patient specific one way valve spacer was utilized. In order to ensure that the disinfection process was strictly followed, respiratory therapy took over administration of all metered dose inhalers except for in the peri-operative areas. Respiratory therapists received extensive education on the new process. Per policy, isolation patients were excluded. Ventilated patients were also excluded due to the absence of a one way valve in the circuit. In order to monitor for contamination, random swabs of common canisters were collected and cultured. Each swab was labeled for identification of employee, nursing unit or patient.

Results: Of 71 swab samples, 70 were negative for contamination. The one positive culture was determined to be normal respiratory flora. The employee with the positive canister swab culture went through re-training on the process. Subsequest swab culture tests have all been negative. Currently routine random swabs are collected to ensure that there is no contamination between patients and that the process is strictly followed by the employees. All monitoring results are reviewed by infection control, respiratory care matrix, pharmacy matrix, and the clinical effectiveness team.

Conclusion: The use of one way valve spacers for administration of oral inhalers and an alcohol disinfection process before and after common canister is safe for patients. Continued monitoring of staff compliance with policy is recommended.

5-205

Category: Quality Assurance / Medication Safety

Title: Pharmacogenetic biomarkers for predisposition to toxicity in colorectal cancer patients

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Purpose: 5-fluorouracil (5-FU) and capecitabine are the gold standards in colorectal cancer (CRC) treatment and are often combined with oxaliplatin (FOLFOX and XELOX chemotherapy, respectively). The purpose of this study was to analyze polymorphisms previously described in literature but with discrepant results associated with moderate to severe toxicity of these treatments in CRC patients and also to identify new possible genetic biomarkers.

Methods: Retrospective study with 48 adult CRC patients treated with adjuvant chemotherapy consisting of bolus/infusional 5-FU, folinic acid modulation and oxaliplatin (FOLFOX) or capecitabine, folinic acid and oxaliplatin (XELOX). The study was approved by the Regional Ethics Committee for Clinical Research and all patients signed an informed consent for the pharmacogenetic study. Clinical data (age, sex, treatment and toxicity) and genotype of the selected single nucleotide polimorphisms (SNPs) were registered. Genomic DNA was isolated using PCR template preparation kit (Roche). Based on the Common Terminology Criteria for Adverse Events (CTCAE) patients were classified in 2 groups depending on the degree of toxicity developed: negative (grades 0-I) or positive (grades II-IV). Selected SNPs were genotyped by the SNaPshot technique and linear by linear association chi-square test (SPSS v.15.0) was used to study associations between polymorphisms and toxicity. $p < 0.05$ was considered significant.

Results: Mean age of the patients included in the study was 67 (SD: 12) years and 58.3% were male. 19 Polymorphisms in 13 genes were selected. 5 genes [XRCC1 (rs25487), ERCC2 (rs13181), ERCC1 (rs11615), GSTP1 (rs1695) and EGFR (rs4559542)] were involved in the metabolic route of oxaliplatin and 8 played a role in the metabolism of the fluoropyrimidines 5-FU and its prodrug capecitabine [MTHFR (rs1801131 and rs1801133), DPYD (rs2297595 and rs3918290), TYMS (rs34743033 and rs34489327), ABCB1 (rs1128503, rs2032582 and rs1045642), ABCC4 (rs4148551 and rs3742106), ABCC5 (rs3805114), CYP2A6 (rs3742106) and CDA (rs2072671)]. Statistically significant associations were obtained between the polymorphism in XRCC1 and the development of anorexia (p=0.046), GSTP1 and diarrhoea (p=0.031), MTHFR (rs1801131) and mucositis (p=0.020) and peripheral neuropathy (p=0.044), DPYD (rs2297595) and nausea and vomiting (p=0.004) and leucopenia (p=0.004), TYMS (rs34489327) and nausea and

vomiting (p=0.048), leucopenia (p=0.010) and hand-foot syndrome (p=0.044), CDA and nausea and vomiting (p=0.042) and ABCC4 (rs3742106) and nausea and vomiting (p=0.047).

Conclusion: These results could help oncologists reduce adverse reactions associated to FOLFOX and XELOX chemotherapy by giving patients the best possible option. The potential clinical applications and the possible benefits to therapy prescribed by oncologists to CRC patients could improve patients quality of life. Bigger cohorts are needed to verify the associations obtained between the polymorphisms in XRCC1, GSTP1, MTHFR, DPYD, TYMS, CDA and ABCC4 and the development of toxicity.

5-206

Category: Quality Assurance / Medication Safety

Title: Incorporation of a medication safety learning experience for PGY1 pharmacy residents into an organization's medication safety improvement process

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Purpose: Promotion of a just culture of safety and dissemination of information to prevent medication errors and minimize adverse drug reactions are important components of the health-care system's medication safety program. Providing opportunities for pharmacy residents to participate in organizational efforts to improve the medication-use process introduces them to these concepts and enables them to achieve specific goals and objectives established by ASHP for residents in postgraduate year one (PGY1) pharmacy resident programs. A longitudinal medication safety learning experience was designed to provide specific experiences for PGY1 pharmacy residents that would involve them in interprofessional teams that assist in the organization's initiatives to make improvements in patient safety. The learning experience would also provide opportunities for resident research in safety and application of skills to complex organizational situations.

Methods: Two pharmacists who actively participate in the health-systems medication safety and quality committees serve as preceptors for the PGY1 medication safety rotation. Initial orientation to medication safety principles is covered in didactic format and includes review of the Joint Commissions National Patient Safety Goals, IOM Reports on Patient Safety, and the organization's policies and procedures related to medication safety and medication event reporting, as well as recognition and prevention of adverse events in clinical practice. During the year, each resident is required to attend a meeting of the organization's multidisciplinary medication safety (MedSafe) committee, where they participate in review of the month's medication event reports and the brainstorming process to identify ways to prevent future errors and adverse drug reactions. Each resident is assigned to complete four separate medication safety projects on a rotating basis: write an article for the nursing newsletter, prepare a safety poster that will be posted in clinics and on hospital nursing units, write an article on a new or unusual adverse drug reaction for the pharmacists' newsletter, and prepare and give a Lessons Learned presentation on medication errors to the pharmacy staff. Specific topics for the projects are suggested by the MedSafe committee based on actual events or patterns of events that had been reviewed, problems identified through review of FDA or ISMP bulletins or other literature sources, medication safety experiences identified by other inter-professional committees and teams, or are suggested by the residents themselves based on experiences from their other learning experiences.

Results: As a part of the 2010-2011 PGY1 pharmacy residency program, each of the eight residents produced four high-quality safety projects that served to provide pertinent information on medication safety and error prevention to various nursing and pharmacy groups within the organization. Examples of projects included a nursing newsletter article and safety poster on the topic of the correct process for bar-code scanning and activating intravenous mini-bags, an article for the pharmacists' newsletter on the potential for allergic reactions to acetaminophen, and a Lessons Learned presentation on errors associated with reconciliation of patient medications from home. Written evaluation of the learning experience and resident performance was done using the on-line evaluation program ResiTrak. The residents demonstrated improvement in writing and public-speaking skills and achieved ASHP PGY1 pharmacy resident program required goals R1.1 Identify opportunities for improvement of the organization's medication-use system and R6.1 Use information technology to make decisions and reduce error.

Conclusion: Incorporation of a medication safety longitudinal learning experience for PGY1 pharmacy residents into the organization's medication safety improvement process provided valuable experience for the residents to refine their communication skills and served to educate health-care professionals about specific medication safety topics on a regular monthly basis. The residents' projects contributed to ongoing efforts to prevent medication errors, improve the medication use process and promote the just culture of safety within the health system.

5-207

Category: Quality Assurance / Medication Safety

Title: Get your priorities straight: a priority setting matrix for medication quality and safety

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Purpose: Alberta Health Services (AHS) is Canadas first province-wide, fully integrated health system. Created in 2008, AHS has brought together the provinces 9 separate health regions into one system and oversees 107 hospitals. Legacy work within these former health regions established goals and priorities to achieve best practice standards in medication management processes, safety, and quality. As well as focusing efforts in addressing these numerous outstanding initiatives, the results of a province-wide assessment in the fall of 2010 by Accreditation Canada (AC) identified 33 unmet criteria for the province within its managing medications standards that required attention. The challenge for the Provincial Pharmacy Services Medication Quality and Safety Team (MQST) was how to prioritize these competing projects for medication safety to meet the needs of AHS and the 3.7 million Albertans it serves. As this was uncharted territory for the province, we developed a priority setting matrix for Medication Quality and Safety.

Methods: In order to assign each of the AC unmet criteria into high, medium, and low priorities for AHS, the summative provincial results of ACs Self-Assessment Questionnaire (SAQ) and the AC on-site visit rankings were retained. As the established priorities for the legacy regions were based on AC standards for best practice in medication safety, they were incorporated into the overall provincial SAQ rankings. However, we believed that a third dimension, impact to patient safety, was needed. A primary matrix was first developed to prioritize each of the unmet criteria, incorporating perceived organizational priority (SAQ) as well as the priority ranking assigned by AC during their on-site visits. The output of this matrix produced a prioritized list of the unmet medication management standards. A second matrix, incorporating patient safety, was then created to prioritize the output of the first matrix. Each unmet criteria/managing medications standard was assigned a weighted score by assessing impact on patient safety using an established scoring system. This system assessed organizational characteristics for impact to patient safety if not implemented. In some instances, where a managing medication standard was highlighted by the organizational SAQ as an area where necessary improvements were needed (red flagged), but not by the AC on-site surveyor (regardless of impact to patient safety) it was automatically assigned an overall priority rating as High.

Results: The 33 unmet managing medication standards were prioritized using three dimensions; the organizational SAQ, AC on-site visit priority ranking, and impact to patient safety. Using the matrix, 21 unmet managing medication standards ranked as high priority, eight ranked as medium priority, and

four ranked as low priorities for AHS. Based on the rankings, AHS Pharmacy Services and the MQST were able to identify and develop short and long term strategic plans that directly related to medication quality and safety improvements for the province.

Conclusion: Efforts to prioritize and address medication quality and safety standards across 107 acute care and psychiatric hospitals are unprecedented in Canada. The development of a matrix that incorporated three dimensions of medication quality and safety organizational priorities, national benchmarks, and impact to patient safety - was effective in establishing a prioritized work plan for ongoing improvement strategies for medication quality and safety on a large scale.

5-208

Category: Quality Assurance / Medication Safety

Title: Implementation and evaluation of a medication safety program in an outpatient primary care medical residency clinic

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Purpose: Improving medication safety has become a national patient safety goal in inpatient and outpatient settings. Effective process improvement interventions have been described in the inpatient setting, but there is scarce information addressing effective interventions in the outpatient primary care setting. The purpose of this study was to design and initiate a comprehensive medication safety program in a primary care medical residency clinic and to evaluate the effect of this program on medication safety culture and medication event reporting.

Methods: This prospective pre/post intervention study was conducted at the St. Vincent Joshua Max Simon Primary Care Center (PCC) in Indianapolis, Indiana. The St. Vincent Hospital institutional review board approved the study. The study was funded by a grant from the St. Vincent Foundation. Eligible participants were PCC faculty physicians, nurses, and medical residents in the Internal Medicine and Family Medicine residency programs and PCC pharmacy staff. Participants voluntarily completed the PeaceHealth Ambulatory Medication Safety Culture Survey, a 16 question validated survey, at baseline and again after 5 months of educational interventions (November 2010 to April 2011). Pre- and post-survey results were paired and blinded. Educational interventions conducted during the study period included didactic lectures, medication safety tip of the month reports, medication event summaries, and one-on-one interactions. Medication event reporting was reviewed at baseline and collected throughout the study period. The primary outcome of this study was to assess the change in the medication safety culture. The secondary outcome was the change in event reporting, over the study duration, as assessed by entry into the St Vincent Health medication event reporting system.

Results: In total, 109 surveys were collected: 65 pre-intervention and 94 post-intervention. This yielded 50 paired surveys, reflecting a paired survey response rate of 44% (50/114). The survey utilized a modified Likert scale of 1 to 4, while omitting a neutral response. Responses of 1 reflected strong disagreement with statements reflecting a culture of safety, and 4 strong agreement. The pre- and post-intervention median composite scores were 3.0000 (Interquartile range (IQR) 2.7219-3.3281) and 3.3125 (IQR 3.0625-3.6875), $p<0.001$, representing significant improvement in perception of a culture of medication safety at the PCC. Survey questions that focused on safety as a priority in the PCC, questions #15 and #16, showed strong improvement. Negative responses decreased from 30% to 12% ($p=0.001$) in #15, and from 60% to 20% ($p<0.001$) in #16, with no strong disagreement responses in the post-survey (1 and 5 strong disagreement responses occurred in the pre-survey for these two questions respectively). With regards to medication event reports, 3 events were entered in the 21 months prior to the study period. During the 6 month study period, 27 medication events were reported. Process

improvements have been implemented within the PCC based on the analysis of the medication events reported within the study period.

Conclusion: Implementation of a comprehensive medication safety program in a primary care medical residency clinic achieved overall improvement in the culture of medication safety. In addition, the educational interventions resulted in a numerical increase in medication event reporting. Additional clinical studies are needed to determine the sustainability of these effects and the applicability of these interventions to non-residency primary care practices.

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Category: Quality Assurance / Medication Safety

Title: Pharmacy Dashboard: Are We On Track?

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Purpose: To develop a tracking mechanism for medication errors causing harm, number of opioid events managed with naloxone, pharmacist interventions, automated dispensing cabinets refill error rate, percentage of automated dispensing cabinet medication overrides, and percent of warfarin patients with baseline INR. Monitoring data is used to develop hospital staff and initiate performance improvement.

Methods: Data collected and reported on a monthly basis to the Medication Management Committee and the Pharmacy and Therapeutics Committee. Reporting is based on number of events and percentage of incidents. The content of the dashboard was based on patient safety initiatives and medication management standards. Data is analyzed by pharmacy, nursing and the medical staff to identify areas that need improvement.

Results: Data was collected from 2009 and 2010. The number of medication errors causing harm trended downward over 24 months, inpatient opioid events managed with naloxone averaged 4/month and remained steady, pharmacist interventions trended up from 2.5% to 3%, refill error rate average was 0.03% and decreased over 24 months from 0.04 to 0.02 error rate, medication overrides trend decreased to 1.4% with a decreasing trend from 4% to 2% over 15 months, and baseline INR averaged at 97%.

Conclusion: Results of the dashboard facilitate staff development and performance improvement for pharmacy, nursing and medical staff. Medication errors and compliance issues are addressed monthly with staff to educate and improve trends. Opioid events are reported as incidents and pain rounds were developed as a result. Pharmacist intervention results contribute to ongoing development of anticoagulation monitoring and antimicrobial stewardship programs. Overall, having a pharmacy dashboard helped our department streamline data reporting and achieve our goals.

5-210

Category: Quality Assurance / Medication Safety

Title: Evaluation of a pharmacist pilot study conducting admission and discharge medication reconciliation and core measure review

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Purpose: Accurate medication reconciliation has been identified to improve patient safety. Patients are at risk for medication errors during transitions of care including at the time of admission and at discharge. Hospital performance measurement and accreditation allows for safety and quality standardization and may affect hospital reimbursement. This pilot study was designed to evaluate pharmacist conducted medication reconciliation on admission and discharge as well as pharmacist review of core measure compliance prior to discharge for Cardiology patients.

Methods: A medication reconciliation pharmacist conducted admission and discharge medication reconciliation for Cardiology patients during the pilot study timeframe in December 2010. The pharmacist also reviewed each patient at the time of discharge for appropriate documentation or if follow-up was required to comply with Heart Failure (HF) or Acute Myocardial Infarction (AMI) Core Measures.

Results: 152 patients were seen by a pharmacist for admission medication reconciliation. On average, 7 discrepancies per patient on the home medication list were corrected by a pharmacist on admission. Seventy-two patients were seen for discharge medication reconciliation. Forty-eight percent of patients had discrepancies related to medications ordered at the time of discharge; more than 90% of these discrepancies required a new physician order. Twenty-seven patients were reviewed at the time of discharge for core measure compliance. One patient required pharmacist intervention to prevent core measure fall-out.

Conclusion: Pharmacist conducted medication reconciliation during transitions of care including at the time of admission and discharge improved patient safety by preventing potential medication errors related to failures in reconciliation. Pharmacist review at the time of discharge may improve core measure compliance for AMI or HF in Cardiology patients.

5-211

Category: Quality Assurance / Medication Safety

Title: Evaluation of medication discrepancies at hospital discharge

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Purpose: Medication reconciliation is a crucial method for identifying discrepancies that occur at points of transition in the hospital system. Hospital discharge poses a high risk of medication discrepancies as patients medications may change and formulary therapeutic substitutions are utilized. Poor communication at transitions of care has been shown to be consistently responsible for more than half of all medication errors that occur in hospitals, as well as up to 20% of all adverse events. The key problems causing these medication errors are: incomplete and inappropriate medication reconciliation at hospital discharge, insufficient patient information, and insufficient communication to the next health care provider. The purpose of this study was to identify any medication discrepancies upon patient discharge by comparing patient discharge instructions and physician dictated discharge summaries. Each discrepancy was stratified by type of discrepancy and characterize based on potential to cause harm.

Methods: The institutional review board approved this retrospective cohort study. Included in the study were 142 patients admitted to a general medicine floor at a community hospital between January 1, 2010 and June 30, 2010. Patients greater than or equal to 90 years of age, discharged to an extended care facility or another institution, patients on no medications prior to admission, prisoners, and pregnant women were excluded from the study. Patient demographics including: age, race, number of medications, hospital unit, admitting physician, and length of stay were collected. Unintentional medication discrepancies were categorized as one of the following: drug omission, no indication, therapeutic duplication, inappropriate route, incorrect dose, incorrect frequency, and formulary interchange. The investigators evaluated each discrepancy in order to determine its potential to cause harm and classified each as unlikely, possible, or probable to cause harm to the patient. Since the study investigators were determining the potential to cause harm instead of actual harm, the assumption was made that each medication discrepancy would not be addressed for 10 days following hospital discharge. Harm to a patient was defined as any discrepancy with the potential to affect patient quality of life, clinical deterioration, and/or risk of mortality as determined by the study investigators. For those unintended discrepancies categorized as probable to cause harm from the physician dictated list to the patient discharge list investigators further determined the severity of the discrepancy. These were

categorized as mild, moderate or severe discomfort or clinical deterioration. Professional judgment and discussion among the study investigators was used to determine potential and severity of harm.

Results: Overall, 68 percent (n equals 96) of patients had at least one unintended medication discrepancy at discharge. Twenty nine percent (n equals 41) of patients were missing a dictated or discharge medication list or provided instructions to resume home meds without listing specific medication instructions. Of the remaining 101 patients with complete dictated lists and discharge instructions there were an average of 2.1 unintended discrepancies per patient. The most common unintended medication discrepancy was drug omission (1.55 discrepancies per patient). There were significantly more discrepancies among staff physicians compared to resident physicians (2.32 vs. 0.94 discrepancies per patient, respectively, p equals 0.016). Also, there were significantly more discrepancies found in patients admitted with 7 or more medications as compared to those with less (1.15 vs. 2.87, p equals 0.002). Sixty percent of discrepancies were categorized as unlikely to cause harm whereas 36 percent and 4 percent were categorized as possible and probable to cause harm, respectively. Two of the 8 discrepancies with a probability of causing harm had the potential to cause severe harm.

Conclusion: Hospital discharge poses a significant risk of medication discrepancies. At discharge the medication list provided to each patient as well as the corresponding list sent to future providers in a dictated summary should be identical. Our study shows that a significant number of discrepancies continue to exist with the most common being omission of medications. These errors have the potential to cause severe patient harm. It is important for medication related changes to be appropriately communicated to the patient at discharge as well as provided to the next provider.

5-212

Category: Quality Assurance / Medication Safety

Title: Prevention of hypoglycemic events using a novel real-time dose adjustment protocol

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Purpose: Hospital hypoglycemia is predictable, and it is preventable by measures other than under treatment of hyperglycemia. Physician orders for antihyperglycemic therapy should be written and, if necessary, be revised so as to respond to the presence of predisposing conditions for hypoglycemia. Prevention of hypoglycemia among hospitalized inpatients depends on matching antihyperglycemic therapy appropriate for the patients medical condition to nutritional intake, coupled with conventional monitoring of blood glucose concentration and appropriate caregiver responses. The frequency of hypoglycemia, like any adverse event, is most likely underestimated by adverse event reporting. In reviewing the removal of 50% dextrose from the automated Pyxis machines, it was determined that we have a relatively high incidence of hypoglycemic events. Many of these events are associated with additional risk factors of advanced age, use of high-risk medications, renal failure, malnutrition or requirement of nutritional support, and decreased caloric intake. Recognizing predisposing conditions that increase patient risk for hypoglycemia and making an appropriate therapeutic response is the key to patient safety and the prevention of a hypoglycemic event.

Methods: At a 140-bed rural community hospital with an average daily census of 48 patients, a protocol was adopted to allow the nurse to adjust doses of sulfonylureas or long acting insulin products based upon the patients real-time condition. For any blood sugar reading of 85 mg/dL or below recorded immediately before a dose is due, the nurse will administer half the prescribed dose at the specific interval for that dose ONLY. A reduction in dose of 50% permits the clinician to proactively prevent a potential adverse drug event, while also helping to prevent future hyperglycemic episodes. Holding a dose completely could potentiate the effects of a high blood sugar and lead to additional long-term sequelae. According to the protocol, any patient on glyburide, glipizide, glipizide extended-release, glimepiride, insulin detemir, NPH, or 70/30 insulins will be ordered finger-stick blood glucose checks before breakfast and supper. Documentation of the blood sugar and the dose administered will be recorded on the Medication Administration Record.

Results: Using this protocol, our utilization of dextrose jets (the chosen indicator for severe hypoglycemia) has decreased by 7.68% per 100 patient-days over a 10-month period. Using the data we have collected, it was noted that an average of 36 hypoglycemic events occur in our institution per month. This protocol has therefore prevented approximately 3 hypoglycemic events each month at this

institution. According to an article published in Current Medical Research and Opinion in 2005, the average cost incurred by an organization for a hypoglycemic event is $1064 (1). With that in mind, this protocol would result in approximately $3192 in savings monthly, and an annual cost savings of more than $38,000.

Conclusion: The protocol has been successful in reducing the incidence of hypoglycemia in this patient population since its inception. It has not only reduced the frequency of adverse drug events in our patients on long-acting anti-diabetic medication, it has also helped increase patient safety, and has helped us to meet the individual needs of this potentially difficult patient population, all while reducing costs to the organization. 1 Bullano MF, Al-Zakwani IS, Fisher MD, Menditto L, Willey VJ, Differences in hypoglycemia event rates and associated cost-consequence in patients initiated on long-acting and intermediate-acting insulin products. Curr Med Res Opin. 2005 Feb;21(2):291-8.

5-213

Category: Quality Assurance / Medication Safety

Title: Evaluating the impact of a pharmacist educational program on warfarin critical drug interactions

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Purpose: The objective of this study was to evaluate the impact of a warfarin critical drug drug interaction (DDI) pharmacist educational program. This retrospective study was designed to compare the weekly rates of pharmacist documentation for warfarin critical DDIs before and after the educational program.

Methods: This study was approved by the institutional review board. The educational program occurred in January 2011 and consisted of management strategies targeting the institution's three most common warfarin critical DDIs. Three training methods were utilized: oral presentation (amiodarone and warfarin), computer information (sulfamethoxazole trimethoprim and warfarin), and the combination of the two methods (levothyroxine and warfarin). Warfarin critical DDIs meeting inclusion criteria were collected for a two month period prior and after the program and for a two week period three months after the program. Each warfarin DDI was matched with its corresponding pharmacy intervention and evaluated for the presence and appropriateness of documentation. Pharmacists were asked to complete an anonymous evaluation one month after completion of the educational program.

Results: Three hundred and twenty one warfarin critical DDIs were included in the two months pre training period and 383 warfarin critical DDIs in the two months post training period. The average weekly rates of appropriate documentation for all warfarin critical DDIs increased from 28.9 percent pre training to 54.8 percent post training. The appropriateness of documentation for all warfarin critical DDIs significantly improved during the two months post training (30.2 percent to 57.7 percent, p less than 0.001) as well as for the documentation for all three targeted DDIs. The appropriateness of documentation for the combined targeted DDIs and for all other warfarin critical DDIs also significantly improved (p less than 0.001). Twenty one of the 64 pharmacists completed the program evaluation, with the majority preferring the combination of the oral presentation and computerized method of learning. Ninety percent of the pharmacists who completed the evaluation were overall satisfied with the program.

Conclusion: The educational program increased pharmacist appropriateness of documentation for targeted and all warfarin critical DDIs. Pharmacists were satisfied with the training program and preferred the combination method of training.

5-214

Category: Quality Assurance / Medication Safety

Title: Efficiencies gained by improved medication movement and decreased missing doses leads to better employee satisfaction

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Purpose: Increased efficiency is a large component in overall employee satisfaction. As a result of an employee satisfaction survey which revealed a low score on a question relating to efficiencies, it was determined that missing medications were the cause of most inefficiencies in both nursing and pharmacy. The pharmacy management team decided to embark on the journey of minimizing the amount of missing medications in the system. A team was developed that consisted of members from pharmacy, nursing and SPPI (System for Partners in Performance Improvement) coaches from our development staff. The teams goal was to identify and understand the reasons why medications were misplaced in the system. The team worked to eliminate the inefficient search for medications on the nursing units, significantly reduce rework in the pharmacy, and create standard work practices for both pharmacy and nursing. After the causes were identified, countermeasures were implemented to allow for increased efficiency and improved employee satisfaction results.

Methods: The team which met on a monthly basis created an A3 for the project and mapped out the medication process flow from the pharmacy to the nursing unit to the patient. Baseline data was collected to quantify the number of missing medication requests in order to prove there was a problem. The team identified two nursing units that would serve as test units for the process. Experiments were also conducted in the pharmacy department. In addition, an interactive website was developed for communication among team members. The team worked to eliminate searching for medications on the nursing units, reduce rework in the pharmacy, and create standard work practices for both pharmacy and nursing. They did this by creating countermeasures for both nursing and pharmacy.

Results: The team focused on decreasing the overall number of missing medication requests as well as improving the employee satisfaction efficiency question. The team was able to show a 17% overall decrease in missing medications. In one year, the pharmacy employee satisfaction score regarding efficiency improved from 3.07 to 3.33 on a 5 point scale.

Conclusion: A medication movement team was created as a result of poor scores seen in an employee satisfaction survey. The team focused on creating standard work in order to minimize the number of medications that were misplaced throughout the health system. Positive outcomes were seen in both decreasing number of missing medications as well as improving employee satisfaction scores. The team continues to meet on a monthly basis to identify areas of waste while continuing to create efficiencies.

5-215

Category: Quality Assurance / Medication Safety

Title: Process improvement in drug distribution via an automated medication dispensing system with barcode scanning

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Purpose: The objective of this process improvement initiative was to improve the medication safety, accuracy, and efficiency in the process of utilizing an automated medication dispensing system. Improvement of the process was needed as the main strategy of drug distribution for this 609-licensed bed teaching hospital relied mainly on an automated medication dispensing system.

Methods: Upon analysis and review of medication occurrence data, an opportunity for improvement of the current automated medication dispensing system was noticed. The pharmacy department adopted the Six Sigma DMAIC concept to improve its automated medication dispensing system with barcode scanning. Each medication was scanned by a pharmacy technician prior to being stocked and loaded into the medication dispensing cabinet in each patient care area. The flow chart outlining the drug distribution and barcode scanning process was developed. Data from medication occurrence reports before and after the implementation of barcode scanning was analyzed and investigated.

Results: After the implementation of barcode scanning process, the monthly average of reported medication stocking errors dropped from 7 to 3. This data represented 57% improvement in the automated medication dispensing process.

Conclusion: Given the risks involved in even one medication error, the ultimate goal is to completely eliminate all errors. To do this, the pharmacy department will continue to make improvements to the system until our goal is achieved. Then necessary strategies to ensure that the improvement is maintained and permanent will be implemented.

5-216

Category: Quality Assurance / Medication Safety

Title: Assessing the use of inappropriate medications in the Lebanese elderly population

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Purpose: The objective of the study was to assess the use of inappropriate medications among elderly patients in Lebanon.

Methods: In April 2011, all elderly (>65 years) individuals visiting selected community pharmacies in different areas in Lebanon were interviewed by pharmacists. Data collection included patients demographics, medical conditions, family and social history, lifestyles, and medications appropriateness. Beers criteria were used as a reference to determine the inappropriate medication use in adults 65 years and older. The study was approved by the institutions review board.

Results: Out of 916 adults who were screened during the study period, 176 elderly outpatients were included. Data from the study group showed a mean age of 72.55 years with a 51.7% of male gender. Patients were geographically categorized as follows: Beirut (45.45%), Mount Lebanon (25.57%), Bekaa (15.34%), North (10.23%) and South (3.41%). Inappropriate medication use was identified in 48 patients (27.27%) of the study group. The most common drugs identified were as follows: alprazolam (37.5%), zolpidem (31.25%), and lorazepam (8.3%). The geographical distribution of patients depending on the inappropriate medication use increased in North and South to 11.54% and 5.77% respectively.

Conclusion: These findings revealed high rates of benzodiazepines uses among the elderly which increases the risk of sedation, confusion, falls, fractures, depression, incontinence and respiratory depression. Information gathered will be used to address counseling strategies in patients utilizing those medications to improve overall health outcomes.

5-217

Category: Quality Assurance / Medication Safety

Title: Identifying the rates of adverse drug events (ADEs) by adjusting for specific medication usage in an integrated delivery system

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Purpose: One of the key components in reducing adverse drug events is to evaluate the current events within a hospital or health-system. Traditionally this is done by compiling data on the top drugs with adverse drug event reports. These generally fall into typical medication classes, such as narcotic pain medications, insulins, anticoagulants, and antibiotics. Many of these classes of medications have had considerable data published for ways to reduce adverse drug events. Our integrated delivery system wanted to look at the adverse drug event data while adjusting for usage rates of the individual drugs. This required development of a denominator for drug usage rates and integrating this with the adverse drug reaction reporting system.

Methods: Several years ago, our integrated delivery system developed a standard web-based system for reporting of adverse drug events across all facilities within the system. In order to code the medication data, a table from First Data Bank (FDB), which only has drug names, was used to identify the medications. Unfortunately, the pharmacy order entry and billing system uses a different naming system, which includes dosage forms, medication strength and other factors and did not cross reference with the FDB table used for ADE reporting. To develop a rate of medication use that works with the ADE data, a cross link table was created to link the drug names from FDB with the different dosage forms and strengths in our pharmacy order entry and billing system. This created a denominator of drug usage rates to be used with the existing ADE data and allow analysis based on individual drug usage adjusted rates of adverse drug events.

Results: After overcoming several barriers for development of a denominator of drug usage, a rate based adverse drug event reporting system was developed for our integrated delivery system. Adverse drug events are now reported by the total number of adverse drug events per medication and by the rate per 1000 doses given of the individual drugs. This format for evaluation of adverse drug events identified medications not normally seen on our top ADE reports and new opportunities to review ADEs and develop methods for reducing adverse drug events.

Conclusion: While challenging to do based on different databases used for adverse drug reporting and medication usage, integration of that data has allowed for identification of medications that are used infrequently, however have a higher rate of adverse drugs per 1000 doses given. These medications are

different than those commonly reported by safety organizations and will allow opportunities to review and develop new strategies for reducing these events in the future.

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Category: Quality Assurance / Medication Safety

Title: Incidence of drug-induced QT-prolongation in hospitalized patients

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Purpose: Vulnerable inpatients are often exposed to potentially dangerous medications. One of the most important drug-induced toxicities is QT prolongation leading to potentially fatal arrhythmias. There are a variety of potential risk factors for and causes of QT prolongation, such as genetic predisposition, age greater than 65 years, female gender, electrolyte disturbances, heart failure, previous myocardial infarction and medications. The purpose of this study was to evaluate the incidence of drug-induced QT prolongation through evaluation of 5 medications known to have this side effect.

Methods: The institutional review board approved this retrospective chart review of patients receiving the following medications for a 5 month time period: haloperidol (intravenous), moxifloxacin, ciprofloxacin, ziprasidone and methadone. Patients were excluded if they were receiving multiple medications known to prolong the QT interval or if they were admitted on any of the above medications. Data was collected on demographics, QTc interval and the presence of risk factors known to prolong QT, such as electrolyte disturbances (hypokalemia, hypocalcemia and hypomagnesemia), heart failure and prior myocardial infarction. QT prolongation was defined as a QTc greater than 500 msec.

Results: A total of 184 patients were evaluated in this study. The average age was 57 years, with 36 percent greater than 65 years. Forty-eight percent of patients were female. Baseline EKG information was not present for 53 percent of patients. Thirteen percent of patient had post-medication administration monitoring only. Just 11 percent of patients had pre- and post-medication administration EKGs. None of these patients developed QTc prolongation. Only the haloperidol group demonstrated a longer QTc interval after administration (441 msec post vs 411 msec pre). Interestingly, 8 percent of patients had a QTc interval at baseline greater than 500 msec. About 1/3 of the study population had 3 or more non-laboratory risk factors for QT prolongation. In addition, the presence of electrolyte abnormalities known to increase risk for QT prolongation was found in 20 percent of patients.

Conclusion: Although no patient developed a QTc prolongation greater than 500 msec, the study revealed potential safety concerns and lack of monitoring for this known side effect of the medications evaluated. The average hospitalized patient presents with or develops many of the risk factors for QT prolongation, as seen by the high prevalence of risk factors in the study population. Recommendations for improved safety and monitoring include EKG monitoring at baseline and post administration when possible in at-risk patients. Medications known to prolong QT interval should not be given to patients

with a baseline QTc greater than 500 msec. Finally, electrolytes abnormalities should be corrected before or as soon as possible after medication administration.

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Category: Quality Assurance / Medication Safety

Title: Education and training of clinical pharmacists to enhance quality improvement efforts

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Purpose: Quality improvement efforts within healthcare institutions are critical to providing safe medical care. Due to the complexity and severity of errors involving the medication use system, pharmacists have a unique opportunity to participate in quality improvement efforts. Since most pharmacists do not receive formal quality improvement training, this project was designed to provide education on basic quality tools and resources to enhance quality improvement efforts.

Methods: A clinical pharmacy specialist with advanced training in healthcare quality and a clinical pharmacist in quality/education developed a competency examination via a computer-based training module (CBT). Clinical pharmacy staff were required to complete the CBT after reviewing a quality improvement primer for pharmacists. A pre-assessment survey to determine baseline knowledge was completed prior to review of the primer and included 8 of the 15 post-assessment competency questions. A score of 80 percent was required to pass the competency exam. Other quality improvement training for clinical pharmacy staff included a separate institutional CBT on the Plan-Do-Study-Act Cycle and participation in a quality/performance improvement project as part of the annual performance evaluation.

Results: Seventy-six clinical pharmacy staff completed the quality improvement CBT. The average score was 93 percent (range: 80 to 100 percent). Of the 8 questions provided in the pre-survey, only 2 questions had a correct response rate of 80 percent or greater (range: 17 percent to 99 percent). Participation in departmental quality and performance projects is ongoing and will be evaluated during the annual performance review.

Conclusion: Pharmacists require additional training and education in quality improvement to effectively participate in quality improvement efforts. Quality improvement education for clinical pharmacists utilizing a pre-survey and CBT in conjunction with active participation in quality and performance improvement projects helped to identify gaps and enhance knowledge.

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Category: Quality Assurance / Medication Safety

Title: Across the pond: global sharing of a unique high alert medicine novel labeling system to reduce the risk of selection errors when dispensing insulin

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Purpose: Medication errors involving insulin have been reported. MEDMARX, Institute of Safe Medication Practices (ISMP), and Institute for Healthcare Improvement (IHI), have reported insulin as one of the high-alert medications that have increased potential for causing significant patient harm. Our Brooklyn hospital pharmacy became proactive reviewing and identifying the nation-wide types of errors relating to insulin storage. Errors in storing and dispensing many formulations of insulin vials looking alike, is problematic. Such conditions lead to having insulin vials mis-selection. The various formulations of different insulin vials look alike, increasing the chance of error. The medication storage bins for those high risk insulin vials were clumsy, messy and chaotic. The labels are on medication bins were not clearly printed and were not standardized throughout the hospital. It was difficult to see in small refrigerator the look-alike insulin vials. Our hospital pharmacy department channeled the 6S theme into implementing safer hospital-wide medication storage: sort, straighten, standardize, shine, safe and sustain. By using the novel labeling system created by a passionate assistant director of pharmacy, in medication safety, this parlayed hospital wide into a safer medication storage for the high alert injectable insulin vials. The following year, this was shared across the pond, globally in a British hospital pharmacy. They took our lessons learned from our best practice and applied it in their hospital pharmacy to reduce the insulin dispensing errors that had occurred at their facility. The insulin selections errors were due to similar packaging and labeling. In addition, they were stored in the same location directly on shelves in a refrigerator. Lack of understanding on those insulin differences also led the dispenser in selecting the wrong product. Some of those errors occurred with the selection of Humalog Mix preparations in place of Humalog.

Methods: Clear plastic trays were used to replace the different color trays in the refridgerator. New labels for insulin storage were designed with the help of the assistant director of pharmacy, medication safety who traveled across the pond to be on site. The newly designed labels mirrored the colors on the insulin packaging. The labels also include the words high risk in the shape of a stop sign to alert staff to double check the product selected. These labels were attached to the front and back of the clear plastic tray so that they were visible from all angles and therefore could be placed on any shelf in the refrigerator. Pharmacy staff were briefed on these changes. Education took place on the differences

between insulins. Incorporated into the in-service, were differences between Humalog and Humalog Mix 25, as those two insulins were identified as causing the most errors.

Results: In the British hospital pharmacy, information on incorrect dispensing of insulin were reviewed using the Pharmacy internal error monitoring forms. The new, revised labeling system was incorporated November 2010. Before the implementation of the safer labeling system, from January 2009 through October 2010, ten incidents relating to an incorrect insulin/form of insulin were identified. One of these incidents resulted in a patient administered the wrong insulin. From November 2010 through May 2011, there has been only one incident of incorrect insulin dispensed for a product that had not yet been properly labeled.

Conclusion: The safer labeling system will be extended to other high risk injectable medicines and those that are look alike/sound alike that cannot be loaded in the automated dispensing machine. Errors will continue to be monitored and the results will be followed with the Pharmacy team.

5-221

Category: Quality Assurance / Medication Safety

Title: Promoting the safe use of alteplase for the treatment of severe frostbite

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Purpose: Frostbite, most often occurring in peripheral tissue such as hands, feet, ears, and nose, can range from mild anesthesia of the skin and localized edema to complete tissue necrosis requiring amputation. Individuals most at risk for frostbite include individuals who are homeless, individuals under the influence of alcohol or drugs, outdoor enthusiasts, and children. Immediate treatment for severe frostbite is imperative in order to salvage the appendage. Treatment includes rapid re-warming in a warm water bath, proper analgesia, and wound treatment, if applicable. The use of alteplase (t-PA) as a thrombolytic for the treatment of severe frostbite has been documented in three small, single-center studies and showed possible reduction of amputation with early interventions. These studies and clinical experience of our Burn / Trauma Intensive Care Unit at the University of Colorado Hospital led to the use of alteplase therapy for severe frostbite. This was accompanied by questions from hospital staff concerning medication compounding, administration, and delivery. Each of these uncertainties could lead to a delay in patient therapy. Additionally, alteplase therapy has been associated with severe side effects such as the increased risk of bleeding. These side effects, compounded by the infrequent, off-label use of alteplase for treatment of severe frostbite, make patient safety a concern for this indication.

Methods: To create an environment leading to safe and appropriate alteplase prescribing and administration for the treatment of frostbite, the University of Colorado Hospital created both a standardized order set and employed the use of smart pump technology. The standardized order set was written by a multidisciplinary team. This collaborative effort ensured that any foreseeable aspects of patient safety were addressed.

Results: The medication order set, Burn Trauma ICU: Thrombolytic Therapy (t-PA) for Severe Frostbite, was implemented for use in March 2011. The order set specifically outlines contraindications to therapy, laboratory tests and other necessary patient-monitoring parameters prior, during, and after alteplase infusion. Specific weight-based dosing, as well as bolus doses and infusion rates are included. Within the smart pump library, a bolus dose was programmed to run over two minutes, and then the infusion rate is based on the total dose given over six hours. The Pharmacy and Therapeutics Committee approved the use of alteplase in the ICUs and emergency department at a dose of 0.15mg / kg IV bolus x 1 dose over 2 minutes, immediately followed by 0.15 mg / kg / hr x 6 hours, for a total dose not to exceed 100 mg. The smart pumps will not allow the total dose of t-PA to exceed 100 mg.

Conclusion: The implementation of a standardized order set and the utilization of smart pump technology will decrease the likelihood of a dosing or administration error with this off-labeled use of a high-risk medication therapy.

5-222

Category: Quality Assurance / Medication Safety

Title: Optimization of blood factor safety and expense within the medication use process

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Purpose: A multidisciplinary group determined that blood factor safety could be better achieved through pharmacy management than through our traditional blood bank management, in which unreconstituted vials were dispensed, documentation was manually completed, and pharmacists were generally excluded. The Pharmacy Department lead an effort to optimize the medication use process surrounding blood factors.

Methods: Factor patient settings include inpatient and ambulatory areas (OR, ED, chemotherapy clinic). An inventory consignment model, 340b pricing and intra-pharmacy ADM storage were chosen to facilitate inventory and expense optimization. Prescribing challenges including widely varied factor vial assays and frequent/urgent dose administration in the setting of an electronic medication management system (CPOE, pharmacy, and electronic MAR) were considered. Pharmacists were empowered to modify prescribed dose based on factor vial assays in order to prevent waste. Standard dose concentrations, on time delivery of patient specific doses, barcode safety enforcement within dose preparation, dispensing, and administration to the patient as well as barcode driven automated manufacturing calculations and documentation within dose preparation were achieved. These goals were accomplished using lot number and vial assay specific barcoding and an IV workflow management system, which guides technicians to the correct volume and diluent for reconstitution for the specific factor and vial assay. Most importantly, pharmacist cognitive review of all factor orders was implemented.

Results: Since implementation, there have been zero dispensing errors and zero administration errors reported. Documentation of factor vial lot numbers, formerly recorded manually in the patient chart by the nurse, is now documented automatically through the IV workflow management system; accessibility of dose preparation lot number information has also improved. Direct pharmacist involvement has been added , through pharmacist review of orders and pharmacist initiated hematology service consults prior to dispensing. This new role for pharmacy has also created an opportunity for our pharmacists to specialize in hemorrhagic coagulopathies.

Conclusion: The migration of blood factors from blood bank to pharmacy has improved the safety and documentation of our blood factor program through use of barcodes throughout the medication use cycle including the use of an IV workflow management system. Optimization of inventory costs through consignment and 340b pricing have allowed significant cost savings.

5-223

Category: Quality Assurance / Medication Safety

Title: Descriptive evaluation of a regional medication take-back event at a community hospital

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Purpose: The steady increase in prescription drug use and lack of safe drug disposal programs have resulted in the accumulation of unused or unwanted medications in the household. Improper disposal of such medications may have a considerable impact on the environment, including childhood poisoning, misuse and abuse, and contaminated waterways. Trace amounts of drug compounds have the potential to cause harm to aquatic life and were identified in drinking water at several locations in the United States. The purpose of this study was to evaluate community medication disposal habits and costs of medications disposed at a hospital sponsored medication take-back event.

Methods: A medication take-back event was held in conjunction with a hospital initiated community Green Fair through the collaboration of the hospital's Green Team, Administration, and Department of Pharmacy. The event was staffed by 2 pharmacists, 2 environmental chemists, and one police officer. All participants were asked to complete a 5-item survey regarding demographics, medication disposal habits prior to the event, reasons for participation, and categories of medications being discarded. Any controlled substances collected were logged and costs were calculated based on average wholesale prices to identify the number and average cost of medications per person.

Results: Eight-eight participants responded to the survey and a total of 451 medications were collected. The majority (94%) were first-time participants and older adults or greater than age 65 (47%). Prior to participation in this event, medications were flushed down the toilet (51%), thrown in the trash (50%), accumulated at home (22%), poured down the drain (9%), given to another individual/organization (7%), or buried in the garden (<1%). Participants disposed of medications because they were expired (73%), no longer needed (66%), or belonged to a deceased (25%). An average of 12 medications was collected per participant. Stimulants (42%) and opioids (27%) were the most common controlled medications disposed. The average cost of controlled substances was about $35 per patient.

Conclusion: The community is unaware of environmental implications of improper medication disposal or accumulation of unwanted medications. Prior to the hospital sponsored medication take event, the majority of participants disposed of medications inappropriately. Disposed medications are costly and implementation of prescribing limits may be beneficial.

5-224

Category: Toxicology

Title: Evaluation of drug information databases by specialists in poison information

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Purpose: In 2010, over 4 million calls were answered by U.S. poison centers. A variety of electronic drug information databases were used to answer many of the inquiries. There are four major drug information databases available to poison centers which range in price, capabilities, and information. The purpose of this prospective study was to evaluate drug information databases (Lexi-Comp, Micromedex, Facts & Comparisons, and Clinical Pharmacology) for accuracy, completeness, and ease of use by specialists in poison information.

Methods: Certified specialists in poison information (CSPIs) were recruited via email from all of the poison centers in the United States and Canada. Any practicing CSPI was eligible to participate. Exclusion criteria included lack of computer access and enrollees who could not complete the quiz within 1 sitting. Subjects meeting the inclusion criteria were enrolled consecutively until the enrollment limit for each poison center was met (max of 5). CSPIs with incomplete quizzes were not included in the analysis. Once enrolled, study subjects were required to answer 14 different randomized drug information questions for each database and complete a demographic and feedback survey at the end of each quiz. Outcomes included accuracy, and completeness of quiz responses, user preference of the drug information database, and database usability defined by rating scales.

Results: Of the 116 CSPIs enrolled in the study, 76 met the inclusion criteria and were included in the analysis. A majority of the CSPIs identified themselves as nurses (68%) and nearly a quarter (22%) identified themselves as pharmacists. Eighty four percent of the specialists had 10 or more years of experience. As far as previous experience using the studied databases, everyone identified Micromedex with 62% also identifying previous use with Facts & Comparisons. The least reported experience was with Clinical Pharmacology at 26% and 78% of specialists reported no use with this database in the past 6 months. After evaluating all 1,064 responses to the drug information questions for each database, Lexi-Comp and Clinical Pharmacology were found to have the most accurate and complete responses at 87% vs. Micromedex and Facts & Comparisons with 85% of responses being accurate and complete. In response to the statement that the database was easy to navigate, agreement or strong agreement was selected at a rate of 74% for Clinical Pharmacology, 66% for Micromedex, 62% for Lexi-Comp, and 54% for Facts & Comparisons. After using all four databases in the study, users ranked in order of preference with 1 being the most preferred, Micromedex and Clinical Pharmacology as the two highest at preference 1 (36%) vs. Lexi-Comp (17%) and Facts & Comparisons (11%). The two highest ranked

databases at preference four, the least preferred, included Facts & Comparisons and Lexi-Comp at 30% and 38%, respectively vs. Clinical Pharmacology (20%) and Micromedex (12%).

Conclusion: Even though a majority of specialists reported previous use with Micromedex and Facts & Comparisons and limited use with Clinical Pharmacology, Clinical Pharmacology was preferred equally to Micromedex. This preference finding may have been related to the high number of users reporting ease of navigation with Clinical Pharmacology. Although Lexi-Comp was the least preferred database, it was found to provide a higher rate of accurate and complete responses to drug information questions compared to Facts & Comparisons and Micromedex.

5-225

Category: Toxicology

Title: Interstitial pneumonitis associated with imatinib in a patient with gastrointestinal stromal tumor (GIST)

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Purpose: This case illustrates the interstitial pneumonitis associated with imatinib after six monthes treatment. A 62-year-old male without lung disease and diagnosed with T3N0M0 stage malignant gastrointestinal stromal tumor (GIST) received imatinib 400 mg per day since December 2009. He was admitted on 11th of June, 2010 due to progressive dyspnea. He was hypoxic and his chest X-ray revealed bilateral lung interstitial infiltration which indicated possible interstitial pneumonitis (IP). IP was suspected to be caused by imatinib, pneumocystis jirovecii, atypical pneumonia or tuberculosis. At this administration imatinib was discontinued and trimethoprim-sulfamethoxazole combined with levofloxacin was given. Oral prednisolone 40 mg bid was also prescribed, but shifted to intravenous methylprednisolone 40 mg q12h later due to progressive respiratory failure. He suffered from tuberculosis, aspiration pneumonia and fungal infection in July. A follow-up lung biopsy showed fibrosis. After 55 days of hospitalization, the patient died from acute respiratory distress syndrome, esophageal bleeding, multi-organ failure, ventilator associated pneumonia, blood stream infection, septic shock due to Chryseobacterium indologenes and Acinetobacter baumannii on 5th of August. The Naranjo Score system was used to assess whether Imatinib was associated with pulmonary toxicity. The Naranjo Score was three indicating imatinib was probable. Imatinib-associated IP or lung fibrosis (>1/10000) is a rare, late-onset chemotherapy-induced lung injury. In previous studies, this event among chronic myelogenous leukemia patients is 0.2% to 1.3% and the dosage used of imatinib is 400 mg to 600 mg per day. In most cases, pneumonitis is resolved after discontinuing imatinib and initiating high dose systemic methylprednisolone for several days. As prophylactic administration is not confirmed yet, oral low dose prednisolone may be feasible. This case received 400 mg per day and had lung fibrosis. Unfortunately, this patient did not receive a high-dose corticosteroid at the start of the treatment. The respiratory condition could not be resolved after 49 days treatment of corticosteroid. Imatinib associated IP can be overlooked easily and fatal. Pharmacists can provide useful information to patients and healthcare providers about potential pulmonary complications and management. IP can present symptoms such as dry cough and dyspnoea (>1/100) that requires timely differential diagnosis. If patients with GIST manifest such symptoms, imatinib should be considered especially in primary phase of treatment and the progressive respiratory condition may be resolved from initial high dose corticosteroid instead of low dose.

Methods: N/A

Results: N/A

Conclusion: N/A

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Category: Toxicology

Title: Predictors of Treatment Failure with n-acetylcysteine for Acetaminophen Toxicity in Adult Patients

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Purpose: Due to the various treatment regimens and protocols, the use of n-acetylcysteine for the treatment of acetaminophen toxicity may be confusing to clinicians due to several controversies that still exist about the management of this patient population. It is unknown whether certain risk factors may exist which predispose a patient to treatment failure. The objective of this study is to determine information about certain patient characteristics that may act risk factors for the development of acute liver failure, candidacy for liver transplantation, or death with acetaminophen toxicity.

Methods: A retrospective cohort trial of patients receiving oral or intravenous n-acetylcysteine admitted to Duke University Hospital between January 2005 and August 2010 was conducted. Patients must have received oral or intravenous n-acetylcysteine for presumed or documented acetaminophen toxicity. The primary outcome was the development of treatment failure (a composite of the development of acute liver failure, liver transplantation, or in-hospital death). Secondary objectives were to describe the relationships of treatment failure between patient characteristics such as those patients presenting with acute liver failure versus those without, the time from ingestion of acetaminophen to treatment with n-acetylcysteine, oral vs. intravenous n-acetylcysteine regimens, or length of n-acetylcysteine therapy with patient outcomes.

Results: 184 patient records were evaluated in patients who had received n-acetylcysteine therapy. Of these, 79 were excluded. 105 patient records met inclusion criteria, 4 patient records were of patients who had multiple admissions during the study period, thus, 101 patient records met inclusion criteria for analysis. Overall, treatment failure occurred in 19 patients (18.8%). The reason for treatment failure was acute liver failure in 13 patients and death in 6 patients. No patient received liver transplantation during the study period. Risk factors for treatment failure included delayed presentation >10 hours ($p=0.0002$), acute liver failure upon presentation ($p<0.0001$), receiving extended therapy of n-acetylcysteine ($p<0.0001$), and receiving non-recommended dosing of n-acetylcysteine ($p=0.0013$). Pre-existing liver dysfunction, multiple co-ingestions, chronic versus acute ingestions, and administration route of n-acetylcysteine were non-significant in the primary analysis.

Conclusion: Our study shows that patients who may have risk for treatment failure with n-acetylcysteine for acetaminophen intoxication include those who present after 10 hours of ingestion as well as those who present with acute liver failure prior to treatment. Further studies are needed to address the management of patients with n-acetylcysteine in these patient populations.