Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-002

Poster Title: Hidden talent: the benefits of an In-house training program for pharmacy technicians

Primary Author: Jean Beach, Beth Israel Deaconess Medical Center; **Email:** jbeach2@bidmc.harvard.edu

Additional Author (s):
Julie Lanza

Purpose: As the role of Pharmacy Technicians expands it has become more difficult to recruit and maintain a well trained and committed work force in the competitive Boston market. When we looked at our Pharmacy Technicians with the most tenure we realized that most often they were trained on the job at BIDMC. With the support of our Work Force Development Team we implemented BIDMC's Pharmacy Technician Pipeline Program. The program is designed to promote career growth for BIDMC's employees and help fill staffing needs in the Pharmacy Department.

Methods: Participants for the program were selected from current hospital employees through a competitive screening and interview process.
Our selection process included a number of assessments that helped us best determine who would likely to be successful in this program and in the new role. We assessed the candidates' reading skills through the Test of Adult Basic Education (TABE) and math skills through a math assessment quiz. Those employees whose reading and math skills were proficient then participated in exercises that assessed their computer skills and hand & eye coordination and ability to see small details. Those with a passing grade moved to the next phase of the selection process which included writing an essay describing why they wanted to participate in the program and a letter of recommendation from their current supervisor. Interviews were scheduled and candidates were selected for the program. The course curriculum was submitted to and approved by the Massachusetts Board of Pharmacy. The course consisted of 30 hours of didactic course work over eight weeks followed by a three week full time clinical practicum in the Pharmacy. Classes were taught by Pharmacy staff members, both Technicians and Pharmacists. Those that successfully completed the program were given full time positions in the Pharmacy. If a student was not successful in the program they returned to their previous positions in the medical center.

Results: The Pharmacy Technician Pipeline program has been offered three times, successfully graduating six out of seven participants. Five of the six graduates went on to become Certified Pharmacy Technicians within six months of completing this course. Of those five all have moved up our career ladder and one of our first graduates was recently promoted to a Pharmacy Tech IV for Sterile Products. Only one graduate is no longer employed in the pharmacy.

Conclusion: Providing an opportunity for hospital employees to pursue a career path in the pharmacy is a win-win situation. By offering a comprehensive in-house Pharmacy Technician training program that includes both didactic and hands- on training, graduates of the program are well prepared for their new roles. An equally important benefit of this program is increasing awareness across the medical center of the critical role pharmacy technicians play in the health care setting. Through information sessions, posters and brochures medical center staff have a greater understanding of the many complex job responsibilities completed by technicians behind the pharmacy walls.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-003

Poster Title: Mitigating the increased price of isoproterenol

Primary Author: Jennifer Brandt, MedStar Washington Hospital Center; **Email:** jennifer.l.brandt@medstar.net

Additional Author (s):
Margaret Breakenridge
Anil Kishore

Purpose: Skyrocketing costs of medications has unfortunately become a routine issue for hospitals. In some cases, the cost has risen more than 6000% in just three years. This is the case with isoproterenol, a beta agonist used for its chronotropic, dromotropic, and ionotropic effects. As a tertiary care hospital with a large cardiac center, isoproterenol was used regularly. The price increase was expected to cost the hospital more than $1.5 million per year. For this reason, strategies were implemented to mitigate this cost increase.

Methods: Through monthly variance analysis, the acute increase in price was identified. A drug use evaluation (DUE) was conducted to quantify how isoproterenol was used. A thorough literature review was also conducted to determine if alternative agents could be used. In addition, a search was conducted to determine the maximal beyond use dating that could be applied to the product. Finally, armed with this data, conversations were had with key stakeholders to identify an approach that would both limit use of isoproterenol, and yet continue to provide quality patient care.

Results: Based on the findings of the DUE and literature reviews, the strategies for limiting the use of can be grouped into two categories: modification of drug use policy and implementation of operational efficiencies. The DUE revealed that isoproterenol was often used in patients with bradycardia or cardiogenic shock and that patients could use the product for an extended period. A literature review revealed that alternative agents, like epinephrine, dobutamine, and dopamine, could be used first line. The other major area of use was in the electrophysiology lab, where isoproterenol was used to induce supraventricular tachycardia. Initially, based on a literature review, the pharmacy batched a dilute solution of isoproterenol. However, given additional increases in price, epinephrine became the first line agent. Clinical practice guidelines were updated and approved by the P&T committee in both instances. In addition to

batching, other operational efficiencies were put in place to discourage inappropriate use and limit waste, including removal from the automated dispensing cabinets.
Although the expenditures have risen significantly in FY16, there has been an estimated savings of $780,000 as a result of these strategies. Additionally, the use has been nearly eliminated, with even larger savings projected for FY17.

Conclusion: The rising cost of isoproterenol necessitated the modification of drug use policy and the implementation of operational efficiencies in order to eliminate waste. In order to be effective, these strategies required a multidisciplinary approach including key stakeholders and decision makers.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-004

Poster Title: Clinical resource utilization pharmacist: a unique, but necessary position

Primary Author: Jennifer Brandt, MedStar Washington Hospital Center; **Email:** jennifer.l.brandt@medstar.net

Additional Author (s):
Margaret Breakenridge
Anil Kishore

Purpose: With an ever increasing focus on cost, the need exists within a pharmacy department to routinely monitor medication use and find new and innovative ways to use limited resources wisely. Within many departments, this responsibility falls to a variety of leadership positions from directors to clinical coordinators and may be spread across multiple positions at once. At this large, tertiary care hospital, this responsibility has fallen to the Clinical Resource Utilization pharmacist, a unique position.

Methods: The position of Clinical Resource Utilization Pharmacist was developed as a part time position and reports to the Associate Director for Clinical Services. In addition to oversight of the Drug Information center, the pharmacist is also responsible for formulary management and the collaborative development of drug use policy, which also includes drug use evaluation to ensure compliance with policies. The pharmacist also routinely performs financial analyses to identify potential opportunities.

Results: The Clinical Resource Utilization pharmacist position has been in existence for more than nine years. In just the past fiscal year, the pharmacist in this position has worked on numerous projects including mitigating the impact of cost increases of isoproterenol, vasopressin, and nitroprusside. Additionally, thirteen clinical practice guidelines have been modified and three new guidelines developed, many in an effort to mitigate increasing drug prices. All guidelines are developed in close collaboration with key stakeholders. Drug use evaluations are done routinely to identify opportunities and compliance with clinical practice guidelines. Modification of policies, operational safeguards, and additional education are often implemented based on the results of these drug use evaluations.
It is estimated that the initiatives implemented as a direct result of the existence of this position has saved this large, tertiary care hospital no less than $2 million in the last fiscal year alone.

This savings was realized through the collaborative development of drug use policy, encouraging use of appropriate alternatives, the implementation of operational efficiencies to eliminate waste. The position allows for one person to focus on cost-savings initiatives while continually improving the quality of care provided to patients.

Conclusion: The existence of a clinical resource pharmacist position can allow for hospital pharmacies to focus on the mitigating the cost increases and improve use of limited resources, while improving the quality of patient care.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-005

Poster Title: Evaluation of reimbursement potential for inpatient pharmacist services

Primary Author: Bethany Chandler, Baptist Health Medical Center; **Email:** bethany.chandler@baptist-health.org

Additional Author (s):
HyeJin Grant
Tonya Robertson
Robert Furrey
Morgan Ramey

Purpose: While reimbursement for inpatient clinical pharmacy services is a challenge, it has been achieved. Oregon pharmacists are receiving substantial reimbursement using Centers for Medicare and Medicaid Services (CMS) Current Procedural Terminology (CPT) codes 99211-99215. Due to the bundled payment structure in Arkansas, our state is currently unable to bill for inpatient pharmacist services. However, outcomes measured may be of interest to insurers leading to possible reimbursement opportunities. The purpose of this study is to capture the value of inpatient pharmacy services through evaluating patient satisfaction, quality of care, and cost of care

Methods: This study evaluated pharmacist interventions provided over a two-month time frame (November 1 – December 31, 2015) to all patients admitted to a 31- bed pulmonary unit within the facility. All pharmacist direct patient care interventions including medication reconciliation, patient counseling, and consult management such as pharmacokinetic dosing, antimicrobial stewardship, TPN management, anticoagulant dosing and monitoring, renal dosing, and IV to PO conversion were documented within the electronic medical record. A fourth year student pharmacist assisted in medication reconciliation during the first study month. Potential reimbursement for inpatient pharmacist interventions was calculated using CPT codes based on levels of medication therapy management (MTM) complexity. Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction scores, thirty-day readmission rates, and length of stay were compared to data from the same two month period the previous year.

Results: Potential reimbursement for 428 inpatient pharmacist interventions over a two-month period calculated to be 74,327 dollars when using CPT codes based on levels of MTM complexity. HCAHPS scores for each question related to medications showed an upward trend, 57.4 percent to 61.3 percent for medication communication domain, 71.4 percent to 76.9 percent for HCAHPS question 16, 25.0 percent to 38.5 percent for question 17, 43.7 percent to 48.9 percent for care transitions domain, and 48.4 percent to 56 percent for question 24. Thirty day readmission rates showed 28 percent reduction in the study group (P equals 0.20), while average length of stay was not impacted (P equals 0.85).

Conclusion: This project was able to capture the substantial value of inpatient pharmacist services when direct patient care encounters were documented with each intervention. Trends show improvement in patient satisfaction and quality of care when HCAHPS patient satisfaction scores and thirty day readmission rates were evaluated, while cost of care was not impacted. Larger sample size is needed to show significant improvement in HCAHPS scores, thirty day readmission rates, and length of stay. This warrants continued evaluation and conversations with the third party payers regarding reimbursement for inpatient clinical pharmacy services.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-006

Poster Title: Use of internet-based survey development software for documentation of pharmacy competency programs

Primary Author: Teresa Cooper, Saint Francis Health System; **Email:** teresacooper@hotmail.com

Additional Author (s):
Jacyntha Sterling

Purpose: Competency assessments are routinely administered to ensure that employee qualifications are consistent with job responsibilities, as is required for compliance with multiple regulatory agencies and for internal quality assurance. These assessments are conducted internally, often without dedicated resources for the department. The provision of ongoing employee education and documentation of competency on department specific measures has been a persistent challenge for our facility. Online survey development software was evaluated as a low-cost approach to address these challenges.

Methods: Online survey software, specifically SurveyMonkey® Gold plan, was used to disseminate educational material, administer assessment questions, and track employee responses within the pharmacy department at Saint Francis Health System in Tulsa, Oklahoma. Educational learning material was developed in a format suitable for the survey page. Questions were presented as stand-alone assessments or were integrated into the lessons. Simple question designs, such as multiple choice or drop-down menus, were frequently used to support ease of scoring; however, more complex question types were also utilized. Data validation logic and forced answer fields were used to ensure all assessment questions were completed with correctly formatted responses. Skip patterns were utilized to add complexity based on the learner's previous response. Software use allowed for rapid dissemination to employees via electronic mail. Response rates were assessed and reminder notifications were sent to non-responders as due-dates approached. Data from each learner's responses were exported into a spreadsheet with utilization of formulas and conditional formatting logic to convert basic survey responses into a scored assessment suitable for printing and filing in employee records. Questions with a high frequency of incorrect responses were examined to identify focus areas for further education. Use of survey software for competency assessment

from April 2014 to April 2016 was evaluated. Paper educational assessments from April 2012 to 2014 were evaluated for a baseline comparison.

Results: In the baseline period, 130 competency tests were administered with a completion rate of 83.8 %, compared to a 92.3% completion rate for the 182 tests evaluated under the software assessment model. For all learners completing an assessment, there was a high likelihood that the test would be completed by the assigned due date (baseline of 96.3% versus 98.8%). Compared to paper assessments, tests were more likely to be distributed to department employees across the entire health-system with the aid of the online survey process. Under the software-based model, no survey recipients selected the obligatory "opt-out" hyperlink, and none of the attempted electronic mail submissions were recorded as undeliverable. However, one learner reported failure to receive survey links through the health-system network electronic mail system. An external electronic mail address was applied with successful transmission. One learner reported difficulty with displaying images within the assigned surveys. Printed copies of the assessment test were provided to this learner plus two others that identified a preference for paper documents. Responses from the three paper assessments were manually transcribed into the spreadsheet for scoring and for continuity of employee records.

Conclusion: Employee response rates to online surveys were higher than previous (pen and paper) approaches to competency assessment, and surveys were likely to be completed prior to the assigned due date. The software permits simultaneous distribution of learning assignments to all facilities in the health system, and, when combined with spreadsheet software, it offers improved efficiency of test scoring. Overall, the use of internet based survey development software was a useful tool for disseminating, tracking, and documenting employee competency assessments within our department and was available at a lower cost than commercial products for employee competency tracking.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-007

Poster Title: Impact of implementation of a multidisciplinary approach to nutrition support on appropriate parenteral nutrition utilization at a community hospital

Primary Author: Mark Decerbo, Roseman University of Health Sciences; **Email:** mdecerbo@roseman.edu

Additional Author (s):
Francisca Akoh
Kristina LaBouff
Vincent Yang
Darren Swenson

Purpose: Parenteral nutrition (PN), a highly complex therapy associated with potentially serious metabolic and infectious complications, requires high levels of expertise to guide appropriate use. PN therapy, while a life-saving measure, can represent a significant financial burden to healthcare systems if used inappropriately. PN has been utilized at our community-hospital since 1996, however there were no previous institutional requirements or guidelines governing its use. Without appropriate use criteria and clear hospital policies, inappropriate prescribing of PN along with its undue patient safety risks and cost may occur. This study sought to evaluate whether a multidisciplinary nutrition support initiative to implement evidenced based inpatient PN guidelines would lead to an increased rate of appropriate PN utilization along with attendant cost-savings.

Methods: All adult inpatients admitted to our institution who received at least one day of parenteral nutrition therapy between July 1, 2015 and September 30, 2015 were retrospectively identified to establish a baseline rate of appropriate institutional PN utilization. Demographic data, major medical comorbidities, days of PN therapy, composition of PN therapy, and indications for PN therapy were evaluated along with direct PN financial expenditures in order to calculate cost per adjusted patient day during the time period. In order to align relevant hospital policies with best practices, a multi-disciplinary team of pharmacists, physicians, dieticians, and nurses was assembled in the fourth quarter of 2015 to develop an in-house quality-improvement initiative targeting the inappropriate utilization of PN. In order to evaluate the effect of the institution-specific multidisciplinary approach to nutrition support utilization, all patients receiving PN between Jan 1, 2016 to March 30, 2016 were

retrospectively identified and evaluated per the aforementioned process. The percent of appropriately initiated PN courses in this quarter following introduction of the initiative were compared to baseline using the Chi-squared test, while costs of PN per adjusted patient day between the same time periods were compared using the student's t-test. The primary outcome was the percent change of appropriately initiated PN courses across time periods. Secondary outcomes included changes in PN costs per adjusted patient day.

Results: In the 3-month time period prior to implementation of the multi-disciplinary PN initiative, a total of 63 PN courses were prescribed, of which 35 courses (56 percent) were retrospectively deemed appropriate per newly-developed institutional standards. In the quarter following institution of the hospital-wide multidisciplinary parenteral nutrition support initiative, a total of 96 PN courses of therapy were initiated, of which 79 courses (82 percent) were deemed appropriate per the newly-implemented institutional standards. This represented a 46 percent increase (p less than 0.05) in the number of clinically appropriate PN courses, resulting in a 27 percent decrease in cost per adjusted patient day of PN costs as compared to baseline (p less than 0.05).

Conclusion: A multi-disciplinary effort spanning several clinical departments targeted the inappropriate use of PN by employing a multi-faceted approach. Through utilization of education, peer to peer discussions, mandatory assessments, protocol development, and focused policies and procedures, this tactic was effective at decreasing inappropriate PN initiation. This proactive recognition of the need to establish and execute evidence-based standards was also successful at achieving a corresponding cost-savings. In the absence of guiding policies and procedures, our institution-specific approach may serve as a model for other facilities considering similar targeted PN interventions.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-008

Poster Title: Organizing and maintaining a functional 340B oversight committee in a disproportionate share hospital

Primary Author: Courtney Delgado, Charleston Area Medical Center; **Email:** courtney.delgado@camc.org

Additional Author (s):
Brian Sayre

Purpose: The 340B Drug Pricing Program is a federal program that requires drug manufacturers to provide outpatient drugs to eligible organizations at discounted prices. It is the organization's responsibility to maintain compliance with all program requirements and legislation. Oversight of a hospital's participation is critical given the program's complexity and the need for full integration and management of stakeholders beyond the pharmacy department. Regular communication and meetings help to ensure that the hospital is compliant with program requirements, prepared for audits, and able to take action when needed. This project was designed to build and maintain an operational 340B oversight committee.

Methods: Pharmacy leadership assembled a group of 340B program stakeholders asking for representation from each of the following departments: laboratory services, compliance, finance, accounting, reimbursement, admissions, pharmacy, oncology, hemophilia services, information technology, legal, supply chain management, and senior administration. Initially meetings were used to obtain stakeholder buy-in. Department representatives were encouraged to learn about the program through training sessions and workshops provided by the Health Resources and Services Administration's Office of Pharmacy Affairs (HRSA: OPA) via Apexus. Next, committee members were educated on the impact of the 340B program within the hospital system and local community. Then they were informed of program operations within the hospital system and the influence and effect on each department.
Once buy-in was established, monthly meetings were scheduled. These proactive meetings are used to communicate legislative updates, new hospital procedures, internal and external audit findings, action plans, and current events. The committee also serves as a decision making body, responsible for the hospital's 340B policies and procedures, management of the Office of Pharmacy Affairs' database, prescriber participation eligibility, program eligibility requirements,

and use of program savings. Additionally, committee members are “on-call” for special meetings concerning immediate compliance issues or audits.

Results: Chaired by the pharmacy department, the 340B oversight committee was planned to include all hospital department stakeholders. With education and communication, multi-disciplinary buy-in was achieved for a committee of 23 members. Monthly committee meetings were organized as a time of reporting, planning, and collaboration. 340B policies and procedures were established and an internal auditing program is actively evolving.
While difficult to measure the success of such a project, the following benchmarks have been obtained. Multi-disciplinary, inter-departmental teams have been established to address varying procedural improvements; such as decreasing patient status change times within the admissions software, and standardizing ordering procedures across all hospital owned pharmacies. The 340B program has been expanded to include more patient services. Designated 340B compliance staff has been hired. Special meetings have been called during external audits, with a 75% committee attendance rate after a 24 hour notice. And the hospital system has successfully completed two hired external audits.

Conclusion: A 340B oversight committee is crucial in maintaining program compliance. A committee composed of all department stakeholders allows for multi-disciplinary communication in order to run an optimal program.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-009

Poster Title: The financial impact of an intravenous (IV) workflow management system in a pediatric hospital

Primary Author: Yihong Deng, University of Cincinnati; **Email:** dengyg@mail.uc.edu

Additional Author (s):
Alex Lin
John Hingl
Jonathan Pemn
Heather Maynard

Purpose: The aim of this study was to evaluate the financial impact of an i.v. workflow management system in a pediatric hospital. The i.v. workflow management system facilitated increasing the production frequency which reduces production lead time and results in less number of i.v. doses prepared and discontinued. It was hypothesized that the i.v. workflow management system could have a positive financial impact by reducing the number of i.v wasted doses and missing i.v. doses requested. The financial impact of the system considered the cost of the wasted and missing doses, and the labor used in preparing wasted and missing doses.

Methods: The sample site was Cincinnati Children's Hospital Medical Center (CCHMC). An i.v. workflow management system (DoseEdge) was implemented at CCHMC to change their batch schedule from every 24 hours to every 2 hours. A retrospective analysis on the hospital information system database was conducted using a three months data before (Feb 1st to April 30th, 2011) and after (Feb 1st to April 30th, 2015) the implementation of the i.v. workflow management system. Timestamps linked to prescribing, preparation, dispensing, administration, and discontinuation linked by order ID was drawn from the databases and a validated mathematical logic was used for calculation of i.v. wasted doses. Number of i.v. missing doses was drawn from the re-dispensed report. Video recordings and field observations were used to determine the time units spent on different tasks by pharmacists and technicians, respectively. Financial impact was determined by combing quarterly acquisition cost for each drug, labor costs of pharmacists and technicians, disposal fee charged by environmental waste companies, and standard accessory cost.

Results: The use of the i.v. workflow management system and change in batch schedules reduced the total number of i.v. doses dispensed by 9,198 over 3 months. The total number of doses wasted was reduced by 14,176 and total number of missing doses was reduced by 2,268. The total volume of wasted doses was reduced by 259.94 liters and total volume of missing doses was reduced by 60.59 liters.

Due to the decrease in wasted i.v. doses, technicians saved 14,316 minutes and pharmacists saved 5,946 minutes after using the i.v. workflow management system. Also, due to the decrease in missing i.v. doses, technicians saved an additional 2,597 minutes and pharmacists saved 1,163 minutes during the study period.

The overall cost savings after using the i.v. workflow management system was $144,019 ($75,159 for wasted doses and $68,860 for missing doses). This includes the saving of drug acquisition cost ($126,133), labor cost ($13,683), accessory cost ($3,819), and disposal fee ($384). The projected yearly saving of using the system will be $576,076.

Conclusion: The use of an i.v. workflow management system to facilitate more frequent i.v. batch production in a pediatric hospital was shown to have positive financial impact. Savings were identified in a decreased number of wasted and missing i.v. doses, labor used in preparing these doses, and overall pharmacy cost.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 4-010

Poster Title: On- year cost savings after an interchange from tiotropium to ipratropium/albuterol nebulizer solution in a community medical center

Primary Author: Hugh Easley, Kalispell Regional Healthcare; **Email:** heasley@krmc.org

Additional Author (s):
Kaci Wilhelm

Purpose: Rising drug costs have placed additional pressure on pharmacists to reduce inpatient drug costs. A common canister protocol resulted in significant savings at Kalispell Regional Medical Center. However, tiotropium costs remained high as it was not eligible for the protocol. Therefore, an interchange to ipratropium/albuterol was investigated. Due to higher acquisition costs for the inhaler, an interchange to the nebulizer solution was implemented. This review quantifies the impact of an interchange from tiotropium to ipratropium/albuterol nebulizer at a 163 bed hospital.

Methods: The interchange from tiotropium to ipratropium/albuterol nebulizer was initiated at Kalispell Regional Medical Center in February 2015. Acquisition costs of the drugs were compared for the pre-interchange period (February 2014-January 2015) to the post-interchange period (February 2015 - January 2016). For cost per day calculation, standard dosing was assumed: tiotropium 1 inhalation once daily, ipratropium/albuterol nebulizer solution one vial via nebulizer four times daily and ipratropium/albuterol inhaler 1 inhalation four times daily.

Results: Acquisition costs for tiotropium decreased by $16,341 or 83.5% in the 12 month post-implementation period. This represents 9.3% of the total spend for the anti-asthmatic and bronchodilator class. Likewise, units of tiotropium inhalers purchased decreased by 81.4% indicating a comparable reduction in utilization. Acquisition costs for ipratropium/albuterol increased $523 for a net savings of $15,819 or 67.2% in 12 months. Based on average acquisition cost in the post-implementation period, cost per day of treatment was $10 for tiotropium, $0.93 for ipratropium/albuterol nebulizer solution and was $7.93 for ipratropium/albuterol respimat inhaler. A switch to the inhaler instead of the nebulizer solution would have reduced the savings by 70%.

Conclusion: An interchange from tiotropium to ipratropium/albuterol nebulizer solution resulted in 12 month net savings of $15,819, representing 9% of the total spend in the anti-asthmatic and bronchodilator class. A limitation of this study is the lack of evaluation on operation costs associated with administering nebulizer treatment compared to an inhaler. Overall, this study confirms previous reports of cost savings after implementing a tiotropium to ipratropium/albuterol nebulizer solution interchange.

Submission Category: Ambulatory Care

Session-Board Number: 4-011

Poster Title: Antibiotics prescribed in primary care and the incidence of errors

Primary Author: Mohammed Aljamal, King Salman Military Hospital; **Email:** mmaljamal@hotmail.com

Additional Author (s):
Ahmed Aljamal

Purpose: The term “prescribing patterns” has been used extensively in studies to describe different aspects of the prescribing process. There are no standard definitions or methodologies for prescribing patterns or prescribing errors studies. The incidence of prescribing errors ranges between 0.5% and 18.8%. Therefore, the purpose of this study was to investigate the prescribing patterns of antibiotics and the incidence of prescribing errors in primary care and the potential relationship between them.

Methods: A prospective study of all prescriptions in a three-month period (June to August) in a primary care has been analyzed. Criteria used include frequency of selected prescribed drugs, average number of items per prescription, compliance to the drug formulary, frequency of prescriptions for antibiotics , generic prescribing and diagnosis. All prescribing errors were identified and documented. The incidence of prescribing errors was calculated by dividing the number of errors identified by the total number of prescriptions.

Results: Total number of prescriptions for the three-month study was 24,404. Emergency Room (ER) and primary care have the highest number of prescriptions (37.1%). The average number of items per prescription was 2.1. The most prescribed drugs were antibiotics and account for 25.3% errors in the primary care and 28.2 % in the emergency. The overall rate of prescribing errors was 18.8%. Primary care error rate was 13.6%. Emergency department had errors rate of 22.3%.

Conclusion: Out of the 24 thousands prescriptions that were included in this study, the average number of items per prescription was 2.1. There was a relation between prescribing of antibiotics and prescribing of trade names ($p < 0.01$), compliance to the formulary ($p < 0.001$),

frequency of injection use ($p < 0.001$) and the incidence of medication errors ($p < 0.01$) and the average number of items per prescription ($p < 0.001$).

Submission Category: Ambulatory Care

Session-Board Number: 4-012

Poster Title: Description of prescribing patterns and patient characteristics of patients initiated on target specific oral anticoagulants (TSOACs)

Primary Author: Regina Arellano, Midwestern University Pharmacy Practice; **Email:** regina.arellano@yahoo.com

Additional Author (s):
Kathy Komperda
Brian Cryder

Purpose: For decades, warfarin has been the only oral anticoagulant available. Although warfarin is highly effective its use is limited by a narrow therapeutic window, frequent lab monitoring, slow onset of action, and numerous drug and food interactions. TSOACs which do not have these same challenges hold significant promise. However, TSOACs are still high-risk medications and require significant effort to assure safe use. The primary objective of this study is to assess dosing appropriateness of TSOACs initiated in patients in an outpatient setting. This study also aims to describe the prescribing patterns including indication, dose, frequency, and education provided.

Methods: Electronic medical records were reviewed retrospectively in a cohort of patients initiated on TSOACs from January 1, 2013 through June 30, 2014 within an outpatient medical group healthcare system in Chicago to obtain specific patient factors including dose, frequency, indication, documented education provided, and documented thromboembolic and bleeding complications. Descriptive statistics were utilized to examine the distribution of prescribing patterns and patient characteristics.

Results: One hundred two patients were included in the study. Rivaroxaban was the most common TSOAC prescribed (72 percent, n equals 73/102). Seventy percent (n equals 51/72) were dose appropriate for the specified indication. Apixaban and dabigatran were prescribed to 27 percent (n equals 28/102) and 1 percent (n equals 1/102) of the population respectively, demonstrating higher dose appropriate frequency than rivaroxaban (86 percent and 100 percent respectively). The most common indication was atrial fibrillation (62 percent, n equals 63/102). In the apixaban and rivaroxaban group, the mean age of patients was 66 and approximately 65 percent were male. Thromboembolic and/or bleeding complications were not

commonly identified. A Limited number (15 percent, n equals 16/102) of patients received any formal education.

Conclusion: Rivaroxaban was identified as the most commonly prescribed TSOAC in this healthcare system. Overall, the majority of TSOACs were dose appropriate; however, only a limited amount of patients received formal education on these high-risk medications. These results support a role for referring patients on TSOACs to an anticoagulation service for patient education.

Submission Category: Ambulatory Care

Session-Board Number: 4-013

Poster Title: Treating hepatitis C virus genotypes 1-4 in an ambulatory care setting: outcomes with direct-acting antiviral regimens

Primary Author: Timothy Bach, MCPHS University/Atrius Health; **Email:** tbach@frontiernet.net

Additional Author (s):
Kathy Zaiken

Purpose: Direct-acting antivirals (DAAs) have drastically improved cure rates and tolerability compared to interferon (IFN)-based regimens, but they are also very costly. For this reason, some payers limit access to treatment to patients in later stages of infection, sometimes requiring a fibrosis score of 3-4 before covering treatment. Post-marketing and cost-effectiveness data with direct-acting antivirals is lacking. The purpose of this study was to determine outcomes and cost-effectiveness with direct-acting antivirals for the treatment of hepatitis C genotypes 1-4 in a real world setting and determine the impact of waiting to treat patients later in the course of infection.

Methods: A total of 360 patients at a 36 clinical sites in Massachusetts with HCV genotypes 1-4 and a prescription for at least one DAA medication between May 2011 and October 2015 were included. Study medications included boceprevir, telaprevir, sofosbuvir, simeprevir, ledipasvir/sofosbuvir, and ombitasvir/paritaprevir/ritonavir/dasabuvir. Study medications may have been used in combination with each other or IFN and/or ribavirin (RBV). The primary investigator completed a retrospective and prospective chart review and data was collected through April 2016. Data analyses were conducted using Microsoft Excel 2010 and SPSS 2007. The primary outcome for the study was to determine cure rates for each treatment regimen and genotype. Secondary outcomes included determining the impact of cirrhosis, fibrosis score, previous treatment experience, age, race, BMI, gender, and HIV co-infection on cure rates; determining mean drug cost per cure for patients with a fibrosis score of 0-2 vs. 3-4; and describing adverse reaction rates.

Results: Cure rates with ledipasvir/sofosbuvir, sofosbuvir + RBV, ledipasvir/sofosbuvir + RBV, sofosbuvir + IFN + RBV, sofosbuvir + simeprevir, telaprevir + IFN + RBV and boceprevir + IFN + RBV were 168/173 (97.1%), 41/46 (89.1%), 17/21 (81.0%), 20/25 (80.0%), 31/41 (75.6%), 17/40 (42.5%) and 2/10 (20.0%), respectively. Cure rates for genotypes 1, 2, 3, and 4 were 250/304

(82.2%), 27/30 (90.0%), 14/16 (87.5%), and 6/7 (85.7%), respectively. When boceprevir and telaprevir regimens were excluded the SVR rate for genotype 1 was 231/254 (90.9%). Patients < 45 years and BMI < 25 kg/m2 were more likely to achieve a cure with ORs of 7.80 (1.03-58.98) and 2.84 (1.17-6.87), respectively. Patients with cirrhosis, fibrosis score of 3-4, and previous treatment for hepatitis C were less likely to achieve a cure with ORs of 0.37 (0.20-0.66), 0.31 (0.14-0.65), and 0.46 (0.26-0.82), respectively. No statistically significant difference was identified based on gender, race, or HIV co-infection. Hepatitis C treatments for patients with a fibrosis score of 0-2 vs. 3-4 cost a mean of $116,579 vs. $167,467 per cure, respectively. Discontinuation due to adverse events occurred in 26% of patients with boceprevir and telaprevir regimens combined and in 1.1% of patients with all other regimens combined.

Conclusion: This study confirms improved cure rates and tolerability with newer DAA regimens compared to older IFN-based regimens and first-generation protease inhibitor regimens. Treatment naive patients, patients < 45 years of age, patients without cirrhosis, patients with fibrosis scores of 0-2, and patients with BMI < 25 kg/m2 responded better to treatment with DAA medications. Treating patients with a fibrosis score of 0-2 resulted in a 30% reduction in hepatitis C drug costs compared to treating patients with fibrosis scores of 3-4. Further studies are needed to evaluate emerging treatment options and to reflect most recent guidelines.

Submission Category: Ambulatory Care

Session-Board Number: 4-014

Poster Title: The impact of an ongoing interdisciplinary patient-centered approach on hemoglobin A1C (A1C) in a low-income, uninsured diabetic patient population in a community free clinic

Primary Author: Ramadas Balasubramanian, Independent; **Email:** rbalu@aol.com

Additional Author (s):
S. Dockery
Gracie Galloway
James Cooke

Purpose: This healthcare facility is a stand-alone 501c3 non-profit free clinic with an in-house pharmacy providing medical care and laboratory services at no cost to low income, uninsured patients with chronic health conditions including diabetes. The clinic is staffed by volunteer healthcare professionals to help the patients manage diabetes and keep them out of the emergency room and the hospital. This report is focused on the impact of the team approach in managing A1C in 2015 with a goal to achieve A1C less than 7 per cent per American Diabetes Association guidelines which has been shown to reduce microvascular complications.

Methods: This retrospective chart review study consisted of 59 randomly-chosen patients (34 females, 25 males-age range 30-76 years-average 53.6 years) with diabetes in 2015. We chose the most recent available A1C as of 6-30-2015 as the baseline and as of 12-31-15 to measure the impact on A1C improvement. We also sorted the results as to how many of these 59 patients with A1C more than 7 improved to less to less than 7 at the end of 2015, and how many with A1C less than 7 remained with A1C less than 7 to measure the impact of the team approach. The interventions included minimizing no-shows by phone calls, providing medications for management of diabetes in house, comprehensive medication therapy review by the pharmacists, encouraging the patients to improve the lifestyle, improving patient-clinic communications through a text-messaging software, etc. We used descriptive statistic for percentages, standard deviation, and averages using Microsoft Excel ® and chi-square statistic to measure the association with a p-value less than 0.05 for significance. This study was exempt from Institutional Review Board approval as the consent to share the de-identified data was provided by the individual patients on registration.

Results: As of 6-30-15, the average A1C for the 59 patients was 8 (range 5.1- 12.6, plus-minus standard deviation 1.8). As of 12-31-15, A1C average decreased to 7.6 (range 5.1-12.2, plus-minus standard deviation 1.7) which did not meet the ADA guidelines, but it trended down toward the goal. However, of these 59 patients, 37 (62.7 per cent) had A1C more than 7 as of 6-30-15 and 17 of these 37 patients achieved A1C of less than 7 at the end of 2015 (45.9% improvement, and it was statistically significant, $P < 0.05$), 12 of 37 patients (32.4 per cent) had no change in A1C in six months and, 8 of 37 (21.6 per cent) had their A1C increased to more than 7 suggesting that there is certainly room to improve in the outcome. Of the remaining 22 of 59 patients who had their initial A1C less than 7 as of 6-30-15, 20 of them (90.9 per cent) maintained their A1C below 7 as of 12-31-15.

Conclusion: The interdisciplinary patient-centered approach in a free clinic was helpful in improving and maintaining A1C reduction to less than 7 per cent in low-income, uninsured patients with diabetes. However, there is room to further improve this quality outcome with other strategies including motivational interviewing to help reduce microvascular complications and avoid hospital admissions and emergency room visits.

Submission Category: Ambulatory Care

Session-Board Number: 4-015

Poster Title: Impact of a clinical pharmacist's interventions on patients' knowledge of direct oral anticoagulants (DOAC)

Primary Author: Simarjit Batth, University of California Davis; **Email:** simarjitbatth@gmail.com

Additional Author (s):
Jennifer Branch
Janeane Giannini
Teresa Kwong
Richard White

Purpose: According to the Joint Commission National Patient Safety Goals, there needs to be a reduction in the likelihood of patient harm associated with the use of anticoagulation therapy. Preliminary results of a study conducted at University of California Davis Medical Center (UCDMC) suggests there is a lack of medication knowledge for patients currently receiving standard of care for their DOAC. Medication counseling can increase patient knowledge of medications, improve compliance, and decrease the need for re-hospitalizations. Pharmacist-managed anticoagulation clinics achieve better clinical outcomes, due to more consistent monitoring, an effective use of resources, and a high standard of patient care.

Methods: A single center, prospective, quality improvement project assessed the impact of counseling done by a pharmacist on patients' knowledge of DOACs. In the intervention group, patients were provided education related to their DOAC. A previous study conducted at UCDMC preliminary results served as the standard of care group in which patients were educated by their healthcare provider. Patients were included in this study if they were > to 18 years old, prescribed rivaroxaban or apixaban for treatment of DVT/PE or non-valvular Afib/Aflutter, able to converse in English sufficiently. Patients were excluded for the following: No means of direct contact, previously participated in a DOAC study, on a DOAC for any other indication, discontinued or switched oral anticoagulants, pregnant, on dialysis, prisoners, cognitive impairment, not followed by a UC Davis provider, planned or scheduled ablation. A questionnaire was used as an assessment tool to determine patients' knowledge of DOACs. Patients were contacted via telephone at least 7 days after initial education. The primary outcome was to compare the improvement in knowledge in the pharmacist intervention group to the standard of care group. The secondary outcome assessed pharmacist interventions

which included periprocedural management, appropriate dosage and frequency prescribed, adverse effect management, patient adherence and any additional patient counseling provided after baseline education.

Results: From January through March 2016, a total of 65 patients were screened for eligibility in this study. Twenty-eight subjects met the exclusion criteria and 37 patients met the inclusion criteria; however, only 22 subjects participated in the study and completed the DOAC questionnaire. For baseline characteristics the median age was 70 years; 45% of the patients were men, and majority of the participants had nonvalvular atrial fibrillation (77%) and were prescribed apixaban (59%). Twenty-two patients receiving either rivaroxaban or apixaban were educated and then completed a knowledge base questionnaire. The average score on the questionnaire for the pharmacist intervention group was 86% compared to the standard of care group's average which was 65%, with a difference of 21% which was statistically significant ($p < 0.001$). A total of 12 interventions were made by a pharmacist over a 3 month period with majority of the interventions requiring additional education about common side effects, missed doses, and if the appropriate dose and frequency for the DOAC was prescribed.

Conclusion: This study demonstrated that patients who received counseling by a pharmacist had greater knowledge of DOACs when compared to patients in the standard of care group.

Submission Category: Ambulatory Care

Session-Board Number: 4-016

Poster Title: Creating the Connecticut community pharmacy practice network through public-private partnerships

Primary Author: Thomas Buckley, University of Connecticut School of Pharmacy; **Email:** thomas.e.buckley@uconn.edu

Additional Author (s):
Marissa Salvo
Mehul Dalal
Monica Jensen
Luis Arroyo

Purpose: New models of team-based care are needed to meet evolving health reform initiatives on state and federal levels. Programs addressing chronic diseases in state health departments and communities can build team relationships through public and private partnerships. This project demonstrates how a pilot initiative between the state health department, the state university school of pharmacy and community pharmacy blossomed into a population health strategy of a state-wide network of community pharmacies providing comprehensive medication management to underserved populations. Translating practice to policy includes identifying opportunities for sustainable financing of pharmacist services through continued engagement with parties involved in health reform implementation.

Methods: Following the success of an urban immunization project with a community pharmacy, the state health department and school of pharmacy partnered on the state chronic disease plan (funded through a grant from the Centers for Disease Control and Prevention) to utilize community pharmacists as “healthcare extenders” in the provision of medication-/self-management for adults with high blood pressure and/or diabetes. The state health department and university institutional review boards approved the project protocol. The school of pharmacy provided medication therapy management (MTM) certification in diabetes and hypertension to community pharmacists, developed protocols and documentation tools for the provision of medication management services, and provided continuous quality improvement and evaluation of the service. High-risk, underserved patients with hypertension and/or diabetes were identified through pharmacy database assessment, engaged through multiple outreach and point-of-service strategies, and consented to receive up to four encounters with

the pharmacist over a 12 month period. Performance measures included the proportion of patients in adherence to hypertension and diabetes medication regimens, the proportion of patients with self-management plans, decreased proportion of patients with A1c > 9%, and increased proportion of patients reaching goal blood pressure of < 140/90 mmHg. The project was also expected to identify policy solutions to provide sustainable financing opportunities for the provision of medication management services.

Results: The network currently consists of 18 pharmacies and 17 pharmacists certified to provide services. A total of 108 patients and 319 encounters have been evaluated for this project. Adherence to therapy was assessed by comparing baseline and post-encounter values of Modified Morisky behavior surveys (MMS-8) and database analysis of the proportion of days covered (PDC) of diabetes and hypertensive medications. The MMS score improved by 30%, and 54% of patients revealed at least medium to high adherence behavior. The average PDC value was 98.7% and 91% of patients had a final PDC of at least 80%. Blood pressure goal was achieved by 59.8% of patients; a 48% improvement of patients at goal from their initial encounter. A1c goal was achieved by 68% of patients; a 13% improvement from their initial encounter. A major policy workshop was convened of key stakeholders which resulted in a published issue brief on the benefits of pharmacist-provided medication management services and the challenges to sustainability. The issue brief highlighted the critical role that medication management plays in treating chronic diseases, and that more widespread integration of pharmacists into chronic care delivery teams has the potential to improve health outcomes.

Conclusion: Public-private partnerships are vital to the development of a community pharmacy network that can provide innovative clinical services to underserved communities. These partnerships are critical to the dissemination of information to policymakers on how best to integrate pharmacist services into health care teams to optimize medication outcomes.

Submission Category: Ambulatory Care

Session-Board Number: 4-017

Poster Title: Describing the role of pharmacy in a multidisciplinary care pathway in evaluation of the use omalizumab in patients with difficult-to-control asthma

Primary Author: Lindemberg Costa, Federal University of Bahia, Brazil; **Email:** lindemberg.rn@gmail.com

Additional Author (s):
Charleston Pinto
Antonio Carlos Lemos
Aramis de Alcantera
Ilka Magalhães Carneiro

Purpose: Describe the experience of a pharmaceutical care service in the evaluation of the use of omalizumab in patients with difficult-to-control asthma. Omalizumab is recommended by national and international guidelines for management of severe persistent allergic asthma. However, the high cost of treatment and their indication require attention in dispensing and monitoring the effectiveness of therapy.

Methods: This is an observational, prospective study, conducted in an Ambulatory in Federal University Bahia, in Salvador, Brazil. all patients admitted in Ambulatory with diagnosis of difficult-to-control asthma and with indication for use of omalizumab between July 2010 and May 2013 were included in the study . The multidisciplinary care is based integrated approach by a team of chest physicians, nurses, pharmacists and social workers, and included, pharmaceutical care with free supply of medicines. The strategic interventions of Department of Pharmaceutical Care include assessment of the level of asthma control, disease knowledge, systematic guidance on the proper inhalation technique on a regular basis, intensive monitoring of adherence to treatment. Furthermore, patients are evaluated at baseline and after 16 weeks of the treatment with omalizumab. Assessment of response to treatment with omalizumab was based in assessing asthma control, using the Asthma Control Test (ACT), and quality of life, using Asthma Quality of Life Questionnaire (AQLQ). Change ≥ 0.5 on the AQLQ scale and ≥ 2.0 on the ACT scale represent a clinically meaningful improvement.

Results: Seventeen patients were evaluated and 88% were female. The mean age of patients was 52 ± 16 years. AQLQ scores improved by ≥ 0.5 points in 15/17 (88 %), being that of these 10 (59%) showed variations ≥ 1.5.
We also observed that 15 (88%) patients had clinically significant changes to the ACT (≥ 2.0). The average variation AQLQ and ACT were 1,75 ± 1,34 and 5,31 ± 6,42, respectively.

Conclusion: Omalizumab improves asthma control and quality of life in omalizumab-treated patients. Pharmacists can play an important role in management of patients with difficult-to-control asthma and in promoting the rational use omalizumab.

Submission Category: Ambulatory Care

Session-Board Number: 4-018

Poster Title: The effect of bariatric weight-loss surgery on diabetic glucose control and reduction in diabetic medications

Primary Author: Staci Dotson, St. Rita's Medical Center; **Email:** srdotson@mercy.com

Additional Author (s):

Purpose: The effect of bariatric weight loss surgery (WLS) has been proposed as an effective tool to help reduce medications and improve glucose control in the diabetic population. This case series looks at 3 different patients and the impact of weight loss surgery on their diabetes medications and other medications. Patient 1, previously on concentrated U500 regular insulin, received surgery for lap band and then gastric sleeve revision. He is currently on short acting meal time insulin and metformin. His measured c-peptide indicates that he is also a candidate for oral therapy antidiabetic agents. His weight has decreased by 124 pounds and hemoglobin A1c decreased by 0.6%. Body mass index has dropped from 44 kg/m^2 to 32kg/m^2. Patient 2 who was previously on basal/bolus insulin is currently only on metformin. His hemoglobin A1c has decreased from 8.7% to 6.2% and weight has dropped by 126 pounds. Body mass index has decreased from 56kg/m^2 to 36kg/m^2. Patient 3 was previously only on metformin. She is currently on no medication for diabetes. Her weight dropped from 244 pounds to 174 pounds. Body mass index has decreased from 40kg/m^2 to 28kg/m^2. Her hemoglobin A1c dropped from 5.4% to 5.2% post op. As shown with these cases, bariatric weight loss surgery can make a significant impact on diabetic therapy. Even in moderate weight loss, the benefits from weight loss surgery can been seen. The clinical pharmacist must be ready to adjust diabetic medications, especially highly concentrated insulin, to prevent hypoglycemic events.

Methods:

Results:

Conclusion:

Submission Category: Ambulatory Care

Session-Board Number: 4-019

Poster Title: Evaluation of the safety of oral antineoplastic agents to implement e-health technologies in the pharmacotherapy follow-up

Primary Author: Vicente Escudero-Vilaplana, Hospital General Universitario Gregorio Marañón; **Email:** vicente.escudero@salud.madrid.org

Additional Author (s):
Roberto Collado-Borrell
Ana Herranz-Alonso
Carlos Codina-Jane
Maria Sanjurjo-Saez

Purpose: The number of oral antineoplastic agents (OAA) has increased dramatically in recent years. E-health 2.0 could be a useful tool to track real time pharmacotherapy and help patients in daily life in the home setting. The design of these new technologies should be consistent with the patients needs.
Our objective was to analyze the characteristics of oncohematological outpatients in treatment with OAA in terms of safety, adherence and health outcomes (HO) in clinical practice, to detect possible points of improvement and specific technology requirements prior to the implementation of an e-health 2.0 program.

Methods: In the context of an e-health 2.0 program pre-implantation phase, a prospective observational study was conducted in two Spanish University Hospitals. We included patients who began OAA between January and June 2014 and who were at least 6 months in treatment. Variables: demographic, clinical (ECOG, diagnosis), pharmaceutical (OAA, concomitant drugs), safety [interactions, adverse events (AE) according to the classification CTCAE.v4.03, drug related problems (DRP) according to the Granada's Third Consensus], adherence (SMAQ questionnaire and dispensing records) and OH (visits to emergency department and admissions). Variables were assessed by the pharmacist in clinical interviews.

Results: 51 patients were analyzed (62.7% men, mean age 68.7 years). The main OAA included were: lenalidomide (29.4%), pazopanib (15.7%) and gefitinib (13.7%). The mean concomitant drugs per patient was 5.3 (DE = 2.7).

Safety: 32 drug-drug interactions were identified (34.4% had category X). All patients presented at least one AE. The most frequent were: fatigue (53%), diarrhoea (41%), skin toxicity (31%) and nauseas (24%), which motivated the reduction of doses in 23.5% of patients. At least one DRP was found in 72.5% of the patients; the most frequent were: relevant clinical interactions (39.1%), probability of AE for lack of any preventive measure (30.4%) and non-compliance to treatment (14.5%).
Adherence: SMAQ= 97.2%, dispensing record= 92.9%.
HO: 33.3% visits to emergency department; 17.6% admissions.

Conclusion: Patients treated with OAA were advanced age, polymedicated, adherents, with at least one AE and DRP. Safety has become the most important issue in the follow-up of patients with OAA. A program of e-health 2.0 focused on the identification of interactions and prevention and management of AE could improve the quality of pharmacotherapy with OAA.

Submission Category: Ambulatory Care

Session-Board Number: 4-020

Poster Title: Evaluating primary medication nonadherence in specialty pharmacy

Primary Author: Sviatlana Ferri, University of Illinois College of Pharmacy; **Email:** skrain2@uic.edu

Additional Author (s):
Rebekah Anguiano

Purpose: Primary medication nonadherence (PMN) is characterized by failure to pick up a new prescription medication within 30 days of the date the first prescription is sent to the pharmacy. High rates of PMN have been reported in the literature, ranging from 5 to 40 percent with treatments for common chronic illnesses; however, there is limited data on PMN rates in the specialty pharmacy setting. Furthermore, there may be unique challenges with specialty medications that may influence the time necessary to initiate therapy. The aim of this study was to measure PMN rates and to identify factors contributing to PMN at the University of Illinois Hospital and Health Sciences System Specialty Pharmacy Service (UISPS).

Methods: This was a retrospective electronic health record review from April 1, 2015 and March 31, 2016 to determine the rates of PMN and underlying causes of PMN with specialty medications dispensed through UISPS. Patients included in the study were prescribed a new specialty medication during the study period, had not received the same medication or a medication in the same drug class within the previous 180 days, and were referred to UISPS for management. The following dates were captured for the analysis: initial referral to UISPS, prior authorization approval, first prescription, insurance claim and first dispense. Rates of PMN were determined by calculating the difference in number of days from the first prescription date to the dispense date. Adjusted rates of PMN were also determined by calculating the difference in number of days from the initial UISPS referral date to the dispense date and then compared to the PMN rates using the traditional definition. The number of prescriptions that were not dispensed within 60 days, and 90 days of written prescription and initial referral dates were also determined. The reasons for PMN were investigated through a manual electronic health record review.

Results: A total of 301 records met inclusion criteria and were included in the analysis. Overall rate of PMN was 18.6 percent using the traditional definition and 36.8 percent using the

adjusted PMN calculation. The number of specialty medications not dispensed within 60 days and 90 days of written prescription and initial referral dates were 13.6, 20.9 percent, and 11.6, 16.6 percent respectively. Notably, a total of 29 medications, or approximately 10 percent, were never dispensed to the patient for various reasons. When evaluated by therapeutic category, biologic response modifier therapy was most commonly associated with high rates of PMN and adjusted PMN respectively at 30.1, 43.8 percent when compared to other categories such as multiple sclerosis 20.8, 20.8 percent and hepatitis c virus (HCV) treatments 13.9, 38.9 percent. Reasons for PMN identified in the chart review in order of highest to lowest frequency included: insurance denials and appeals, high medication costs, missing information such as required laboratory tests, and patient unreachable or refusing to start treatment.

Conclusion: This study demonstrates that the rates of PMN with specialty medications may be higher than rates reported in the literature for other chronic illnesses. This in part, could be due to strict criteria for use and high associated drug costs. The traditional definition of PMN may substantially underestimate the true rates of PMN with specialty medications and this must be further investigated. Additionally, rates of PMN may be substantially higher in certain therapeutic categories such as HCV treatments. This analysis was beneficial in identifying the underlying reasons for PMN which was most often related to cost of the drug and insurance restrictions.

Submission Category: Ambulatory Care

Session-Board Number: 4-021

Poster Title: Implementation and evaluation of a pharmacist-led prior authorization service in four primary care clinics

Primary Author: MaRanda Herring, Harding University; **Email:** mksherring@harding.edu

Additional Author (s):
Kelly Walls

Purpose: Prior authorization programs are designed to limit access to specified medications until certain predetermined criteria have been met. The prior authorization process is complex and varies among third-party payers. Historically, nurses at the study clinics completed prior authorizations when their other duties were complete. The Affordable Care Act has led to an increase in patient visits and prior authorization requests. For this reason and others, prior authorizations were being delayed, leading to treatment delays. The purpose of this project was to improve timeliness and quality of care by designing and implementing a pharmacist-led prior authorization service.

Methods: The clinics' pharmacists were notified of the need for a prior authorization by fax, electronic request, or phone call from the patient or pharmacy. The pharmacists checked for prior authorization requests daily and subsequently reviewed patients' charts to determine the appropriateness of each prior authorization request.
When it was determined that a prior authorization was required in order to provide optimal patient care, the pharmacist pursued the prior authorization online, by phone, or by fax. The patient's third-party payers dictated which method was used to complete the request.
When it was equally appropriate to substitute the prescribed medication for a therapeutically equivalent alternative, the patient's prescription formulary was evaluated, and the most appropriate and cost-effective medication was substituted. Pharmacist-led therapeutic substitution is legally permissible in the state of Arkansas; the clinics' physicians granted approval for the pharmacists to provide this service.
In instances where it was unclear which route was most appropriate or when the prior authorization request was not approved, the pharmacist consulted the prescriber for further direction.
The pharmacist documented each intervention in each patient's medical record and in an Excel spreadsheet. Data collected include name of drug requested; date of request; date of

completion; action(s) completed by the pharmacist; amount of time spent by the pharmacist; outcome; third-party payer; and patient demographics.

Results: From May 1, 2014 to May 31, 2016, the clinical pharmacists received 1,030 prior authorization requests. Fifteen percent of these were sent in error or required a different type of intervention than prior authorization or therapeutic substitution. Prior authorization was pursued for 50% of the requests received, and therapeutic substitution was performed for 30%. An appeal or letter of medical necessity was required for 4% of prior authorizations pursued. Seventy percent of prior authorization requests were completed within two days of receiving the faxed request, while 5% took over one week. Outcomes were not documented for all prior authorizations pursued. Of the prior authorizations documented as “denied,”, 34% were ultimately substituted by the pharmacist with an appropriate alternative.
The average time spent on a prior authorization request was approximately 21 minutes with a range of 2 to 270 minutes. The pharmacists spend an average of 3.3 hours per week on prior authorizations.

Conclusion: The pharmacist-led prior authorization service improved timeliness of resolving prior authorization requests. Pharmacists completed prior authorizations early in the day and were able to complete most requests on the day they were received. Due to pharmacists’ clinical knowledge and authority to substitute therapeutically equivalent medications, the prior authorization process was often circumvented, and patients received their medications with minimal delay. Completion of prior authorizations and therapeutic substitutions by pharmacists decreased provider and nurse workload, increased provider and nurse satisfaction, and improved patient care.

Submission Category: Ambulatory Care

Session-Board Number: 4-022

Poster Title: Pharmacotherapy clinic implementation in a health-care-for-the-homeless clinic

Primary Author: Jaime Hornecker, University of Wyoming School of Pharmacy; **Email:** jmebob@uwyo.edu

Additional Author (s):
Michelle Hilaire
Cassandra Stith

Purpose: Providing health care for the homeless population presents several challenges, especially where appropriate medication use is concerned. In 2015, the Health Care for the Homeless (HCH) clinic in Casper, Wyoming, together with clinical pharmacists, established a formal medication dispensary designed to serve patients who would otherwise be unable to afford their medications, and expanded services via implementation of a pharmacotherapy clinic in January 2016. Pharmacists provide comprehensive education and management, with focused attention on anticoagulation, diabetes, asthma, and COPD. The primary objective of this study is to assess the effectiveness of a pharmacist-managed pharmacotherapy clinic implemented at a Health Care for the Homeless clinic.

Methods: Providers at HCH identify and refer patients who would benefit from pharmacist education and management to the pharmacotherapy clinic. Individual appointments are then scheduled between the patient and the pharmacist. Clinic is held one half-day weekly, with some appointments scheduled on an as-needed basis other days of the week. All recommendations are documented and communicated to the patient's primary care provider, with follow-up as appropriate. Evaluation of the number and type of interventions performed by a pharmacist related to appropriate medication use in the homeless population was used to assess the primary objective. HCH providers were administered a satisfaction survey at the beginning and at the end of the study period. Patients who consented to participate in the study were given a satisfaction survey prior to their first appointment and at the conclusion of the study period or at their last scheduled appointment. This study was approved by the University of Wyoming Institutional Review Board.

Results: During the three-month study period, a total of 20 patients were referred to the pharmacotherapy clinic. Fourteen patients provided informed consent and were seen by the

pharmacist in a total of 36 appointments. Patients aged in range from 36-62, were primarily male, and seen predominantly for diabetes. Satisfaction surveys were completed by four HCH providers. A total of 40 interventions were made by the pharmacist, with 37 accepted (92.5%). 52% of interventions were suggested to improve the appropriateness and effectiveness of medication therapy; other interventions were evenly split between safety/adverse drug events, strategies to improve adherence, and warfarin dose adjustments. Satisfaction with pharmacy services improved among both patients and providers, and was overwhelmingly positive. Education on nonpharmacologic disease state management was identified as an area where improvement is needed.

Conclusion: Results of this study were limited by the small sample size, short study duration, and adherence to scheduled appointments. Data collection and statistical analysis will be continued. Initial evaluation suggests that implementation of a pharmacotherapy clinic at HCH improved medication prescribing practices and is effective in providing patient care. Both patients and providers are satisfied with their interactions with pharmacists at HCH. Further long-term evaluation will determine the full impact of pharmacist-managed appointments and the pharmacotherapy services at this HCH clinic.

Submission Category: Ambulatory Care

Session-Board Number: 4-023

Poster Title: Community pharmacy experience in Lebanon

Primary Author: Katia Iskandar, Lebanese International University; **Email:** katia.iskandar@liu.edu.lb

Additional Author (s):
Pascale Salameh
Etwal Bouraad

Purpose: The role of community pharmacist is expanding beyond the traditional product-oriented functions of dispensing and distributing medications toward a more patient-centered, outcomes oriented pharmaceutical practice. A review of the studies investigating patient attitudes and perception of community pharmacy services were conducted in different Middle Eastern countries and showed variable findings relatively in contrast to those reported in developed countries. The aim of this study is to investigate patient's perception of the pharmacist role in the community.

Methods: After the approval of the Institutional Board of Review in the University and for a period of three months, from July 2013 till September 2013 the data were collected from pharmacies located in different regions in Lebanon including Beirut, Bekaa, South Lebanon, North as well as Mount Lebanon. The structured questionnaire was developed based on similar studies done in different Middle Eastern and European countries and included questions on patient's sociodemographic characteristics, patient's expectations of a good pharmacy service and patient's perception of the pharmacist role in the community. In order to explore the level of communication with the pharmacist, patients were asked closed ended questions about barriers for asking questions to the pharmacists. A 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree) was also used to assess further the extent to which patients agreed with statements related to the pharmacist's roles in the community. All patients were consented before the start of the any interview that was conducted for a maximum of 20 minutes.

Results: Total number of respondents was 565 patients , all Lebanese citizens, mostly females (56.5 %), from different age groups. The majority of respondents were married (60.5%) and (41.1%) have a university degree. Respondent's perception of the community pharmacy

services characteristics gave similar response rates (40%) including respect , empathy , quick response to questions , quick services as well as good counseling . Respondents experience of the community pharmacy shows that the pharmacist counsels about drug use and administration (37.7%), checks drug interactions (42.3%), listens to patient's problems (46%), diagnoses the problem & gives the appropriate treatment (48.5%), gives non-pharmacologic advice (47.4%), follows-up with the patient conditions (47.8%) . Moreover, (51%) of patients strongly agreed that the community pharmacist is qualified to advice about appropriate use of medications, 34% strongly agreed that they feel comfortable talking with him/her about health problems, and 38% strongly agreed that pharmacists are the first person to contact in case of emergency. Nevertheless respondents perceived barriers for asking questions to the pharmacists including no privacy (42%), pharmacists are not always available at the pharmacy (41%), pharmacists has no time to counsel (46 %), and pharmacists are unfriendly (49%).

Conclusion: Public perception toward community pharmacist in Lebanon is poor despite highly qualified and dedicated pharmacists. The order of pharmacist, Ministry of health and community pharmacist can collaboratively play a crucial role in enforcing the established laws and enhancing public awareness about the role of community pharmacist as a healthcare professional.

Submission Category: Automation/ Informatics

Session-Board Number: 4-024

Poster Title: Improving medication adherence at the point of care using healthcare analytics

Primary Author: Kevin Chiang, Kaiser Permanente; **Email:** kevin.m.chiang@kp.org

Additional Author (s):
Carl Dominguez
Thong Dang
Abir Makarem

Purpose: According to the Centers of Disease Control and Prevention (CDC), nearly half of Americans in 2013 are considered non-adherent to their medications. Medication adherence (MA) rate for most organizations has reached a plateau despite efforts to increase its awareness. An innovative approach is needed to further improve MA. The purpose of this descriptive study is to provide an overview of a seamless, ongoing process developed within Kaiser Permanente (KP) to improve MA, by leveraging data, analytics and technology. This new process empowers outpatient pharmacists and facilitates patient counseling to provide targeted and impactful care at the time of dispensing.

Methods: Pharmacy Analytical Services (PAS), an inter-regional pharmacy analytical group within Kaiser Permanente, analyzes healthcare data from over 400 sources using Oracle Structure Query Language (SQL). PAS identifies members meeting specific clinical criteria, including medication non-adherence as defined by proportion of days covered (PDC) < 80% and member not meeting clinical goals such as elevated Hemoglobin A1c level. Once the cohort is identified, data is streamlined into the outpatient pharmacy system (ePIMS) when prescription filling process is initiated and an Outpatient Clinical Information Summary (OCIS) sheet is printed alongside prescription labels for eligible members. At the time of prescription pick-up, pharmacist will then counsel the patient on non-adherence, using information on OCIS sheet, as part of Outpatient Clinical Services (OPCS) program.
In general, outpatient pharmacies do not have clinical information readily available for pharmacists to perform in-depth counseling. An OCIS sheet, on the other hand, is populated with specific adherence intervention alerts, demographic information, laboratory results, prescription history, PDC rate and hospitalization data. The information provided creates an opportunity for a more directed counseling session focused on non-adherence and the importance of meeting clinical goals.

Results: Since 2012, this program has been implemented in 204 pharmacies, across 4 states (CA, CO, GA, HI). Nationwide rollout to over 420 pharmacies is expected to be completed by the end of 2016 to include KP pharmacies in District of Columbia, Virginia, Washington and Oregon. This program currently includes modules for members in diabetes and atherosclerotic cardiovascular disease (ASCVD) registries, with future expansion to include members in the hypertension, osteoporosis and asthma registries. The results of this program are pending and will be available at the time of presentation.

Conclusion: The convergence of big data, analytics and technological advancements has presented unprecedented opportunities for healthcare organizations to efficiently improve the quality of patient care. Through this program, we have combined the science of technology and art of patient care to transform the way we care for our members.

Submission Category: Automation/ Informatics

Session-Board Number: 4-025

Poster Title: Using predictive analytics to identify patients at risk of worsening HA1C control

Primary Author: Kevin Chiang, Kaiser Permanente; **Email:** kevin.m.chiang@kp.org

Additional Author (s):
Mohamed Umarji

Purpose: Diabetes is a major driver of health care costs. According to American Diabetes Association, 30 million Americans have diabetes, with an estimated annual cost of $322 billion to manage this chronic condition. Controlling the growth of diabetes will have a significant impact on reducing health care costs. However, efficiency would have to be developed to maximize the impact of our limited resources to control disease progression. In this study, we assessed the use of predictive analytics in identifying patients who are likely to fall out of control (HA1C>8%) in the next 6 months. By identifying this cohort, proactive intervention can be made to improve clinical outcome, while reducing overall healthcare cost.

Methods: Kaiser Permanente (KP), an integrated healthcare system in Southern California, has a registry of over 370,000 members with diabetes. In this study, we compiled 125 patient variables ranging from laboratory, hospitalization, demographic, medication adherence, social history and census data for this cohort. Predictive analytics was then applied using Oracle Data Miner software to identify data anomaly, established trends and generated a predictive model. A subset of of the member data were used to train and test the model. Once the predictive model was developed, it was applied to the entire cohort to identify members who were likely to cross the HA1C threshold of 8%. Probability was calculated for each member, as well as recall rate (to measure the completeness or true positive rate) and precision rate (to measure precision of the prediction) were measured to assess quality of the model. 6,000 members were chosen at random and compared to traditional member identification methods (using HA1C between 7.8% and 8%) for validation.

Results: At 32% probability of crossing HA1C threshold of 8%, we identified 5,899 members using the predictive model, with 58% precision and 32% recall rate. Out of this sample cohort, 3,431 were observed as out of control within 6 months. Using the traditional method, 2,300 members were observed as out of control within 6 months.

Conclusion: Using predictive analytics, we have improved the efficiency in identifying members whom we can make the greatest impact. When combining this information with clinical outreach, we can improve clinical outcome, while reducing healthcare cost.

Submission Category: Automation/ Informatics

Session-Board Number: 4-026

Poster Title: Data analysis to optimize primary national drug code at nine university health-system ambulatory pharmacy locations for improved inventory management and cost savings

Primary Author: Barbara Giacomelli, McKesson Health Systems; **Email:** barbara.giacomelli@mckesson.com

Additional Author (s):
Brad Myers
Julia Chisholm
Rebecca Steel

Purpose: The purpose of this project was to analyze drug purchases and prescription fill data compared to manufacturer contracts, drug availability and state approved drug formulary to identify the preferred national drug code. Based on this information preferences were updated in the pharmacy information system and the drug wholesaler ordering system with the goal to improve inventory management by decreasing the number of line items stocked at nine ambulatory pharmacy locations, reduce expired medications, and provide overall cost savings through the selection of the most cost effective medication.

Methods: Using the generic code number, twelve months of drug purchases were compiled for the nine ambulatory pharmacy locations for a university health system. Data was further consolidated to take into account class of trade, public health service drugs and wholesale acquisition drugs for pricing. The staff at each pharmacy location was interviewed to understand patient population served and how purchasing decisions were made. This information along with the compiled data was analyzed against prescription fill data, manufacturer contracts, drug availability, and state prescription formulary to identify the preferred national drug code. The preferred public health service drug was compared to the preferred wholesale acquisition drug to compile a final list and potential savings estimated. The final preferred national drug code medication list was updated in the ambulatory pharmacy information system and the drug wholesaler ordering system. Un-open packages of non-preferred medications were returned to the drug wholesaler for credit and to eliminate unnecessary on-hand inventory. Three months after changing the preferred national drug code medication list an analysis of drug purchases, against historical purchases, was conducted to identify realized cost savings across the nine ambulatory pharmacy locations.

Results: The initial analysis identified a potential three million savings opportunity across the nine ambulatory pharmacy locations at the university health system. After additional review of drug availability, physician preferences and state prescription formulary some medications could not be changed to the recommended preferred national drug code. It was also identified that the work effort to change the preferences in the current pharmacy information system was twice the original estimate, based on the need to change the preference in each pharmacy information system database. Based on the work effort I was decided to change the preferred national drug code for the medications with the highest savings opportunity. Out of 1051 recommended national drug code medication changes only 106 were changed. These changes resulted in $390,029 in savings over five months, for the university health system. This savings was extrapolated to $936,071 over 12-months.

Conclusion: Through data analysis, health systems can realize cost savings through standardization of medication national drug code selection across multiple pharmacy locations. Data analysis needs to take into consideration parameters such as manufacturer drug contracts, drug availability, and prescription benefit reimbursement. Other considerations such as the work effort to update pharmacy information system preferences is also important to ensure the savings is greater than the cost of change.

Submission Category: Automation/ Informatics

Session-Board Number: 4-027

Poster Title: Initial attempt at smart pump data set optimization and validation for a 16-hospital health system

Primary Author: Jon Gorton, Cardinal Health; **Email:** robb.gorton@cardinalhealth.com

Additional Author (s):
Kourtney Packer
Michael Rutland

Purpose: With smart infusion pumps providing real time alerts to clinicians, it is important to optimize the pump data set to ensure patient safety while minimizing unnecessary alerts. Smart pumps can provide a wealth of continuous quality improvement (CQI) data for data set optimization. This project was an initial attempt at data set optimization and validation for a sixteen hospital health system using a common pump data set.

Methods: Six months of CQI data, from 09/01/2014 to 02/28/2015 was selected for analysis. Pump CQI data was collected from Alaris System smart infusion devices with Guardrails Suite MX software, from sixteen hospitals using a common data set. A team of nine pharmacists was assembled to evaluate the data. Six hospital pharmacy managers, two informatics pharmacists and one pharmacy market director. Clinical pharmacy managers were consulted for appropriateness of the data set and for data set compliance within best practice guidelines. Using Guardrails CQI Reporter software was run for all facilities and results were aggregated in an Excel spreadsheet. Based on results, oxytocin, propofol, and norepinephrine were selected for drill down analysis of infusion rate deviation from the data set maximum infusion rate limits.

Results: Overall there were 83523 alerts for 1287469 infusions using Guardrails. For norepinephrine there were a total of 979 Alerts by Times the Limit Range. Of that, 409 alerts (41.8 percent) occurred at 1 to 1.499 times the limit. . Based on the hospitals best practice guidelines, the decision was made to keep the soft maximum limit at 40 mcg/min. For propofol there were a total of 8259 Alerts by Times the Limit Range. Of that, 5214 alerts (63.1 percent) occurred at 1 to 1.499 times the limit. Based on the hospitals best practice guidelines, the decision was made to keep the soft maximum limit at 50 mcg/kg/min. For oxytocin there were a total of 9654 Alerts by Times the Limit Range. Of that, 2841 alerts (29.4 percent) occurred at 1 to 1.499 times the limit, 1407 alerts (14.6 percent) at 1.5 to 1.999 times the limit and 2165

alerts (22.4 percent) at 2 to 2.499 times the limit. The 2056 alerts at 10 to 99.999 times the limit represent oxytocin bolused after delivery. Based on the hospitals best practice guidelines, the decision was made to increase the soft maximum limit from 20 milliunit/min to 40 milliunits/min.

Conclusion: The initial attempt at data set review was successful in validating the data set soft maximum infusion rate limits for norepinephrine and propofol. Additionally, it uncovered an opportunity to optimize the data set and reduce unnecessary alerts by increasing the soft maximum infusion rate limit for oxytocin. The methodology used will also provide a framework for analyzing smart infusion pump CQI data in the future.

Submission Category: Automation/ Informatics

Session-Board Number: 4-028

Poster Title: Evaluating the impact of real-time clinical decision support on documented pharmacist interventions

Primary Author: Gabriel Guerra, Hospital Corporation of America; **Email:** gabriel.guerra@my.liu.edu

Additional Author (s):
Hayley Burgess
Mandelin Cooper
Joan Kramer
Sarah Fraker

Purpose: Documentation efforts by pharmacists are key to adhering to standards of practice and prove demonstrable evidence of pharmacists' contributions to high-quality, coordinated care. Documentation of interventions has also been used to quantify associated cost-savings directly from pharmacist interventions. This study aimed to investigate the impact on documented pharmacist interventions after implementation of a real-time clinical decision support (RTCDS) system throughout a large hospital system.

Methods: This Institutional Review Board approved study was a retrospective cross-over analysis occurring before and after the implementation of a RTCDS software amongst two identified groups of hospitals. Baseline pharmacy intervention data was obtained from an enterprise dashboard for all facilities from July 2013 through November 2013. Comparable data was obtained through the RTCDS software dashboard post implementation from July 2014 through November 2014 for Group 1 (Gr1) hospitals and July 2015 through November 2015 for Gr1 and Group 2 (Gr2) hospitals. Acknowledged alerts where no action was taken by the pharmacist were excluded. The total number of interventions were then analyzed as a percent change over time as a whole number per group and per hospital within each group. When applicable, interventions were subcategorized into the following types: Antimicrobial, Drug Regimen Modification, IV to PO, and Renal Dosing Modification. Facility characteristics were obtained and compared for 2013 and 2015 and included bed count (BC), adjusted patient days (APD), case-mix index (CMI), number of active pharmacist users in the RTCDS (RPH), and pharmacy department hours (PDH). A linear regression model was performed to identify any

relationship between a change in facility characteristics and percentage change in pharmacy interventions.

Results: Sixty-six hospitals were included for analysis (Gr1 34, Gr2 32). The following average characteristics were identified: BC (Gr1 357, Gr2 343), APD (Gr1 12,138, Gr2 11,236), CMI (Gr1 1.448, Gr2 1.404), RPH (Gr1 21, Gr2 22) and PDH (Gr1 33,699, Gr2 31,951). There was no change in investigated characteristics over the study time period that demonstrated a statistical correlation to the percent change of documented pharmacist interventions (p=NS). Comparing 2015 data for Gr1 and Gr2 to 2013 baseline data, the following changes were identified: Total interventions (Gr1 18%, Gr2 25%), Antimicrobial (Gr1 33%, Gr2 33%), Drug Regimen Modification (Gr1 22%, Gr2 44%), IV to PO (Gr1 57%, Gr2 104%), and Renal Dosing Modification (Gr1 56%, Gr2 104%). When each hospital was analyzed independently, the average percent change in 2015 compared to baseline data in 2013 was identified: Total interventions (Gr1 65%, Gr2 47%), Antimicrobial (Gr1 133%, Gr2 103%), Drug Regimen Modification (Gr1 270%, Gr2 125%), IV to PO (Gr1 241%, Gr2 269%), and Renal Dosing Modification (Gr1 294%, Gr2 384%). Overall, the average percent change of total documented pharmacy interventions between both groups was 50.58% (95% CI 23.11 – 78.05) which was statistically significant ($p < 0.0001$).

Conclusion: The implementation of a RTCDS resulted in a statistically significant increase in total documented pharmacy interventions. The largest impact was observed in documented interventions for Renal Dosing Modifications and IV to PO conversions. These results demonstrated that a RTCDS is able to capture a larger number of pharmacy interventions compared to a manually documented process. Further research is needed to determine if an increase in documented interventions was a result of improved potential intervention identification or ease of intervention documentation through the RTCDS.

Submission Category: Automation/ Informatics

Session-Board Number: 4-029

Poster Title: Optimizing workflow in a sole community teaching hospital by developing best practices for utilizing automated dispensing technology in order to improve operational and patient outcomes

Primary Author: Jason Harsanye, Kingman Regional Medical Center; **Email:** jaharsanye@yahoo.com

Additional Author (s):
Michael Steiger
William Latimer

Purpose: Operational efficiency is extremely important in today's healthcare model. Understanding how automated dispensing technology impacts workflow efficiency is critical when determining how to develop best practices for a medication dispensing process. Interdepartmental and intradepartmental collaboration provides a well-rounded perspective for obtaining data to improve operational efficiency via automated dispensing technology. This project was designed to improve medication utilization, workflow efficiency and patient outcomes.

Methods: An initial project scope and plan were developed via a project charter by working with internal and external stakeholders. Automated dispensing technology metrics that impact operational workflow were obtained from industry best practices. These metrics were evaluated via literature review by the pharmacy department's operations manager. An analysis of the current state and future state pharmacy workflow, along with value stream mapping were used to help evaluate, design and optimize operational workflow. In order to assess the primary outcome, time studies were performed for several process points throughout the medication dispensing process. All time studies were conducted by utilizing a stop watch to assess the approximate time associated with each patient-related process. A log book was used to collect both pre and post renovation time assessments.

Results: The project was assigned a tentative timeline of 90 days to complete. In order to improve operational and patient outcomes, several automated reports were developed to provide utilization data for the department's automated dispensing technology. These reports allowed pharmacy staff members to make appropriate operational adjustments when

necessary. New processes for reviewing and optimizing the department's automated dispensing technology allowed the pharmacy department to assess operational activity every quarter at a minimum. The end result of these newly defined workflow processes increased ADC vend to fill ratios, decreased ADC stock out ratios, improved medication inventory utilization and clinical outcomes.

Conclusion: The project charter document served as an instrumental tool for keeping the project on track, on time, and within scope. The post project operational workflow improved both operational and clinical outcomes. Therefore, the primary outcome for the project was met by allowing intradepartmental and interdepartmental more time to focus on providing timing medication administration, medication counseling and an explanation of medical care compliance with patients.

Submission Category: Automation/ Informatics

Session-Board Number: 4-030

Poster Title: The clinical impact of medication errors prevented by an intravenous (IV) workflow management system in a pediatric hospital

Primary Author: Alex Lin, University of Cincinnati; **Email:** alex.lin@uc.edu

Additional Author (s):
Cory Simonavice
Gehring Aaron
Yihong Deng
Jonathan Penm

Purpose: The objective of this study was to determine the potential clinical impact of i.v. preparation errors prevented due to the use of an i.v. workflow management system. The i.v. workflow management system (DoseEdge® Pharmacy Workflow Manager, Baxter Healthcare Corporation, Round Lake, IL).) uses bar code and photographic technology to track and verify correct preparation of i.v. doses. The use of the system was hypothesized to decrease i.v. preparation errors and thus reduce potential harmful effects from medication errors.

Methods: The study site was Cincinnati Children's Hospital Medical Center (CCHMC) in Cincinnati, Ohio. In a previous study, data was collected from February 1st to April 30th, 2015 to determine the number and types of errors detected by the i.v. workflow management system and by staff pharmacists. A stratified sample was randomly selected to include 25% of each error type. The potential clinical severity of each prevented i.v. preparation error was evaluated using an algorithm developed by the National Coordinating Council for Medication Error Reporting and Prevention. Each prevented error was given a severity rating of C through I, with "C" causing no harm to the patient, and "I" causing the patient's death. Error severity rankings were based on available clinical information obtained from the patients' electronic health records. The evaluators included two senior PharmD students who independently ranked the potential clinical impact of each prevented error. Any disagreement between the evaluators was resolved during group discussion including a licensed clinical pharmacist. Descriptive statistical analysis was used to demonstrate the mean severity score for each dispensing error type. Kruskal-Wallis Test and Wilcoxon Sum Rank Test were applied to determine if any difference in severity existed between each type of error.

Results: The total number of errors detected was 1,162. The i.v. workflow management system intercepted 983 (84.6%) of the errors; including wrong concentration (101), wrong diluent (504), wrong drug (376) and product expired (82) errors. Pharmacists detected 179 (15.4%) errors; including wrong volume (140), dose expired (15), wrong drug (5), dose damaged (1) and other errors.

Twenty-five percent of each category was randomly selected to evaluate their potential clinical consequence. Patient medical charts could not be identified for 40 of the errors. In the 250 errors evaluated, 190 (76%) were ranked as "would not cause any harm to the patient"; 35 (14%) would cause no harm but require increased patient monitoring; six (2.4%) could cause temporary patient harm and need for treatment; two (0.8%) could cause initial or prolonged hospitalization; five (2%) could cause permanent patient harm; five (2%) could cause near death events; and seven (2.8%) could potentially cause death.

The result of Kruskal Wallis Test showed there was significant difference in potential clinical severity between different types of errors (P=0.0044). Pairwise comparison showed wrong diluent errors were less severe than other types of errors (p=0.0013), wrong drug errors were significantly more severe than other types of errors (p=0.0012).

Conclusion: The results of this study agree with previous research that demonstrates most medication errors may cause little harm, but errors that do cause harm have serious outcomes. This study establishes that the type of i.v. preparation error has a significant impact on the severity of the potential clinical outcome, with wrong drug errors being the most dangerous. Our research also demonstrates the ability to determine the benefits of preventing harm caused by errors, whereas most previous research evaluates the errors after they occur. This allows researchers to evaluate the value of a new technology or new procedure that prevents errors.

Submission Category: Automation/ Informatics

Session-Board Number: 4-031

Poster Title: Implementation of a name verification label/bar code process for insulin pen single patient administration

Primary Author: Lauren McCormick, Deborah Heart and Lung Center; **Email:** mccormickl@deborah.org

Additional Author (s):

Purpose: Avoiding inadvertent insulin pen use on multiple patients is a priority for both nursing and pharmacy to promote patient safety and decrease infection risk. Desired basal prandial insulin regimens consist of multiple orders using a single commercial medication-specific but not patient-specific bar code. This name verification initiative was devised to use bar coding methodology not only to identify correct drug selection but also to correctly identify the right patient's insulin pen, and more importantly, alert the nurse if the pen belonged to another patient prior to medication administration.

Methods: A multidisciplinary group representing pharmacy, nursing, infection control and process improvement convened to devise an insulin pen patient identification process. A prescription number bar code would tie the patient to the medication but would not definitively identify the medication. Problematically, multiple prescription numbers would be needed for basal prandial insulin orders and doses changed frequently. An insulin pen name verification "dummy" order (and prescription number bar code) was suggested in addition to utilizing the commercial insulin pen bar code. This single order (and bar code label on the pen) could carry through multiple dosage adjustments that would be verified with the commercial insulin pen bar code. The name verification order was added to pharmacy and computerized provider order entry order sets. It was recognized that scanning the commercial insulin pen bar code first would negate the safety benefit of the insulin pen name verification bar code. A stop sign shaped red high alert sticker is placed just below the name verification prescription number bar code on the label. Nurses were instructed to "stop" and scan the name verification label bar code first to identify the patient then scan the commercial insulin pen bar code to identify the medication. A computer based learning module, posters and unit based instruction were used to roll out the new ordering, labeling and process to providers, pharmacy and nursing.

Results: Bedside Medication Verification was implemented on September 15, 2015. The insulin pen name verification process was implemented on January 25, 2016. 117 of 117 assigned nurses completed the computer based learning module. Initially, pharmacy label positioning on the limited real estate of pen itself was erratic (bar codes and essential labeling were covered) but retraining and visual tools corrected this issue. Discontinuing and restarting insulin regimens resulted in occasional duplication and/or changes to the insulin pen name verification prescription number. Pens were then returned to the pharmacy for relabeling. Bedside medication verification scanning rates for 2/1/16 – 4/30/16 were 78.09% for the insulin pen name verification bar code and 85.01% for the commercial insulin pen bar code versus an overall scanning rate of 91% for all medications. Further investigation revealed inconsistencies with insulin pen name verification administration or non-administration when the corresponding insulin dose was not given. In addition, bedside medication verification rates for some nursing units were well below the targeted threshold of 95%.

Conclusion: If used correctly, the insulin pen name verification prescription number bar code in conjunction with the commercial insulin pen bar code correctly identifies both the patient and the medication prior to insulin pen medication administration. Nurses were enthusiastic about the process and value the added safety measure it provides. However, further nursing clarification and training is needed on insulin pen name verification administration or non-administration for bedside medication documentation when the corresponding insulin dose is not given as well as for the bedside medication verification process in general in order to meet targeted goals for all nursing units.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-032

Poster Title: Acenocoumarol in nonvalvular atrial fibrillation: assessment of anticoagulation control

Primary Author: Paula Arrabal-Durán, Pharmacy Department. Hospital General Universitario Gregorio Marañón. Instituto de Investigación Sanitaria Gregorio Marañón (IiSGM).; **Email:** paula.arrabal@salud.madrid.org

Additional Author (s):
María Esther Durán-García
María Gómez-Antúnez
Ana Herranz-Alonso
María Sanjurjo-Sáez

Purpose: Vitamin K antagonists (VKA; e.g. acenocoumarol) keep on being the first choice in patients with nonvalvular atrial fibrillation (NVAF), while the “new oral anticoagulants” (NOAC; e.g. dabigatran) remain a switching strategy in those patients who are not able to achieve an optimal anticoagulation control and when there is a clear benefit in terms of cost-effectiveness. To quantify anticoagulation control, we can assess how well the patient´s intensity of anticoagulation is maintained within the therapeutic range through different methods.
The aims of this study were to assess the level of anticoagulation control in a cohort of patients with NVAF treated with acenocoumarol by applying two different methods and to evaluate the level of concordance between them.

Methods: We performed a retrospective observational study of all adult patients admitted to an Internal Medicine unit of a tertiary care hospital during 2014, who were diagnosed of NVAF and were treated with acenocoumarol. The exclusion criteria were less than 3 determinations of International Normalized Ratio (INR) within the prior six months to the admission; a period of ≥90 days without determinations; ≥2 periods of 60 days without determinations; and patients with interruptions in the administration of acenocoumarol owing to surgery or invasive procedure within the last six months.
INR values within the six months prior to admission were retrieved. The level of anticoagulation control was calculated by the percentage of INR values within therapeutic range (ITR, tests ratio method) and by the percentage of time in therapeutic range (TTR, Rosendaal method).

Therapeutic range was defined as INR between 2.0 and 3.0. To define a "good control", we considered the thresholds stablished by the Spanish Government recommendations (ITR greater or equal [≥] than 60.0 per cent [%] or TTR ≥ than 65.0%).
The kappa index was used to estimate the level of concordance between the aforementioned methods.
Further data we recorded comprised demographic characteristics.
Given that ours was an observational study performed as part of routine clinical practice, neither ethics committee approval nor written informed consent from the patients was required.

Results: The final sample comprised 109 patients. Median age was 82.6 years (interquartile range [IQR], 79.2-86.2), and 56.9% of patients were female. We analysed 961 INR values, being 9 (IQR, 7-10) the median number of values per patient.
If tests ratio method was considered, 61.5% of patients were poorly controlled. In the other hand, if Rosendaal method was considered, this percentage was 55.0%.
The median ITR was 55.6% (IQR, 38.8-66.7) and the median TTR was 60.7% (IQR, 39.7-74.9).
The percentage of patients with a TTR greater than the ITR was 69.4%; 28.8% had a TTR lower than the ITR and 1.8% had identical values with both methods.
Kappa index was 0,613 (IC95%: 0,466-0,761).

Conclusion: It is recommended to assess the intensity of anticoagulation in patients with NVAF who are admitted into a hospital, owing that a high proportion of them could present a suboptimal therapeutic control and then could have benefit from NOAC.
We found that TTR calculated with the Rosendaal method was higher than the ITR calculated by the tests ratio method in most cases. The level of concordance between both methods was moderate.
The tests ratio method is the simplest measure to compute and understand, but we recommend the Rosendaal method, since it incorporates time. Nevertheless, the tests ratio method remains a reasonable anticoagulation control measure in practices unable to calculate TTR.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-033

Poster Title: Argatroban use for pulmonary embolism in a critically ill patient with end-stage renal disease

Primary Author: Priscilla Ayala, Comprehensive Pharmacy Services; **Email:** priscilla.ayalaclass@upr.edu

Additional Author (s):

Purpose: This case report illustrates the use of argatroban for the treatment of a pulmonary embolism in a critically ill patient with a heparin allergy and end-stage renal disease. The patient presented to the emergency department with chills and fever and was diagnosed with sepsis and bacteremia. Past medical history included diabetes mellitus type 2, asthma, end-stage renal disease on hemodialysis, congestive heart failure with a cardiac resynchronization therapy (CRT) device that was previously changed and all leads but one on the cavo-atrial junction were removed. This lead was the source of methicillin resistant staphylococcus aureus (MRSA) bacteremia with valvular involvement. At hospital day 33, the patient developed cardiorespiratory arrest and was placed on mechanical ventilation with a rule out of septic emboli to the lungs and was transferred to the intensive care unit (ICU). The institution did not have an argatroban protocol and the Clinical Pharmacist was asked to develop one. A literature review was performed and patient-specific instructions were developed using a hepatic/critically ill nomogram, which recommended an initial dose of 0.5 mcg/kg/min (in contrast with normal hepatic function recommended dose of 2 mcg/kg/min). The patient had a slightly elevated baseline aPTT of 36.8 seconds (normal range is 23.8 to 30.2 seconds), although the patient had not received any anticoagulation prior to argatroban use. The baseline hepatic panel was within normal limits. The protocol was personally discussed with the nurses. Warfarin 5 mg was started on hospital day 34, after achievement of desired aPTT (45-90 seconds) with argatroban. The patient received a total of 36 hours of argatroban and was continued on warfarin until a therapeutic INR of 2.5 was achieved. A drug-drug interaction with ceftaroline was discovered as the INR increased to 7.4 approximately 48 hours after argatroban was discontinued. Appropriate warfarin dose adjustments were made. Anticoagulation therapy was successful, the patient was extubated and eventually transferred out of ICU. This case illustrates the successful use of argatroban in a patient without heparin-induced thrombocytopenia but with renal dysfunction and heparin allergy which limited the use of other anticoagulants. This case contributes to what has been reported in the literature of a

need for lower argatroban doses in critically ill patients with normal hepatic function and decreased renal function; conditions where a dose adjustment is not typically necessary. This case also highlights the drug-drug interaction between ceftaroline and warfarin and the necessity of dose adjustments to decrease the risk of bleeding. The ethics committee approval is pending.

Methods:

Results:

Conclusion:

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-034

Poster Title: Clinical and economic impact of an optimization program for reducing bleeding events in patients with acute coronary syndrome

Primary Author: Ana de Lorenzo-Pinto, Hospital General Universitario Gregorio Marañón; **Email:** ana.lorenzo@salud.madrid.org

Additional Author (s):
Héctor Bueno
Ana Herranz-Alonso
Belén Marzal-Alfaro
María Sanjurjo-Sáez

Purpose: The aim of the study was to evaluate the clinical and economic impact of a program for reducing bleeding events in patients with acute coronary syndrome (ACS) through the optimization of the antithrombotic therapy.

Methods: We designed a pre-post quasi-experimental intervention study using retrospective cohorts. The first cohort was analyzed to detect correctable measures contributing to bleeding (PRE: January-July 2010). Secondly, a bundle of interventions was implemented and, thirdly, a second cohort of patients was evaluated to investigate the impact of our measures in bleeding reduction (POST: September 2011-February 2012).
The economic analysis took into account cost-savings related to bleeding prevention and costs associated with the program implementation. To estimate cost-savings, data published in an article that included a population similar to our setting were used. The study estimated an average cost of a bleeding episode after an ACS, in Spain, of approximately 8,000€, ranging from 1,400€ (for a lethal hemorrhage) and 9,300€ (if a decrease in hemoglobin > 3 g/dl).
Impact on health outcomes was evaluated through comparison of the percentage of bleedings and 30-day readmissions between both cohorts of patients. Readmission rates were provided by the Financial Management Service of the hospital.

Results: A total of 677 patients were included (377 in PRE and 300 in POST). The bundle of interventions consisted of:

1) Overdose avoidance measures: The percentage of patients overdosed was reduced by 66.3% ($p < 0.001$).
2) Prescription of antithrombotic drugs with better bleeding profiles: The percentage of patients treated with fondaparinux increased (2.4% versus 50.7%; $p < 0.001$).
3) Avoidance of combinations of antithrombotic agents with worse bleeding profiles: Only one patient received abciximab plus bivalirudin ($p=0.016$).
4) Mandatory measurement of body weight: The percentage of patients weighed was increased (67.4% versus 88.7%; $p < 0.001$).
In POST, the total bleeding rate was reduced by 29.2% ($p < 0.05$, OR: 0.62; 95% CI: 0.44 to 0.88). In PRE, 15 bleeding episodes were associated with an hemoglobin drop > 3g/dL and one episode was fatal. In POST, 8 episodes were related with an hemoglobin drop > 3g/dL and none of the bleeding events was fatal. The 30-day readmission rate was 7.7% in PRE and 5% in POST ($p=0.20$).
Thanks to the implementation of the bundle of interventions, the estimated avoided cost was 95.113,6€/year. This means that 10,1€ would be obtained for each euro invested during the first year and 36.3€ during the following years.

Conclusion: The optimization program for reducing bleeding events has proven to be efficient and has the potential to reduce readmissions in patients diagnosed of ACS.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-035

Poster Title: Evaluation of unfractionated heparin for therapeutic anticoagulation in obese patients

Primary Author: Jenna Dietrich, University of Iowa Hospitals and Clinics; **Email:** jenna.n.dietrich@gmail.com

Additional Author (s):
Ryan Hobbs
Jamie Smelser

Purpose: Obese dosing recommendations for unfractionated heparin (UFH) were implemented in April 2013 based on results from a dose finding study conducted at the University of Iowa Hospitals and Clinics (UIHC) from 2011-2012. The dose finding study determined that patients weighing at least 150 kg required UFH infusion rates above a prior 1500 units/hour dose cap. The revised UIHC heparin protocol recommends that patients who weigh at least 150 kg receive initial infusion rates of 13 units/kg/hour and 11 units/kg/hour for venous thromboembolism (VTE) and non-VTE indications, respectively, with no maximum initial infusion rate. Our study was conducted to evaluate the efficacy of the heparin protocol in obese patients and to assess prescriber adherence to the protocol.

Methods: The institutional review board approved this single center, retrospective chart review of adult patients who received unfractionated heparin for therapeutic anticoagulation between April 15, 2013 and September 30, 2015 and weighed at least 150 kg at the initiation of therapy. Exclusion criteria included: patients less than 18 years of age, use of a customized heparin nomogram, initiation of UFH therapy at an outside hospital, administration of UFH therapy for less than 24 hours, failure to achieve two consecutive therapeutic aPTTs while on UFH therapy, concomitant use of continuous renal replacement therapy and use of a direct thrombin inhibitor within 24 hours. Primary outcomes of the study included: heparin infusion rate in units/kg/hour at the time of the first of two consecutive therapeutic aPTTs in patients with VTE and non-VTE indications and time to first therapeutic aPTT when the initial heparin rate followed the protocol compared to when the protocol was not followed. Secondary outcomes evaluated the rate at which the heparin nomogram was followed for the initial dosing of UFH in patients weighing at least 150 kg and the number of dose adjustments and lab measurements

required prior to achieving a therapeutic aPTT. The results from this 2016 analysis were compared and combined with a previous analysis conducted in 2014.

Results: A total of 48 patients were included (19 patients in the 2014 analysis and 29 patients in the 2016 analysis). The average weight was 181 kg. Indications for heparin included VTE (42 percent), acute coronary syndrome or ACS (10 percent), atrial fibrillation (27 percent) and bridging therapy (21 percent). The average UFH dose at first therapeutic aPTT was 13.4, 11.3, 12 and 14.4 units/kg/hour for VTE, ACS, atrial fibrillation and bridging therapy indications, respectively. Initial infusion rates were guideline adherent in 42 percent of the patients evaluated (32 and 48 percent in 2014 and 2016, respectively). The average time to first therapeutic aPTT was 19.8 hours with protocol adherence and 47.7 hours with non-adherence. The average number of dose adjustments required was 1.6 with protocol adherence and 4.9 with non-adherence, and the average number of lab draws was 3.1 with protocol adherence and 6.8 with protocol non-adherence.

Conclusion: Patients who weighed at least 150 kg and received initial heparin infusion rates congruent with the revised protocol, reached therapeutic anticoagulation over 24 hours faster than patients with initial infusion rates that differed from protocol recommendations. Protocol non-adherence resulted in more lab draws and dose adjustments, in addition to delays in achieving adequate anticoagulation. The overall heparin obese dosing adherence rate did improve between 2014 and 2016, however, further efforts will be made to improve adherence rates.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-036

Poster Title: Use of the platelet aggregation inhibitor ticagrelor in the management of atherothrombotic conditions: overview of the PARTHENON global clinical trial program

Primary Author: Paul Dobesh, University of Nebraska Medical Center College of Pharmacy; **Email:** pdobesh@unmc.edu

Additional Author (s):

Purpose: Treatment guidelines for the management of patients with acute coronary syndromes (ACS) recommend that dual antiplatelet therapy with a P2Y12 receptor antagonist and aspirin be commenced early after the acute cardiovascular event. Ticagrelor is a direct-acting, reversible P2Y12 inhibitor, currently indicated (in combination with aspirin) for reduction of cardiovascular (CV) death, myocardial infarction (MI), and stroke in patients with ACS or history of MI. The PARTHENON global outcomes program is investigating the role of ticagrelor across a range of atherothrombotic disorders. An overview of the PARTHENON Program is presented and key outcomes reviewed.

Methods: The PARTHENON Program includes approximately 80,000 high-risk patients, across five active comparator (clopidogrel and/or aspirin)- and placebo-controlled randomized studies. All studies were approved by the appropriate ethics committee or institutional review board. The primary end points of all studies are composites of MI, ischemic or all-cause stroke, and CV or all-cause death. Published study results are evaluated for three studies: PLATelet inhibition and patient Outcomes (PLATO [N=18,624; NCT00391872) was conducted in ACS patients receiving background aspirin. PrEvention with TicaGrelor of SecondAry Thrombotic Events in High-RiSk Patients with Prior AcUte Coronary Syndrome – Thrombolysis In Myocardial Infarction (PEGASUS TIMI-54 [N=21,162; NCT01225562]) was conducted in patients with MI 1–3 years prior. The acute Stroke Or transient isChemic attack tReated with Aspirin or Ticagrelor and patient outcomES (SOCRATES) study (N=13,199; NCT01994720) was conducted in patients with acute ischemic stroke or transient ischemic attack. In addition, two studies are ongoing: Examining Use of tiCagreLor In peripheral artery Disease (EUCLID [N=13885; NCT01732822]) is investigating efficacy of ticagrelor versus clopidogrel in patients with peripheral artery disease (36-month timeframe). The effect of Ticagrelor on Health outcomes in diabEtes Mellitus patients Intervention Study (THEMIS [N=~19000; NCT01991795]) is investigating ticagrelor

versus clopidogrel in patients with type 2 diabetes and coronary atherosclerosis (48-month timeframe).

Results: In PLATO, superiority of ticagrelor 90mg bid over clopidogrel 75mg daily in CV event (CVE) reduction was demonstrated at 12 months (9.8% versus 11.7% for ticagrelor- and clopidogrel-treated patients, respectively; $P < 0.001$). There was no difference in overall major bleeding between groups (11.6% and 11.2%, respectively; P=0.43), but ticagrelor was associated with increased non-coronary artery bypass graft-related bleeding (4.5% versus 3.8%, P=0.03). PEGASUS TIMI-54 demonstrated long-term CVE reduction with ticagrelor 90mg or 60mg bid plus aspirin, versus aspirin alone. Event rate at 3 years was 7.85% with ticagrelor 90mg, 7.77% with 60mg, and 9.04% with placebo (P=0.008 and P=0.004 for ticagrelor 90 and 60mg, versus placebo, respectively). These results led to an expanded ticagrelor indication to include long-term (>1-year) management of patients with history of MI. Increase in major bleeding occurred with ticagrelor (2.6% with 90mg and 2.3% with 60mg) versus placebo (1.06%) ($P < 0.001$ for each dose versus placebo), but without increase in intracranial hemorrhage or fatal bleeding. In SOCRATES, the primary end point occurred in fewer ticagrelor monotherapy-treated (6.7%) versus aspirin-treated (7.5%) patients (hazard ratio, 0.89; 95% CI, 0.78–1.01), but was not statistically significant (P=0.07). No increase in major bleeding occurred with ticagrelor versus aspirin (0.5% versus 0.6%, respectively).

Conclusion: Data from the PARTHENON Program have been instrumental to approval of ticagrelor for the reduction of thrombotic CVE in patients with ACS or history of MI. Ongoing large-scale PARTHENON studies will continue to enhance understanding of the role of ticagrelor across a range of atherothrombotic conditions.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-037

Poster Title: Treatment failure of apixaban in a patient with metastatic pancreatic cancer

Primary Author: Nicole East, Fairleigh Dickinson University; **Email:** nicoleleast@gmail.com

Additional Author (s):
Jesse Sullivan
Jaclyn Winnicki

Purpose: This case report illustrates the treatment failure of apixaban in a 57 year old Caucasian male patient with extensive bilateral pulmonary emboli and newly diagnosed metastatic pancreatic cancer. The patient presented to the emergency room (ER) complaining of cough, congestion, lightheadedness and dizziness with dyspnea on exertion since the previous night. His past medical history is significant for a recent deep venous thrombosis (DVT) and hypertension. The patient was diagnosed with a DVT of the left lower leg two months prior than the current admission where he chose to leave against medical advice but was willing to accept outpatient treatment. He was put on apixaban, which was dosed appropriately for a DVT. After two months, he returned to the ER with the current complaints. It was verified that the patient was compliant with his home medications. A chest CT confirmed extensive bilateral pulmonary emboli and a new pancreatic mass with lesions in the liver. The patient was admitted to the telemetry unit for further evaluation and started on a continuous intravenous heparin drip for anticoagulation and ipratropium/albuterol one vial (3mL) four times a day. The patient also required oxygen supplementation. Gastroenterology and Hematology/Oncology (Hem/Onc) teams were consulted. On day two, the patient received an IVC filter. On day four, a magnetic resonance cholangiopancreatography revealed the mass on the tail of the pancreas was consistent with a malignancy and the findings also showed liver metastases. The patient's CA19-9 was elevated at 147,306 units/mL. The patient was ordered a guided biopsy of the liver and pancreatic lesions on day five. On day seven, the biopsy results were confirmed as adenocarcinoma. The patient was determined to have stage 4-pancreatic cancer and was recommended to receive chemotherapy as an outpatient. It was decided by Hem/Onc that the patient would get a port-a-cath inserted and be sent home on fondaparinux 7.5mg subcutaneously daily (dosing weight= 73kg). The patient was discharged on day 12. A literature search revealed an article of an experimental model that supports the hypercoagulability of pancreatic adenocarcinoma cells in inducing thrombin generation and their ability to alter antithrombotic efficiency of low-molecular weight heparin (LMWH) and specific factor Xa

inhibitors. Currently, there is not enough evidence to support the use of any of the direct oral anticoagulants (DOACs) in a patient with a confirmed venous thromboembolism (VTE) and cancer. While some evidence suggests the DOACs may be successfully used to treat a VTE, majority of the evidence still suggests that LMWH is the medication of choice. This case demonstrates the treatment failure of apixaban in a patient with stage 4-pancreatic cancer and proves that more evidence is needed to determine the place of therapy of DOACs in patients with cancer-associated thrombosis. This case also proves that each patient should be treated individually based on patient-specific factors.

Methods:

Results:

Conclusion:

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-038

Poster Title: Clinical response to inhaled treprostinil in patients with pulmonary arterial hypertension

Primary Author: Cher Enderby, Mayo Clinic; **Email:** enderby.cher@mayo.edu

Additional Author (s):
Charles Burger

Purpose: Treprostinil is a prostacyclin analogue that directly vasodilates the pulmonary and systemic arterial vascular beds. Inhaled treprostinil was approved by the Food and Drug Administration in July 2009 for the treatment of group 1 pulmonary arterial hypertension (PAH). Inhaled treprostinil avoids issues associated with continuous infusion prostanoids such as pump failure, site access, and potentially life-threatening infections. The purpose of this study is to describe a single institutional experience with inhaled treprostinil.

Methods: After Institutional Review Board approval, a retrospective review of the electronic medical record and Pulmonary Hypertension (PH) Clinic database was performed. Consecutive patients with group 1 PAH that received inhaled treprostinil from July 2009 through September 2015 were identified. Data collected included patient demographics, vital signs, and prognostic indicators such as New York Heart Association (NHYA) functional class (FC), 6-minute walk distance (6MWD), brain natriuretic peptide (BNP), and echocardiographic (ECHO) PAH assessment including right arterial pressure (RAP), mean pulmonary artery pressure (mPAP), right ventricular (RV) size, and RV function. Inhaled treprostinil dosing, concomitant PH medications, and a qualitative physician assessment of patient's clinical status (stable, improved, or worse) at the time of the outpatient visit were also collected. Prognostic indicators and the physician's assessment were used to assess treatment response while on inhaled treprostinil. A short-term response was arbitrarily defined as less than 12 months and a sustained effect is greater than 36 months. A modified (routine follow-up lung function or right heart catheterization was not performed) Registry to Evaluate Early and Long-term PAH Disease Management (REVEAL) risk score was calculated prior to and after initiation of inhaled treprostinil. A score of 7 or less is considered low risk. Descriptive statistics were used to describe the data.

Results: Sixteen patients were included (mean age 58 years, eighty-one percent female). Mean time on inhaled treprostinil was 21 months. Baseline NYHA FC was III for 13, II for 2, IV for 1 patient ; mean 6MWD 322 meters , BNP 326 picogram per milliliter, RAP 10, and mPAP 52 millimeters mercury, respectively. Baseline RV size was normal in 2; mildly in 1, moderately in 7, and severely enlarged in 6 patients. Baseline RV function was normal in 3; mildly in 1, moderately in 7, and severely depressed in 5 patients. Baseline physician assessment of clinical status was stable for 4, improved for 1, and worse for 11 patients.
Eleven patients improved on inhaled treprostinil. Two patients each had a short-term and sustained effect. Treatment discontinuation occurred due to adverse effects (2) and patient preference (2). One patient discontinued against medical advice and did not return for follow-up. Mean modified REVEAL risk scores (RRS) were 7 at baseline and follow-up. RRS decreased in 7 of 11 patients that improved and remained stable in the other 2 patients (RRS 5 and 6, respectively). Follow-up RRS were available in 4 of the 5 patients considered non-responders and worsened in 3 of 4.

Conclusion: The majority of the group 1 PAH patients in this consecutive series, single-center experience tolerated inhaled treprostinil, and remained on therapy for over 12 months. In addition, both subjective and objective improvement was observed in more than two-thirds of the patients.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-039

Poster Title: Evaluation of oral antithrombotic therapy for hospitalized patients with nonvalvular atrial fibrillation

Primary Author: Martha Espinoza-Friedman, Cleveland Clinic Florida; **Email:** espinom@ccf.org

Additional Author (s):
Rena Coll

Purpose: The American College of Cardiology Foundation, American Heart Association, and European Society of Cardiology (ACC/AHA/ESC) 2011 Guidelines, and Antithrombotic Therapy for Atrial Fibrillation, 9th edition American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines provide recommendations regarding the choice of anticoagulant for stroke risk reduction for nonvalvular atrial fibrillation (NVAF) patients. Despite clear benefit of recommended therapies, there are still gaps between recommendations and clinical practice. Adherence to guidelines for NVAF patient population can improve outcomes. The purpose of this study was to evaluate and compare anti-thrombotic selection based on risk stratification for treatment, bleeding factors and practice guidelines

Methods: This study was an institutional review board approved, retrospective chart review. This quality improvement project was based on identifying patients with a diagnosis of NVAF that were admitted to community hospital between January 2015 and December 2015. Patients with a primary diagnosis of NVAF and greater than 18 years of age were collected from the electronic health record (EHR). Patients were excluded if receiving anticoagulation for a reason other than NVAF or pregnancy. Primary outcomes were to estimate the patient's risk of stroke and systemic embolism and determine compliance with guidelines based on risk assessment scores and antithrombotic agent selection at discharge. Secondary outcomes included patient's risk of bleeding based on risk assessment scores, length of stay and 30-day readmissions. Data and statistical analysis was conducted using Microsoft Access and the Statistical Data Analysis program (STATA). Descriptive statistics were utilized for all parameters.

Results: A total of 258 NVAF patients were evaluated. A majority of patients were greater than 60 years of age with a mean age of 72.2 years. Sixty-nine patients were admitted on warfarin and only 31.9 percent were within desired therapeutic INR range. Antithrombotic therapy assessment on admission indicated that 63 patients had a moderate risk and 110 patients had a

high risk of stroke. Fifteen percent were not receiving treatment on admission; 62.4 percent were on monotherapy; and 22.4 percent were receiving combination therapy. Antithrombotic therapy assessment on discharge indicated that 12.9 percent were not receiving treatment, 69.4 percent were on monotherapy; and 17.6 percent were on combination therapy. The average length of stay was 4.96 days. Five (9.62 percent) of patients discharged on warfarin monotherapy had a 30 day re-admission and the average length of stay was 5.01 days. Seven (8.14 percent) of patients discharged on a new oral anticoagulant had a 30 day re-admission and the average length of stay was 2.98 days.

Conclusion: This evaluation identified opportunities for pharmacists to close the gap for NVAF treatment based on the current guidelines. Standardizing stroke risk stratification within the electronic health record may improve guideline compliance, stroke treatment, bleeding risk assessment, and medication adherence. In addition, the NVAF electronic template can assist the pharmacy department with follow-up after therapy initiation to assess disease and medication awareness. The pharmacist can also provide medication counseling, evaluate patient risk for medication non-adherence and ensure that every NVAF patient has access to appropriate medication and follow-up post discharge.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-040

Poster Title: Evaluation of regadenoson and dipyridamole for use in pharmacologic stress tests

Primary Author: Shelby Gaudet, Baptist Hospital; **Email:** shelby.gaudet@bhcpns.org

Additional Author (s):
Cara Iacobellis
Rudy Seelmann

Purpose: A pharmacologic stress test is indicated when a patient cannot tolerate prolonged physical activity or if other contraindications exist to exclude them from an exercise stress test. Baptist Healthcare currently uses both regadenoson and dipyridamole as pharmacologic agents. There are proposed benefits of using regadenoson, including shorter test duration and fewer adverse effects. However, changes in CMS reimbursement and standardization of care across our health system prompted investigation into alternatives. The purpose of this institutional review board approved study was to compare the adverse events, image quality, and patient satisfaction associated with both agents.

Methods: A pharmacist-developed protocol was implemented in Baptist Hospital's Heart Center to guide staff when selecting an agent for pharmacologic stress testing. Dipyridamole was selected as the first line agent in the protocol. However, if regadenoson was specifically requested or contraindications to dipyridamole existed, regadenoson was used. The protocol was accompanied by a recordkeeping form on which staff documented the patient's age, gender, agent administered, timing and dosage of any rescue aminophylline given, stress test duration, and any adverse effects. Additionally, telephone interviews were conducted within 24 – 72 hours of pharmacologic stress test completion. A standardized questionnaire was used to gauge overall patient satisfaction and assess for delayed adverse effects. Efficacy was assessed by evaluation of stress test duration and image quality. Safety was assessed by number of reported adverse events. Patient satisfaction was assessed via telephone interview results. All patients receiving a pharmacological stress test were included in the prospective data collection.

Results: Data collected from March 1, 2016 to April 30, 2016 was analyzed. A total of 78 patients were included (13 in the dipyridamole group and 65 in the regadenoson group). There was no statistically significant difference in regards to demographic information, image quality,

adverse events, or patient satisfaction scores. Patients in the dipyridamole group had significantly lower pharmaceutical cost compared to regadenoson ($11.66 vs $157.20, p =0.002). Patients in the dipyridamole group spent a significantly longer time in the stress test room during their procedure (41.3 minutes +/- 12.3 minutes vs 27.6 minutes +/- 10.9 minutes, p =0.003),however this did not significantly impact the time until medication administration (20.9 minutes +/- 11.9 minutes vs 14.6 min +/- 6.6 min, p =0.115) or staffing requirements at our Heart Center. Patient's in the dipyridamole group were given rescue aminophylline significantly more than the patients in the regadenoson group (69.2% vs 15.4%, p =0.0002).

Conclusion: While our study is limited by sample size, we were able to show that utilizing dipyridamole via a pharmacist-developed protocol resulted in similar image quality, adverse events, and patient satisfaction scores while significantly reducing pharmaceutical cost compared to regadenoson.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-041

Poster Title: Clinical pharmacy engagement in a multidisciplinary acute myocardial infarction patient care program at a community hospital

Primary Author: Shelby Gaudet, Baptist Hospital; **Email:** shelby.gaudet@bhcpns.org

Additional Author (s):
Mandy Bradshaw
Rudy Seelmann

Purpose: In July of 2014, Baptist Hospital partnered with Yale University to develop a multidisciplinary approach to reduce our mortality rate of patients admitted to our facility with a diagnosis of acute myocardial infarction (AMI). The pharmacy department began a pilot study using our current pharmacy resources to provide comprehensive medication therapy management services focused on AMI patients.

Methods: Clinical pharmacist worked closely with physicians, cardiac educators, nursing, and informatics to identify AMI patients, perform comprehensive medication reviews with recommendations based on current guidelines, provide lifestyle and medication counseling, and provide medication access services including bedside delivery of medications. Baseline mortality data was compared to mortality data after implementation of the program. Clinical pharmacist interventions were tracked and analyzed. Clinical pharmacist interventions from January 1, 2015 to March 31, 2016 were collected and analyzed and included data on a total of 328 AMI patients.

Results: Our institution's baseline mortality rate for AMI patients for fiscal year 2014 was 6.69%. Our goal for the program was to reduce the unadjusted 30-day mortality rate for all payer classifications by 3% by December 31, 2015. Through our multidisciplinary approach, we exceeded our goal for every month that the program has been in place with the December 2015 mortality rate equal to 2.68%.
Clinical pharmacist documented medication therapy management services were performed on 74% (n=328) of AMI patients admitted to our facility for the study period. Twenty-two percent (n=81) of AMI patients had an evidence-based medication added to patient's therapy by a clinical pharmacist, 26% (n=99) of AMI patients had a medication error detected and corrected by a clinical pharmacist, and 26% (n=98) of AMI patients had an adverse reaction prevented by

a clinical pharmacist intervention. We were able to generate $533,043 in revenue from utilizing the bedside delivery program and were able to show a cost avoidance of $31,850 from clinical pharmacist interventions.

Conclusion: Through a multidisciplinary approach, our institution was able to successfully implement strategies to reduce our mortality rate in AMI patients. Clinical pharmacist played a critical role in providing medication therapy management services to this patient population. Based on the positive impact of our medication therapy management service provided to our AMI patients, we were able to receive approval for an additional 1.5 FTE to expand clinical pharmacist serviced to other high risk disease states including chronic obstruction pulmonary disease, pneumonia, and heart failure.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 4-042

Poster Title: Performance of a chromogenic assay in hospital clinical laboratories for the measurement of apixaban concentration in plasma

Primary Author: James Groce, Campbell University College of Pharmacy & Health Sciences; The Moses H. Cone Memorial Hospital/Cone Health; **Email:** james.groce@conehealth.com

Additional Author (s):
Bala Carver
Douglas Cines

Purpose: Apixaban is an oral direct Factor Xa inhibitor commonly used at fixed daily dosages cleared by regulatory authorities for use as a direct oral anticoagulant (DOAC) without the need for routine blood monitoring. Quantification of apixaban's anti-Xa activity may be desired in specific clinical situations including emergency surgery, severe bleeding, the decision-making process whether to administer tPA for CVA, and in the course of interventional procedures. The purpose of this study was to assess the performance of a rapid assay designed to measure apixaban's anti-Xa activity in comparison to results obtained by the reference standard of liquid chromatography-mass spectrometry.

Methods: Institutional review board approval was obtained to permit analysis of 164 plasma samples at three clinical laboratories in the US. Of the samples, 153 were samples obtained from clinical studies sponsored by Bristol-Myers Squibb (BMS) for which informed consent had been obtained. The remaining 11 samples were spiked samples for assaying high concentrations. The chromogenic assay for apixaban quantitation in plasma was performed using proper assay methodology, calibrators, and quality controls. All tests were performed at the 3 respective laboratories using equivalent instrumentation. The results obtained from the rapid chromogenic assay were compared to LCMS measurements performed by the BMS reference site.

Results: Method comparison demonstrated LCMS results from 21 to 534 ng/mL versus 29 to 494 ng/mL for anti-Xa results. The correlation between the chromogenic Anti-Xa assay and LCMS was (r^2 equals 0.986). A Bland Altman graph was plotted to observe differences. Average bias was calculated according to CLSI guidelines. For levels of apixaban below 140 ng/mL, the average bias was minus 3ng/mL; for levels of apixaban above 140 ng/mL, the average bias was

minus 0.9 percent. While no clinical thresholds are defined for DOACs, some levels are of interest for assay interpretation and bias were calculated at several of these levels. At 30, 50, 200 and 400 ng/mL, the bias were plus 2.03 ng/mL, plus 0.12 ng/mL, minus 1.38 percent and plus 1.53 percent, respectively. No differences were observed between the 3 sites and the bias observed per site was similar to all sites. 124 samples from patients not taking apixaban were below detection limits upon testing confirming specificity of the assay. Inter-laboratory coefficient of variation (CV) was determined for two apixaban levels: for an apixaban level equivalent to 77ng/mL, the inter-laboratory CV was 6.08 percent and for an apixaban level equivalent to 280ng/mL, the inter-laboratory CV was 3.15 percent.

Conclusion: The comparison between the rapid chromogenic assay for measuring apixaban plasma concentration and the LCMS method demonstrates excellent overall correlation between both methodologies. The average bias and the bias observed for both low and high concentrations were very close. The automated method for measuring apixaban activity can be performed with existing clinical laboratory instrumentation found in the typical hospital clinical laboratory. The rapid chromogenic assay permits haemostasis laboratories the ability to quickly measure apixaban plasma concentrations which may be useful in serious or emergency patient situations, thereby assisting pharmacists in anticoagulation management within their respective healthcare systems.

Submission Category: Clinical Services Management

Session-Board Number: 4-043

Poster Title: Glycemic control among Type 2 diabetic patients in a tertiary hospital

Primary Author: Mohammed Almeziny, Prince Sultan Military Medical City; **Email:** meziny@hotmail.com

Additional Author (s):
Asma AlMuaither
Bashair AlJumah

Purpose: Diabetes mellitus (DM) is the most common chronic endocrine disorder affecting adult population. American Diabetes Association (ADA) recommends lowering HbA1c to ≤ 7% to reduce microvascular and macrovascular complications. This study aims to assess current practice in the management of patient with type 2 diabetes mellitus (T2DM) in a tertiary hospital and it studies the proportion of patients who are reaching target haemoglobin A1c (HbA1c) according to international guidelines. In addition, evaluate the impact of HbA1c value on practitioners decision to modify treatment plans

Methods: The included patients are T2DM adults who are visiting outpatient endocrine clinics for at least the second follow up visit. Those who are newly diagnosed, pregnant women, any patient with compliance issue or any situation that may affect drug response have been excluded. In outpatient pharmacy, prescriptions and laboratory values for the included subjects have been reviewed through hospital laboratory system to assess therapeutic response and to address need for any therapeutic modification.

Results: The study conducted in a tertiary hospital with 1,200 beds capacity, for a period of one month. A data collection form was developed to gather the patient data. The study sample consists of 378 patients 246 of them were female and 132 were male. Patients ages ranged between 17-94 years with a standard deviation of ± 12. About 24% of patients have reached target glycemic control (HbA1c < 7%) and that indicates inadequate control of diabetes among subjects, as mean HbA1c was 8.2%. After reviewing patient's laboratory results for the current and previous visits, as well as the treatment regimens that have been prescribed based on the patient's laboratory values about 69% of the total population needed modification and only half of them had their treatment plans modified. Moreover, most patients are overweight or obese. This result is similar to what have been reported in many articles.

Currently, the pharmacist need to login to laboratory system to be able to review patient's laboratory result therefore, it is recommended to integrate laboratory and pharmacy systems to link the laboratory value such as HbA1c with antidiabetic agents so, when the pharmacist review any antidiabetic agents the laboratory value appear in the same screen.

Conclusion: The current practice in the management of patients with T2DM in the hospital is not consistent with the ADA guideline recommendations, which necessitate the need to explore the gap behind the actual practice and evidence based guidelines. Furthermore, practical strategies aimed at more effective management of type 2 diabetes patients are strongly required. Programs that both motivate patients to make the important lifestyle changes, and educate practitioners about the international guidelines recommendations to be initiated in the tertiary hospital.

Submission Category: Clinical Services Management

Session-Board Number: 4-044

Poster Title: Assessment of clinical pharmacists' practice patterns in an inpatient setting

Primary Author: Brittany Dillard, Spectrum Health; **Email:** brittany.dillard@spectrumhealth.org

Additional Author (s):
Alexis Peeples
Jessica Rademacher

Purpose: The importance of advancing pharmacy practice by shifting from a primarily dispensing-focused to patient-centered model has been addressed several times, most recently in the Pharmacy Forecast 2016-2020 from the American Society of Health-System Pharmacists (ASHP). In order to align with recommendations to best utilize clinical pharmacists' expertise, we must first identify how pharmacists' time is distributed on a daily basis. This project was designed to quantify conventional and progressive responsibilities of pharmacists at Spectrum Health Butterworth in Grand Rapids, Michigan.

Methods: We conducted a prospective, observational study to evaluate the time commitment of clinical pharmacists fulfilling daily expectations. Clinical pharmacists responsible for internal medicine and cardiology units were directly observed on five non-sequential days by fourth-year pharmacy students. Data was collected to demonstrate time devoted toward conventional and progressive clinical pharmacist activities. Additionally, hospital and unit-based census data was collected on study days.

Results: A total of six clinical pharmacist positions were observed on five separate days. Unit-based pharmacists were each responsible for an average of 83 patients. On average, clinical pharmacists spent 91 percent of available time on observed activities. When adjusted for multi-tasking, the total time spent on conventional and progressive daily activities was eight hours and twenty-seven minutes per eight hour shift. The majority of each pharmacist's shift (54 percent) was spent on conventional tasks, such as order verification, product checking, and medication distribution. Progressive clinical activities represented an average of 35 percent of pharmacists' time. Progressive activities were comprised of medication interventions (11 percent), patient chart review (9 percent), multi-disciplinary rounds (9 percent), and pharmacokinetic monitoring (6 percent). A daily comprehensive chart review was performed on 9 percent of admitted patients on units observed in this study.

Conclusion: Clinical pharmacists' activities observed in this study primarily consisted of conventional tasks, including order verification, product checking, and medication distribution. One-third of pharmacists' time is spent on progressive clinical activities or direct patient care. Continued optimization of pharmacy practice patterns is needed in order to increase time spent on progressive patient care activities. Identification and quantification of daily clinical pharmacists' duties will inform future modifications of the pharmacy practice model at this institution.

Submission Category: Clinical Services Management

Session-Board Number: 4-045

Poster Title: Evaluation of methods for educating pharmacists about pharmacogenomics within a health system

Primary Author: Henry Dunnenberger, NorthShore University HealthSystem; **Email:** hdunnenberger@gmail.com

Additional Author (s):
Jae Shin
Annette Sereika
Peter Hulick

Purpose: Clinical implementation of pharmacogenomics is expanding across the country. Formea et. al. performed a survey of pharmacists indicated that they believe they should be knowledgeable about pharmacogenomics. However, it also identified that 63% of pharmacists did not feel comfortable applying pharmacogenomics results to drug therapy signifying a need for education. Currently, there is a lack of published data on the best method to educate pharmacists about pharmacogenomics. The purpose of this project is to identify an effective, sustainable, and scalable method of educating pharmacists about pharmacogenomics.

Methods: This research project compares two education methods to identify which method is more effective for delivering pharmacogenomics education to health system-based pharmacists. An institutional working group using publically available resources developed the education methods. The methods evaluated were on-demand PowerPoint modules versus on-demand literature-based education. The PowerPoint presentations were available through the health system's electronic learning portal, which included an 'Introduction to Pharmacogenomics' and 'CYP2D6' PowerPoints. The literature-based education method included an 'Introduction to Pharmacogenomics' handout and article and a link to the CYP2D6 CPIC guideline. All Illinois licensed pharmacists within the health system were invited to participate. The pharmacists were required to complete a pre-education survey containing demographic, perception-based and nine knowledge-based questions. Participants were stratified based on practice site and randomized to one of the on-demand educational methods. Immediately after completion of the educational modules, a post-education survey with the same perception- and knowledge-based questions was to be completed. Differences between these perception- and knowledge-based questions were analyzed to determine which

education method was more effective. This project was approved by the institutional review board. McNemar tests were utilized to compare knowledge-based question results from the surveys. Signed rank tests were used to analyze the other questions.

Results: There were 157 pharmacists that were contacted within the health system to participate in this study. A total of 31 pharmacists completed both surveys. 71% of the responses were from the inpatient setting, 13% from the ambulatory care clinic, and 16% from the outpatient oncology center. The on-demand literature group average scores improved by 1.9 questions after completion of the education materials (5.3 vs. 7.2; p=0.0033). The on-demand PowerPoint groups average scores improved by 2.1 questions after completion of the education materials (6.2 vs. 8.3; p=0.00001). When comparing the post-education knowledge-based question results between the literature group and PowerPoint group, the PowerPoint group demonstrated a better average score by 1.1 questions (7.2 vs. 8.3; p=0.023). The PowerPoint materials took approximately 15-60 minutes to complete and the literature-based materials ranged from 15-120 minutes to review.

Conclusion: The results demonstrated that on-demand PowerPoints were more effective at educating pharmacists on pharmacogenomics. Another important factor to consider is the length of time required to complete the educational material, as the educational method must be incorporated into a pharmacist or healthcare provider workflow. Therefore the more efficiently the healthcare provider can be educated on a topic, the more practical it is to incorporate into the healthcare provider's schedule. Based on the results of this study, healthcare providers within the health system will be educated about pharmacogenomics utilizing the on-demand PowerPoint method.

Submission Category: Clinical Services Management

Session-Board Number: 4-046

Poster Title: Practice model transformation across a national health system

Primary Author: Lynn Eschenbacher, Ascension; **Email:** lynnrx@hotmail.com

Additional Author (s):
Roy Guharoy

Purpose: Advancing the practice of pharmacy is extremely important to the future of our profession. Often it is known what is needed to be implemented however getting started can be overwhelming and intimidating. Starting with a few basic steps to develop an action plan with deliverables as well as addressing a culture change with change management are two easy ways to get organized and begin the process. We utilized a workshop with rapid design techniques to create a plan for practice model transformation.

Methods: A national pharmacy dashboard was developed with key performance indicators (KPI) for practice model transformation. The dashboard was programmed using QuickBase with each KPI having its own row and the ability to score based on adherence and implementation. A workshop was conducted to identify: what services and activities were essential, what skills, knowledge and competencies required, how to teach adult learners, any barriers and any other logistical needs. Techniques used in the workshop included post it note affinity brainstorming, round robin discussion and voting with dots to gain consensus. All the information from the workshop was used to develop a timeline with milestones for practice model tranformation.

Results: As a result of the workshop the top identified services and activities were anticoagulation management, pain management, antimicrobial stewardship, total parenteral nutrition management, rounding with physician teams and prospective profile review. In addition, the skill of order verification was identified. Each of these services was then further expanded with the brainstorming to identify all the specific knowledge an d competencies required. Learning techniques to educate the pharmacy team included flipped classroom, small groups, one-on-ones and case based. Competency assessment to ensure retention of the knowledge as well as application of the knowledge included case based and written and oral exams. The national dashboard showed an overall baseline across the 23 states of a 20% compliance with identified key performance metrics. One year after focus and development it is

now 55%. The framework is not established for continued growth and implementation of practice model transformation.

Conclusion: Practice model transformation can be overwhelming to develop a timeline and action plan to get started as well as the culture change for pharmacists and pharmacy technicians. Using rapid design techniques and change management through a workshop structure can help to overcome any overwhelming concerns and more forward implementing advance practice opportunities for pharmacy. Developing and using a national dashboard of key performance indicators for practice model transformation can track baseline and ongoing performance at a local and national level.

Submission Category: Clinical Services Management

Session-Board Number: 4-047

Poster Title: Bridging the gap: characterization of a dual pharmacist role in drug information and investigational drug services

Primary Author: Lauren Karel, Thomas Jefferson University Hospital; **Email:** lauren.karel@jefferson.edu

Additional Author (s):
Rania Sadaka
Cindy Wordell

Purpose: Investigational Drug Services have seen a substantial rise in activity due to increased clinical studies being conducted, particularly in the field of oncology. Investigational Drug Services are often managed by Drug Information departments, thus creating an opportunity for collaboration in work. The purpose of this report is to describe the development of a unique position in pharmacy practice that leverages the knowledge and skill set of a drug information pharmacist in improving Investigational Drug Service workflow and function.

Methods: A drug information pharmacy specialist was deployed to the Investigational Drug Service for orientation and intensive training. Job functions reviewed included investigational product dispensing, inventory management, budget preparation, and administrative roles. Following training, the drug information pharmacist participated in updating standard operating procedures, redesigning workflow, study protocol review, and pharmacy student and resident experiential education.

Results: Staffing levels increased by fifty percent with the incorporation of the drug information pharmacist in the current organizational structure of the Investigational Drug Service. The increased headcount permitted stronger participation by research pharmacists at clinical trial site initiation visits, as well as faster turnaround in the institution for opening clinical trials at the practice site. Efficient protocol review by research and drug information pharmacists enhanced investigator satisfaction and encouraged pharmaceutical industry attention for clinical trials at the site. Creation of standard operating procedures further defined Investigational Drug Service staff roles, including expanded pharmacy technician duties. Research and drug information pharmacists were also given opportunities to collaborate on

drug formulary reviews for the oncology subcommittee of the Pharmacy and Therapeutics Committee and didactic lectures for a Drug Information and Literature Evaluation course.

Conclusion: Drug Information pharmacists play a vital role in many activities that include educating pharmacists, preparing staff reference materials, responding to information queries, and managing formularies and medication use policies. Although revenue generating, Investigational Drug Services are historically understaffed. Expanding Drug Information Services to support Investigational Drug Service operations is a valuable tool to foster growth in this unique pharmacy practice site.

Submission Category: Clinical Services Management

Session-Board Number: 4-048

Poster Title: Extension of clinical pharmacist drug order cancellation

Primary Author: Mariosa Kieran, Mater Misericordiae University Hospital; **Email:** mkieran@mater.ie

Additional Author (s):
Jennifer Brown
Ciaran Meegan

Purpose: In 2009, the MMUH introduced Clinical Pharmacist cancellation of dangerous written drug orders, enabling pharmacists to act when confronted with potentially dangerous prescribing errors. In 2014, an extension of this cancelling role was approved to include cancellation of other drug orders upon verbal agreement or request from a doctor.
This study aims are:
• To introduce pharmacist cancellation of written drug orders on verbal agreement / request of a doctor.
• To review this extension of this Clinical Pharmacist cancelling role 6 months post-implementation

Methods: • Prior to role extension, scenarios where pharmacist cancellation on verbal agreement / request would apply were identified.
• The process for cancellation on verbal agreement / doctor request was incorporated into relevant SOPs to include scenarios suitable for cancellation, documentation requirements and a training procedure.
• Post-intervention, the pharmacist cancellation of drug orders on verbal agreement / doctor request was quantified.

Results: Clinical Pharmacists identified 38 scenarios for potential cancellation on verbal agreement / request over 3 weeks in January / February 2015, primarily involving discontinuation of electrolytes (n = 18).
The extension of the cancellation role was rolled out in February 2015. Updated SOPs were distributed to all Clinical Pharmacists in conjunction with a presentation on the extended cancelling role. Clinical pharmacists completed a training process for this extended role.

In the first 6 months post implementation, 15 drug orders have been cancelled on verbal agreement, with 40 % involving inappropriate paracetamol duplication.

Conclusion: MMUH Clinical Pharmacists can now cancel drug orders on verbal agreement or on request from a doctor. A standardised procedure for cancellation was introduced. The number of drug orders cancelled in the first 6 months post implementation is lower than expected. Causative factors include good availability of doctors on wards at the time of intervention and a reduction in clinical pharmacists fully trained on cancellation due to staff turnover.

Submission Category: Clinical Services Management

Session-Board Number: 4-049

Poster Title: Impact of pharmacy services on the transition of care in the acute care hospital setting

Primary Author: Viktoriya Malamud, Riverview Medical Center; **Email:** vfridman@meridianhealth.com

Additional Author (s):
Kira Fedorenko
Alex Wang

Purpose: The role of a transition of care pharmacist with a focus on medication management has gained attention and shown to improve patient outcomes at the time of transition between community and acute hospital settings. Pharmacists are trained to provide comprehensive medication management and have established themselves as essential components of the medical team. The objective of this study was to evaluate a pharmacist's ability to impact patient care by overseeing the admission and discharge processes from a medication perspective. The pharmacist utilized evidence based guidelines, assisted with formulary access, education and individualized therapy management focusing on high-risk patients.

Methods: An 8 week prospective pilot study was conducted from June to August 2014 at a community hospital. Two pharmacists were assigned to two telemetry units (average 30 beds each) during the hours of 9 – 4:30 PM from Monday to Friday. Pharmacists conducted a comprehensive evaluation of home medication list within 24-48 hours of patient admission utilizing information obtained from patient, patients family members, caregivers, outpatient pharmacies, physician offices, as well as hospital electronic medical records. The accuracy of the medication reconciliation record completed by the Emergency room nurse was compared to the one completed by the nurse in the telemetry unit and finally to pharmacist completed record. The number of discrepancies between the pharmacist and nurse performed medication reconciliation were tabulated along with the pharmacist time spent collecting the accurate medication reconciliation. Upon discharge, the pharmacist reviewed the discharge medication list for drug and disease state interactions, as well as educated patients and their families regarding new medications, disease state management, and compliance. All clinical interventions were documented using a collection tool including renal dose adjustments, drug-interactions, and duplication of therapy, as well as incorrect dose, route or frequency.

Pharmacists played an important role in coordinating patient's therapy at the time of discharge with case management and physicians encompassing the patients insurance and discharge placement.

Results: A total of 233 patient's medication histories were reviewed and collected by pharmacists resulting in 756 identified discrepancies (3.24 discrepancies per patient). These discrepancies included at least one of the following: wrong drug, formulation, dose, frequency, route or missing medication. Additionally, 33% (78/233) of patients required clinical interventions such as drug interactions, renal dosing, contraindications, and restarting home medication. During discharge, a total of 149 patients' were counseled and had their discharge medication list reviewed which resulted in 203 interventions (on average 1.36 interventions identified per patient and 1.16 interventions clarified per patient). Nearly half of these patients (71/149) had one or more of the core diagnosis (Congestive Heart Failure, Pneumonia, Acute Myocardial Infarction, or Chronic Obstructive Pulmonary Disease) and required 106 clinical interventions ranging from renal dose adjustments, to duplication of therapy, drug interactions, or wrong dose.

Conclusion: The program reported a significant number of interventions in improving medication management upon admission and discharge. All healthcare providers have expressed the need to continue this program and expand to 5 units. As pharmacists continue to play an integral role, they have been able to influence physician behavior while improving transition of care. The oversight by pharmacists is pivotal in increasing accuracy of discharge orders, providing education, and coordination of care. Significant interventions captured by pharmacists during this study show that the involvement of pharmacists in the medication reconciliation process reduces errors and improves patient safety.

Submission Category: Clinical Services Management

Session-Board Number: 4-050

Poster Title: Development of a transitions-of-care pharmacist tool to predict 30-day rehospitalization

Primary Author: Laura McAuliffe, Lifespan Corporation; **Email:** laurahunt11@gmail.com

Additional Author (s):
Andrew Zullo
Sergio Petrillo
Ruth Dapaah-Afriyie
Christine Berard-Collins

Purpose: Rehospitalization within 30 days is common and expensive. Existing rehospitalization risk prediction models use complex scores not calculable prior to discharge and do not use variables readily available to pharmacists. Pharmacist-managed transitional care services are effective in reducing rehospitalization rates. However, tools specifically created for use by transitions of care pharmacists before discharge to target their continued services are needed. The objectives of this study are to 1) identify factors associated with an increased risk of 30-day rehospitalization, and 2) develop a practical prediction tool for use by pharmacists to target enrollment in continued outpatient transitions of care services.

Methods: Our retrospective study was comprised of a cohort of 690 patients at Lifespan Health System who had an initial encounter with an inpatient transitions of care pharmacist. Data were extracted from transitions of care pharmacy notes and the electronic medical record. The outcome was the first unplanned rehospitalization to any Lifespan-affiliated inpatient facility within 30-days of discharge. Patients who were 18 years of age or older and admitted to the hospital between December 4th, 2013 and September 30th, 2015 were included. Patients who died within 30 days of hospital discharge were excluded. Univariable and multivariable logistic regression were used to identify predictors of 30-day rehospitalization and develop a prediction tool. We assessed the following categories in our regression model: hospitalization characteristics, demographics, healthcare utilization, comorbidities, medication use, and transitions of care pharmacist encounter characteristics. Discrimination of our model was assessed using the c-statistic. Calibration was assessed using the Hosmer-Lemeshow goodness of fit test.

Results: Mean age of the study cohort was 65 years (SD 13.8) and 54 percent were male. About 40 percent of the subjects had six or more chronic conditions and 43 percent were taking ten or more medications at discharge. The overall risk of 30-day readmission was 14.8 percent. We identified three key predictors of rehospitalization after a pharmacist encounter in the univariable models: having 6 or more chronic conditions at discharge (OR 2.59; 95 percent CI 1.57-4.28), taking greater than ten medications at discharge (OR 1.63; 95 percent CI 1.01-2.65), and having commercial insurance coverage (versus Medicare, OR 0.33; 95 percent CI 0.16-0.68). Another potentially important predictor included the transitions of care pharmacist contacting a prescriber during their index hospitalization (OR 1.36; 95 percent CI 0.89-2.09). In the final multivariable model, having six or more chronic conditions at discharge (OR 1.88; 95 percent CI 1.05-3.36) and commercial insurance coverage (OR 0.40; 95 percent CI 0.18-0.87) remained significant. The model had fair discrimination (C-statistic, 0.66) and good calibration (p-value 0.87). Patients in the highest quintile of rehospitalization risk predicted by our model were 5.8 times (95 percent CI 2.5-13.6) more likely to be readmitted than those in the lowest quintile.

Conclusion: These findings suggest that among patients who see a transitions of care pharmacist during an inpatient hospitalization, comorbidity burden and insurance coverage are most predictive of 30-day rehospitalization. Our prediction tool has fair discriminative ability, good calibration, and may assist transitions of care pharmacists with selection of patients for additional post-discharge follow-up and care to avoid rehospitalizations.

Submission Category: Clinical Services Management

Session-Board Number: 4-051

Poster Title: The effect on medication reconciliation through implementation of a pharmacy technician and pharmacist team in the emergency department

Primary Author: Kelly McNorton, Windsor Regional Hospital; **Email:** kelly.mcnorton@wrh.on.ca

Additional Author (s):
Antoinette Duronio

Purpose: Medication reconciliation is an integral step in ensuring accurate medication delivery to patients in an effort to reduce risk of medication related errors at transitions of care. As part of a quality improvement initiative to increase medication reconciliation and to enhance pharmacy services, a pharmacy technician and pharmacist team was implemented to service the emergency department (ED) in a community hospital. Measurable outcomes include the number of medication reconciliations completed, the percent of medication reconciliations completed based on ED admissions, pharmacist interventions, medication turn around time (TAT) and healthcare provider satisfaction.

Methods: A regulated pharmacy technician and pharmacist team were positioned in a 252 bed community hospital ED. The team provided services for 8 hours a day, 5 days per week. All technicians involved were educated on best possible medication history taking, medication reconciliation and customer service training program. A four week pilot was initiated in September 2015, four different pharmacists and technicians were scheduled one week intervals in the ED. The roles and responsibilities for both the pharmacist and pharmacy technician were outlined and reviewed. Pharmacy technician specific roles included: order entry, clarifying orders, obtaining additional information on patient demographics and allergies, obtaining best possible medication histories, delivering medications to automated dispensing units, delivering urgent medications from central pharmacy, and checking immunization fridge temperature. Pharmacist specific roles included verification and clinical assessment of medication orders, clarifying orders, medication administration record (MAR) printing, medication reconciliation, renal dose adjustment, therapeutic substitutions, antimicrobial stewardship, warfarin management and providing drug information. This study reviews data three months pre- and post-implementation of ED pharmacist and pharmacy technician team. Descriptive statistics were used to describe categorical variables and data are expressed as percentages or means.

Results: The pharmacy team completed 112 medication reconciliations pre-implementation compared to 272 post-implementation. The total (1219 versus 1386) and average (406 versus 462) number of admissions through the ED were similar pre-and post-implementation between the two groups. There was a significant difference in the percentage of medication reconciliations completed based on the number of patients admitted pre- and post-implementation (9.2 percent versus 19.6 percent, p value less than 0.0001). The number of clinical interventions documented by the pharmacist was lower post-implementation (36 versus 18, p value less than 0.05). Central pharmacy workload was reduced as the mean number of orders processed by the ED pharmacist team post-implementation was 10 871 orders per month. Furthermore, mean medication TAT decreased from 64.28 to 60.41 post-implementation (p value 0.4). A survey was sent to nursing and pharmacy staff to assess satisfaction of pharmacy team services in the ED. All healthcare providers who participated indicated that pharmacy availability to clarify orders, answer questions, and complete medication reconciliation were improved or much improved post-implementation of the pharmacy team in ED.

Conclusion: Implementation of a pharmacist and pharmacy technician team in the ED significantly increased the percentage of medication reconciliations completed. Medication TAT did not differ post-implementation and the number of interventions documented by the pharmacist decreased. The decentralized pharmacy team improved nursing and pharmacy satisfaction by allowing accessibility to answer medication related questions, clarify orders quickly and resolve MAR discrepancies.

Submission Category: Clinical Services Management

Session-Board Number: 4-052

Poster Title: Implementing policy to reduce hypnotic use to decrease falls

Primary Author: Parth Patel, Silver Cross Hospital; **Email:** ppatel@silvercross.org

Additional Author (s):
Michael Sweany
Frank Butler

Purpose: The association between hypnotics and potential for falls has been identified in previous literature. In efforts to increase patient satisfaction, physicians will commonly offer a sleeping agent to patient. No data suggests that patients' sleep improves with the use of these agents. Also, there is lacking evidence to support better outcomes for these patients who use hypnotics or detrimental effects to sleep deprivation in short term hospital stays. Our policy was designed to limit use of these agents to help reduce the risk of patient falls.

Methods: A policy was designed to stop order for zolpidem and estazolam for patients' initial 48hrs of admissions. If documented sleep was less than 4 hr in the first 48hrs of admission, an order for a sleep aid was accepted. If a hypnotic was administered for sleep, patients were deemed a high fall risk with all institution precautions placed. Also, a non-pharmacological sleep protocol was devised to help aide in sleep induction for individuals to avoid usage of hypnotics and increase patient satisfaction in the initial 48 hours after admission. Education to physicians was explained at various group meetings.

Results: Usage of administer hypnotics decrease by 50%. Falls dropped from an average of 2 falls/month associated with hypnotic usage within 24 hours to no attributable falls for 3 consecutive months.

Conclusion: This policy design was highly successful in decreasing hypnotic use and falls.

Submission Category: Critical Care

Session-Board Number: 4-054

Poster Title: Age-specific effects of an analgesia and sedation protocol in neurocritical care patients

Primary Author: Leana Mahmoud, Lifespan/Rhode Island Hospital; **Email:** lmahmoud@lifespan.org

Additional Author (s):
Andrew Zullo
Corey Fehnel
Bradford Thompson
Linda Wendell

Purpose: Specific guidelines for the management of pain and agitation among neurocritically ill patients do not currently exist. We developed an analgesia and sedation protocol in our neurocritical care unit (NCCU) to optimize management of pain and agitation in our patients. Protocol effectiveness may differ by age due to physiologic differences between older and younger patients. In particularly, older patients may have more drug accumulation due to declines in organ system function and the lipophilicity of the protocol drugs. The objective of this study was to measure the age-specific protocol effects on mortality, health service utilization, and costs.

Methods: We conducted a retrospective cohort study of patients admitted to our NCCU between 2/1/2011 and 1/31/2013 before the protocol was implemented and between 2/1/2013 and 1/31/2015 after the protocol was implemented. All intubated patients were included except for those with a diagnosis of status epilepticus due to higher doses of sedatives needed. Pain was assessed using the Critical Care Pain Observation Tool and was treated with fentanyl. Agitation was assessed using the Richmond Agitation and Sedation Scale and treated with propofol (first-line) or midazolam (second-line). Patients were stratified into two groups by age: those less than 65 years and those 65 years of age and older. To estimate the age-effect of the protocol on outcomes, we used log-binomial regression for mortality and gamma regression with a log link for costs and length of stay. All regression estimates were adjusted for linear time trends.

Results: A total of 1197 patients were included the study population: 576 prior to and 621 after protocol implementation. There were 688 patients who were 64 years old or younger, of whom 348 (50.6 percent) were on protocol, and 509 who were 65 years or older, of whom 273 (53.6 percent) were on protocol. Patients in the older group were less likely to be male (49.1 vs 62.8 percent) and to be admitted for a traumatic brain injury (19.3 vs 24.6 percent) or subarachnoid hemorrhage (11.8 vs 17.2 percent)(p-value for all less than 0.001). The effect of the protocol was similar in each age group for most outcomes, including mortality, total hospital costs, intensive care costs, hospital length of stay, and intensive care length of stay. However, the effect of the protocol on ventilator days appeared to differ by age group (older group RR 0.94, 95 percent CI 0.60-1.48; younger group RR 1.61, 95 percent CI 0.96-2.69; p-value for interaction less than 0.01). Similarly, the effect of the protocol on respiratory care costs differed by age (older group RR 0.91, 95 percent CI 0.57-1.46; younger group RR 1.46, 95 percent CI 0.89-2.40; p-value for interaction less than 0.001).

Conclusion: The neurocritical care unit analgesia and sedation protocol did not appear to have age-specific effects on most patient outcomes. However, the effect of the protocol on ventilator days and respiratory care costs may differ by age group.

Submission Category: Critical Care

Session-Board Number: 4-055

Poster Title: Effect of modafinil on cognitive function in intensive care unit patients: a retrospective cohort study

Primary Author: Yoonsun Mo, Western New England University; **Email:** yoonsmo@gmail.com

Additional Author (s):
Michael Thomas
Todd Miano
George Karras
Adam Sakiel

Purpose: Modafinil, a non-amphetamine cognitive enhancing agent, holds the potential to improve recovery from cognitive impairment after intensive care unit (ICU) admission. Its safety profile, low potential for abuse compared to conventional stimulants, and lack of drug interactions makes modafinil an attractive agent for use in ICU patients. To date, however, there is a paucity of data on modafinil use in the ICU setting. The purpose of this study was to determine whether the administration of modafinil to ICU patients improved their cognitive function by promoting wakefulness.

Methods: This was a retrospective cohort study conducted at Mercy Medical Center (MMC), a 336-bed community hospital. Institutional review board (IRB) approval was obtained before data collection commenced. Between January 1, 2010 and March 19, 2016, all patients aged 18 and older who were admitted to the ICU for at least 24 hours and initiated on modafinil while in the ICU were evaluated for eligibility. Other inclusion criteria included modafinil therapy for more than 48 hours and the need for ventilatory support at the time of modafinil administration. The primary objective was to determine the effectiveness of modafinil on improving cognitive function in ICU patients. The lowest Glasgow Coma Scale (GCS) scores and requirements of opioids, benzodiazepines, and propofol were recorded during 48 hours, divided in 6- to 12-hour periods, before and after the start of modafinil therapy. Non-parametric repeated measures statistical analysis was used to account for the skewed distribution of the data. GCS scores over time were examined with the Friedman test, followed by pairwise signed rank tests using the Bonferroni correction (alpha was set to 0.005 for pairwise comparisons). The secondary objective was the proportion of patients who experienced a serious adverse event during modafinil treatment. Chart reviews of clinical

progress notes and nursing flow sheets were used to identify possible adverse events related to modafinil.

Results: Patient data from 38 eligible patients ranging in age from 52 to 83 years (mean, 68 years) with a male to female ratio of 1to1 were included in the analysis. Twenty-one patients (55 %) required invasive mechanical ventilation at the start of modafinil administration. The average daily modafinil dose was 180 mg (SD equals 37.7 mg) and was given for an average duration of 9 days. The median GCS score between 6 and 0 hours prior to modafinil administration was 11.0 (IQR 9-13). GCS increased significantly after modafinil (Friedman test, p less than 0.0001). GCS was higher at 0-6 hours (median 12.5 [10-15], p equals 0.0001) and 6-12 hours (median 11.5 [10-15], p equals 0.0022). GCS was not different at 18-24 hours (median 11.0, [9-15], p equals 0.0094), but increased further at 36-48 hours (median 14 [10-14], p less than 0.0002). The requirements of opioids and sedatives during the first 6 hours prior to modafinil administration were not significantly different from post-treatment time periods (0-6, 0-12, 0-24, and 0-48 hours). None of the patients in this study experienced any major adverse effects associated with modafinil therapy.

Conclusion: Despite the inherent limitations associated with the retrospective nature of this study, the findings suggest that modafinil shows promise of improving cognitive function in ICU patients. This investigation provides unique insight into the potential use of modafinil in a wide variety of ICU patients. However, additional studies are needed to determine whether modafinil has an effect on patient outcomes in the ICU.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-056

Poster Title: Evaluation of stress ulcer prophylaxis in non-critically ill patients in a regional community hospital

Primary Author: Shannon Allcron, Owensboro Health Regional Hospital; **Email:** shannon.allcron@owensborohealth.org

Additional Author (s):
Kristan Vollman

Purpose: Administration of stress ulcer prophylaxis (SUP) is common among hospitalized patients. In 1999, the American Society of Health-System Pharmacists published guidelines on SUP. The main indications for SUP is critically ill patients requiring mechanical ventilation or with coagulopathy. The guidelines do not recommend SUP in the non-intensive care unit setting. However, these medications are often continued upon transfer from the intensive care unit (ICU) in patients who were not receiving these classes of medications prior to hospital admission. Prolonged administration of these medications can lead to adverse events such as Clostridium difficile infection or pneumonia. In an effort to characterize the use of inappropriate SUP in a regional community hospital, we sought to evaluate current practice in non-critically ill patients.

Methods: Approval was obtained from the Institutional Review Board. This was a retrospective, randomized chart review of 50 patients admitted to the study institution between January 1, 2016 and March 31, 2016 who received a histamine-2 receptor (H2RA) antagonist or proton pump inhibitor (PPI). Patients were excluded if they were on a H2RA or PPI prior to admission, were admitted for gastrointestinal bleeding or required chronic mechanical ventilation prior to admission. Patients with as needed and one-time orders for these medications were also excluded. Stress ulcer prophylaxis was deemed inappropriate if patients were not in the ICU. Data collected included total days of inappropriate SUP, hospital and non-ICU length of stay (LOS), medication initiated, service of ordering provider, and presence of Clostridium difficile diarrhea or pneumonia after the initiation of SUP. Descriptive statistics were utilized to present the data.

Results: Of the 50 patients reviewed, 27 (54 percent) were female with a mean (± standard deviation, SD) age of 60.9 ± 17.7 years. The mean (± SD) hospital and non-ICU LOS were 7.5 ±

5.4 days and 6.4 ± 4.9 days, respectively. The mean (± SD) total days of inappropriate SUP was 5.1 ± 4.6 days. Ninety percent (45/50) of patients received a PPI and 38 percent (19/50) of patients were discharged on SUP therapy. Seventy-two percent (36/50) of patients were initiated on SUP but never admitted to the ICU. Hospitalists, internal medicine and general surgery initiated inappropriate therapy in 68 percent (34/50) of the study population. For therapy initiated by general surgery providers, 67 percent was ordered from an order set. There were no patients treated for Clostridium difficile infection or pneumonia after having SUP initiated.

Conclusion: The results of this single-center retrospective study indicate opportunity with hospitalists, internal medicine physicians and general surgery physicians for decreasing the use of inappropriate SUP. A review of general surgery order sets may be appropriate to remove SUP as an option. The absence of Clostridium difficile infection or pneumonia was likely due to patients only being evaluated while inpatient and receiving either a H2RA or PPI. The discontinuation of inappropriate SUP represents a vital area for pharmacist intervention to prevent adverse drug events and prolonged length of therapy.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-058

Poster Title: Restricting intravenous acetaminophen use: effectiveness of an institutional approach

Primary Author: Jason Babby, The Mount Sinai Hospital; **Email:** jason.babby@mountsinai.org

Additional Author (s):
Jashvant Poeran
Nicole Zubizarreta
Karen Banoff
Madhu Mazumdar

Purpose: Although widely used, the utility of intravenous (IV) acetaminophen relative to its price is still controversial. While there is a variation in the type of restrictions applied in the institutional setting, information is lacking on their effectiveness. Therefore, we aimed to study the effectiveness of the approach to limit IV acetaminophen ordering at our hospital (>1000-bed, tertiary-care urban teaching hospital): from June 2014 on, electronic ordering was restricted to 1) specific services (Anesthesia, Pain Service, Palliative Care, Cath Laboratory, Pediatrics), 2) only nothing-by-mouth patients, and 3) orders active for 24 hours except for Palliative Care.

Methods: All IV acetaminophen orders from June 2012 to June 2015 were extracted and plotted it by monthly intervals for time series analysis to estimate changes between the period before (24 months) and after the restriction (13 months). A segmented regression analysis assessed immediate changes (change in intercept of the plotted line) and changes over time (change in slope of the plotted line) in ordering behavior while controlling for baseline trends. This is the strongest quasi-experimental approach for evaluating longitudinal effects of policy implementations. Analyses were performed for institution-wide IV acetaminophen orders as well as stratified by 1) type of ordering provider (residents versus others including physician assistants, fellows and attendings), 2) top 30 most frequent prescribers versus others, and 3) type of orders (‘once every 4 hours’ [the current default] versus other order types including ‘once’ and ‘once every 4 hours AS NEEDED’).

Results: Overall, IV acetaminophen use increased sharply from 435 (June 2012) to 1,342 (June 2015) orders/month with residents and anesthesiology providers ordering the most. Following

the restriction, IV acetaminophen orders briefly decreased (intercept change -326 orders/month; P=0.002) only to increase again and exceed pre-intervention levels with the same positive slope as before the intervention (P=0.257). The restriction did not change ordering behavior among residents (intercept change -137 P=0.075; slope change +5.2 P=0.514) while other types of ordering providers did demonstrate changes. Moreover, the restriction did affect the top 30 prescribers (intercept change -279 P=0.001; slope change -24.1 P=0.003) while not significantly affecting less frequent prescribers. 'Once every 4 hours' orders greatly decreased after the restriction (intercept change -348 $P < 0.001$; slope change -37.7 $P < 0.001$) while 'once' orders- increased (slope change +24.9 $P < 0.001$) and 'once every 4 hours AS NEEDED' did not change.

Conclusion: Overall, it appears the restrictions at our hospital did not affect long term IV acetaminophen prescribing behavior. Our results; however, provide useful insights into the groups to target (residents, non-frequent prescribers) as well as additional changes in the electronic ordering of IV acetaminophen, e.g. changing the default order from 'once every 4 hours' to 'once every 4 hours AS NEEDED', or even to just 'once'. These changes are currently under discussion at our institution; continued monitoring will provide insights into the effectiveness of these interventions which might prove useful to other institutions as well.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-059

Poster Title: Utilization of intravenous acetaminophen in a small community hospital: two years later

Primary Author: Leslie Barefoot, Carteret Health Care; **Email:** lmbarefoot@ccgh.org

Additional Author (s):

Purpose: Intravenous acetaminophen (Ofirmev) was submitted for formulary consideration to the Pharmacy and Therapeutics (P&T) Committee at Carteret Health Care (CHC) in January 2014. The committee chose not to add this medication to formulary at that time, citing cost concerns and other alternatives already on formulary. In June 2014, the P&T committee was again asked to consider the addition of the medication to formulary by anesthesia. At that time, the committee decided to add the medication to formulary, restricting its use the perioperative setting for one-time dosing administration. The purpose of this retrospective medication use evaluation is to characterize the utilization Ofirmev at CHC.

Methods: Patients who received Ofirmev from January 2014 through May 2016 were evaluated for age, height, weight, sex, indication for use, medical insurance status, and cost to the institution. In addition, the length of hospital stay and the total amount of opioids administered were collected. This data was then analyzed for further use.

Results: Over the past 2.5 years, a total of 51 patients were identified as receiving Ofirmev, accounting for a total of 52 medication orders. The average age of patients was 19.9 years (range 1.25-81 years). The majority of patients (72.5%) receiving this medication were pediatric patients and 64.2% of these patients were female. At CHC, anesthesia was found to utilize Ofirmev 84.6% of the time, hospitalist 5.7%, orthopedist 3.8%, general surgeons 1.9%, otolaryngologist 1.9%, and oncologist/hematologist 1.9% of the time. Each of these patients received no greater than one vial, with the exception of one patient who received 20 vials during their hospitalization. From January 2014 through May 2016, the cost of a vial of Ofirmev increased by approximately 300%.

Conclusion: Results from the medication use evaluation demonstrate the need to further educate health care providers at CHC about the formulary restriction of Ofirmev. This also

highlighted the need for further education surrounding appropriate patient selection in order to help minimize cost and optimize patient care.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-060

Poster Title: Effect of patiromer on serum potassium in hyperkalemic patients with Type 2 diabetes on RAAS inhibitors with or without insulin therapy for diabetes

Primary Author: Wade Benton, Relypsa, Inc.; **Email:** wbenton@relypsa.com

Additional Author (s):
Patrick Rossignol
Coleman Gross
Susan Arthur
Matthew Weir

Purpose: Patiromer, a sodium-free non-absorbed potassium-binding polymer that uses calcium as the counter-exchange ion, is approved in the U.S. for the treatment of hyperkalemia. A prespecified subgroup analysis of the Phase 3 OPAL-HK study showed no difference in the mean reduction from baseline in serum K at Week 4 with patiromer in patients with hyperkalemia and chronic kidney disease (CKD), with and without diabetes mellitus type 2 (DM2) (p=0.77 for interaction). Here we analyzed pooled data from patients with DM2 in OPAL-HK and a Phase 2 study (AMETHYST-DN) to determine if daily insulin use modifies patiromer's effects on serum K-lowering.

Methods: This was a post-hoc pooled analysis of DM2 patients treated with patiromer (N=443) in two studies of the treatment of hyperkalemia in CKD. In AMETHYST-DN (NCT01371747), a randomized, open-label, 52-week study, all (n=304) patients had DM. In the 4-week, single-blind, initial treatment phase of OPAL-HK (NCT01810939), 139 patients (57%) had DM2. Entry serum K (based on local laboratory values) was >5.0 to < 6.0 mEq/L and 5.1 to < 6.5 mEq/L, respectively, and patiromer starting doses were 8.4-33.6 g/d and 8.4-16.8 g/d, respectively. Difference between DM2 patients using insulin (DM2+ins) vs those not using insulin (DM2-ins) for change in serum K (central laboratory) from baseline through 4 weeks (when all patients were on patiromer) was analyzed using mixed-effect model repeated measure (MMRM) adjusted for baseline serum K, study, and patiromer starting dose. Data are shown as mean±SEM.

Results: In the pooled analysis, 177 (40%) patients used insulin, 87.6% of whom used a short- or rapid-acting insulin. Compared to DM2-ins (n=266), DM2+ins had higher baseline mean±SEM

serum K (5.44 ± 0.030 vs 5.36 ± 0.023 mEq/L, P < 0.05, analysis of variance), HbA1c (7.80 ± 0.12 vs 6.96 ± 0.09%) and time since DM2 diagnosis (18.3 ± 0.63 vs 10.4 ± 0.42 yr); stage of CKD, eGFR, and BMI were similar between groups. At Week 4, the LS-mean±95% confidence interval for change from baseline in serum K and proportion of subjects who achieved target range serum K (3.8–5.0 mEq/L) were similar in DM2+ins and DM2-ins (change in serum K: −0.84 ± 0.04 vs −0.78 ± 0.03 mEq/L, P < 0.0001 vs baseline for both; proportion of patients with target range serum K: 85.4% [79.0, 90.5%] vs 86.7% [81.8, 90.7%]). The frequency of serum K values < 3.5 mEq/L with patiromer was 2.0% in DM2 patients (1.1% in DM+ins and 2.6% DM-ins). Patiromer was generally well tolerated. At least one adverse event (AE) was experienced by 28.4% of DM2 patients. The most common individual AE was constipation (DM2: 6.1%; DM2+ins: 7.3%; DM-ins: 5.3%); all constipation events were mild or moderate in severity.

Conclusion: This is the first report on the effect of a potassium binder on serum K in patients with hyperkalemia receiving daily subcutaneous insulin injections for diabetes. In this analysis, patiromer reduced serum K in hyperkalemic patients with CKD and diabetes irrespective of daily insulin use.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-061

Poster Title: Drug information resources in community pharmacies in Ohio

Primary Author: Katlyn Brown, Ohio Northern University; **Email:** k-brown.2@onu.edu

Additional Author (s):
Mary Ellen Hethcox
Karen Kier

Purpose: Pharmacists are one of the most accessible health care providers, and as such, are in a position to impart more information to patients about medications, including specific questions about their prescribed medications, as well as alternative options. Additionally, with increased patient care services and an expanded collaborative practice approved in Ohio, specialty resources are necessary to provide the best information. This responsibility means that it is extremely important for pharmacists to have access to appropriate resources.

Methods: A survey of community pharmacists in Ohio was designed to determine which resources are readily available, are pharmacists comfortable with their resources, are they equipped to use them, and are the resources appropriate for the services the pharmacy offers. This survey was distributed via email through Qualtrics Surveying Tool with the candidates obtained through a list of community pharmacies by the Ohio Board of Pharmacy. The institutional review board of the university approved the study and informed consent was implied by participation in the survey as per the directions in the email. Respondents were categorized by large chain community, small chain community, independent, or clinic/outpatient. Descriptive and inferential statistics were utilized. The Pearson chi-square test was used to analyze data where appropriate.

Results: A total of 318 of 2067 surveys were received. Respondents represented the entire survey population – 67.6 percent (pct) large chain community, 20.1 pct community independent, 6.6 pct small chain community. Reported prescription volume was a mean of 280 per day. A statistical difference was noted for the most frequently reported accessible resources per pharmacy type: Drug Facts and Comparison (64.7 pct electronic, 15.4 pct paper, p less than 0.152 and 0.014), Ohio Laws (73.3 pct electronic, 32.1 pct paper; p less than 0.046 and 0.009), Federal Laws (51.9 pct electronic, 11.3 pct paper; p less than 0.442 and 0.027), and Clinical Pharmacology (46.2 pct electronic; p less than 0.023). Eighty percent of pharmacies

reported participation in medication therapy management and immunizations. Large chain community pharmacies reported more involvement with immunizations (p equal to 0.000), while independent pharmacies reported more involvement with medication therapy management (p less than 0.004). While pharmacists are performing these extra services 17 pct reported they were not trained with how to use their resources. In addition, 33 pct stated that they would like access to more resources to better serve their patients. Concern was noted that 30 pct have no internet access in the pharmacy.

Conclusion: Through this research, pharmacy schools can better equip their students for the types of resources to which they will have access in the community pharmacy setting to serve their patients. Advocacy for better resource usage and targeted educational campaigns on resources will help improve drug information provided in community pharmacies.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-062

Poster Title: Evaluation of the diabetic ketoacidosis protocol within a community healthcare system

Primary Author: Kathleen Calkins, Creighton University; **Email:** kathleencalkins@creighton.edu

Additional Author (s):
Stacey Dull
Ryan Dull
Erin Santiago

Purpose: Diabetic ketoacidosis (DKA) is an acute, potentially life-threatening hyperglycemic emergency in patients with diabetes mellitus which increases morbidity and mortality if not treated appropriately. In our community healthcare system, treatment of DKA is protocol-driven and reportedly based on the current American Diabetes Association (ADA) guidelines; however, many healthcare professionals feel the protocol is inadequate and may not achieve these goals. The primary objective of this study was to determine if our community healthcare system's DKA protocol achieves the glycemic targets established by the ADA guidelines for hyperglycemic crises.

Methods: A retrospective chart review of adult patients admitted to a CHI Health legacy hospital from January 1, 2015 through April 30, 2015 with a diagnosis of DKA as defined by the ADA was performed. The primary outcome was the proportion of adults who achieved the recommended rate of blood glucose decline during the acute phase. According to the ADA, an appropriate rate of blood glucose decline during the acute phase is defined as a drop in blood glucose of 50-75 mg/dL/hr. The secondary outcome was the proportion of patients who achieved the recommended target blood glucose during the maintenance phase. This phase was reached once the blood glucose was less than or equal to 200 mg/dL for 1 point of care blood glucose test (POCT). According to the ADA, the target blood glucose during this phase should be 150-200 mg/dL. Data were collected for each POCT while the patient was receiving intravenous insulin. Patients were excluded if they received subcutaneous insulin without intravenous insulin, the institution's DKA protocol was not used to order their insulin or if they were pregnant. Safety outcomes included serum potassium concentration during intravenous insulin therapy, inappropriate rate adjustments and hypoglycemia (blood glucose less than 70 mg/dL).

Results: A total of 147 DKA cases were reviewed with 24 cases meeting the inclusion criteria. During the acute phase, a total of 172 POCT were performed for all patients. An appropriate rate of blood glucose decline was observed in 11 percent of these tests, while over 70 percent showed a blood glucose decline that was less than 50 mg/dL/hr. During the maintenance phase, a total of 335 POCT were performed for all patients. The target blood glucose of 150-200 mg/dL was achieved for 23.3 percent of these tests, while over 70 percent showed an elevated blood glucose of greater than 200 mg/dL. Inappropriate insulin rate adjustments according to the institution's protocol were made for 35.5 percent of the total POCT during the acute and maintenance phases combined. A total of 8 patients experienced a serum potassium concentration less than 3.3 mmol/L while receiving intravenous insulin. No episodes of hypoglycemia were observed while receiving intravenous insulin.

Conclusion: Our community healthcare system's DKA protocol does not adequately achieve the glycemic targets established by the ADA guidelines for hyperglycemic crises. Blood glucose decline during the acute phase was slower than recommended for more than half of patients. Similarly, blood glucose levels were above the recommended target range for the majority of patients. No patients experienced episodes of hypoglycemia while receiving intravenous insulin. The results of this analysis are currently being used to make evidence-based revisions to the institution's DKA protocol which will enhance achievement of ADA established glycemic targets.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-063

Poster Title: Assessment of potential cost-savings with use of newer antimicrobial agents in a small community outpatient infusion center in Hawaii

Primary Author: Cherie Chu, University of Hawaii at Hilo Daniel K. Inouye College of Pharmacy; **Email:** chucheri@hawaii.edu

Additional Author (s):
Alexander Guimaraes

Purpose: Outpatient infusion centers are utilized to treat patients requiring prolonged intravenous antibiotic therapy for certain infections. Development of antimicrobials that have a shorter duration of therapy, and improvements in price points of oral formulations create opportunities for cost-savings. These agents could decrease costs associated with office visits, drug administration, and procurement as well as overall medical costs. Antimicrobials identified as opportunities for cost-savings for those diagnosed with soft skin and tissue infections (SSTIs) include: oral linezolid and intravenous oritavancin. The objective of this medication use evaluation was to evaluate outpatient antimicrobial use and potential opportunities for cost-savings.

Methods: We performed a retrospective descriptive study of patients who received outpatient parenteral antimicrobial therapy from September 1, 2013 to March 31, 2016. Antimicrobial agent, indication and duration of therapy were documented for each patient. Cost analysis was completed using data from patients who had cellulitis, a type of SSTI, as an indication. Facility specific drug acquisition costs, actual duration of therapy, and proposed duration of therapy for oral linezolid and intravenous oritavancin were accounted for in the cost analysis.

Results: During the study period 49 patients received orders for outpatient parenteral antimicrobial therapy. The most common indications for antimicrobial therapy were osteomyelitis and cellulitis. The most common antimicrobial agents used were ceftriaxone and ertapenem. Cost analysis showed that if oral linezolid or single dose intravenous oritavancin was utilized for cellulitis, estimated cost-savings would be $20,579.94 and $16,013.25 respectively.

Conclusion: Treatment of SSTIs was identified as an area of possible cost-savings for patients utilizing the outpatient infusion clinic. While direct drug costs for oral linezolid and single dose injectable antimicrobial agents like oritavancin may be greater than other treatment regimens, they may prove useful due to decreased administrative costs associated with their use.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-064

Poster Title: Review of patient controlled analgesia orders in a medical and surgical hospital

Primary Author: Ma Chu, University of Missouri - Kansas City School of Pharmacy; **Email:** mcmn8@mail.umkc.edu

Additional Author (s):
Eric Wombwell
Kristin Peterson
Kevin Briner
Nicholas Ngugi

Purpose: Patient controlled analgesia (PCA) is used in a hospital to control severe acute pain often related to a surgical procedure or cancer. Utilizing a PCA for pain control allows the patient to self-administer pain medication resulting in better control of pain. If a PCA order is over or under recommended parameters this can result in excessive sedation or inadequate pain control, respectively. The goal of this review was to evaluate the current prescribing and utilization practices of PCAs at our facility to assess the frequency at which PCA doses were initiated within usual recommended parameters and consequences of initiation dosing.

Methods: A retrospective review was conducted of inpatient PCA orders and chart documentation from September 1st to November 30th 2015. Opioids available in PCA form include fentanyl, morphine, and hydromorphone. The primary parameters examined were PCA dose, lockout interval, continuous rate, 1-hour limit, and loading dose. The secondary parameters examined include numerical pain score pre/post PCA dose administration, naloxone administration, frequency of respiratory depression or excessive sedation, and frequency of emergency medical team called during PCA therapy. The data was analyzed using descriptive statistics. Patients receiving continuous infusions of intravenous opioids were excluded from analysis.

Results: A total of 117 inpatients were included in analysis. Hydromorphone was the most frequently used agent for PCA occurring in 47.9 percent of patients, followed by morphine in 41.9 percent, and least frequently, fentanyl in 11.1 percent of patients. The PCA dose, lockout interval, continuous infusion rate, and 1 hour limit were all within their particular recommended ranges (99.1 percent, 100 percent, 99.1 percent, and 93.2 percent, respectively).

A loading dose was ordered for 76 percent of patients, all of which were within the recommended range; a loading dose was not ordered for 24 percent of patients. Pain was assessed by utilizing a 0-10 numeric pain scale and documented, pre- and post-PCA dose, in 12.8 percent of patients. Naloxone was administered to antagonize the effects of the PCA in 2.6 percent of patients. Frequency of respiratory depression or excessive sedation occurred in 1.7 percent of patients. Of the 117 patients, no emergency medical attention was necessitated as a result of PCA use.

Conclusion: PCA initiation dosing was within recommended parameters in nearly all reviewed patients. Very few circumstances were out of range. Respiratory depression and excessive sedation when documented in this review were not connected to PCA dosing outside of usual recommended parameters. The PCA 1-hour limit was the parameter most often out of range, with the majority over the recommended maximum dose. A low percent of pre- and post-PCA pain scores were identified in this study. An identified area for improvement was documentation of pre- and post-PCA pain scores.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-065

Poster Title: Evaluation of medicine information practice addressed towards nurses at hospital wards at the capital region of Denmark

Primary Author: Lene Colberg, The Hospital Pharmacy, The Capital Region of Denmark; **Email:** lene.colberg@regionh.dk

Additional Author (s):
Helle Armandi

Purpose: The Medicine Information Centre provides drug information to healthcare professionals employed in the Capital Region of Denmark.
Approximately 30 % of all hospital employees in the region are nurses, but even though nurses are the major healthcare profession at the hospitals, and although nurses are largely responsible for handling drugs in hospital wards, this is not reflected in the number of enquiries received from nurses to the Medicine Information Centre.
As the long-term goal of The Medicine Information Centre is to optimize drug Information towards this particular healthcare profession, the aim of this presentation is to evaluate previous medicine information practice towards nurses, motivated by the determination to strengthen the Medicine Information Centre efforts to meet the hospital nurses needs.

Methods: A 5 year retrospective study of enquiries made by nurses employed at hospitals in the Capital Region of Denmark to the Medicine Information Centre was conducted.
Data was collected from the Q&A database SAID. All enquiries from nurses were differentiated by categories, in order to determine top categories. Furthermore it has been identified which electronic databases in terms of medicine-tools and -guides the Medicine Information Centre supply to nurses. Daily hits has been counted and used to express the extent of use of the services.

Results: Data collected from the Q&A database SAID shows that 5143 cases were conducted in the period from 01.01.11-01.01.16. Of these 934 originated from nurses, which equals 18 % of all enquiries received. Provided that each nurse only asks once, this corresponds to 1.6 % of all nurses in the region using the Medicine Information Centre. However pharmacy staff at wards

also contacts the Medicine Information Centre with drug related enquiries and it is unknown how many of these enquiries origin from nurses. Enquiries are differentiated into 15 categories; but data reveals that the vast majority of questions from nurses lies within the categories product information (19%), dosing and administration (26%) and storage and stability (13%). Furthermore the Medicine Information Centre offers intranet guides, made to support nurses in practical handling of medicines, such as an injectable drugs guide. Daily hits on this database were estimated to 740 hits in 2013.
Another intranet tool is a list of crushable tablets, with 3409 hits per year; this equals a daily average of 10 hitsfrom hospital staff, however it is impossible to determine to which extent this tool is used by nurses alone, as any hospital profession has access to this list.

Conclusion: This poster is to present the Medicine Information Centre current status of drug information aimed at nurses in the Capital Region of Denmark, in order to refine and enhance cooperation further.
Hospital employed nurses are potentially a very large group of enquirers at the Medicine Information Centre, however it seems there is a great potential to target medicine information towards this particular group of healthcare professionals.
Results of this evaluation indicate that nurses tend to use electronic services that are specific and easily accessible rather than contacting The Medicine Information Centre in person.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-066

Poster Title: Sodium-glucose cotransporter2 (SGLT2) inhibitor utilization evaluation at a community hospital

Primary Author: Marsha Crader, University of Arkansas for Medical Sciences; **Email:** mfcrader@uams.edu

Additional Author (s):

Purpose: The sodium-glucose cotransporter 2 (SGLT2) inhibitor class has received multiple safety warnings from the Food and Drug Administration (FDA) since it was first introduced to the market. In an effort to ensure patient safety, a community hospital's Pharmacy and Therapeutics Committee completed a medication utilization evaluation (MUE) for its formulary SGLT2 inhibitor. The purpose of the MUE was to identify if SGLT2 inhibitor use led to any adverse events and if canagliflozin was used optimally during hospitalization.

Methods: The Pharmacy and Therapeutics Committee completed a SGLT2 inhibitor MUE one year after canagliflozin was added to the hospital formulary. All patients from the observation unit and those admitted to the hospital who received at least one dose of canaglifozin were included in the retrospective review. Patients were randomly selected from a computer generated report of patient encounter numbers who received canagliflozin during hospitalization. Patient electronic medical records (EMRs) were reviewed to identify patient use of SGLT2 inhibitors prior to admission. Each patient's EMR was reviewed for the following adverse events: ketoacidosis, urinary tract infections (UTIs), genital yeast infections, pancreatitis, hyperkalemia (potassium greater than 5), hypotension (systolic less than 90 mmHg or diastolic less than 60 mmHg not classified as orthostatic hypotension), and hypoglycemia (blood glucose less than 70). Adverse drug reactions that would likely only be observed in the outpatient setting were excluded from the evaluation. Potential adverse drug reactions were assessed by the Naranjo Algorithm to identify the probability of the adverse event being caused by the SGLT2 inhibitor. Any adverse reaction that was considered possible, probable, or definitely caused by a SGLT2 inhibitor was included in the results. Each patient's EMR was also assessed for canagliflozin discontinuation for creatinine clearance (CrCl) less than 30 mL/min, dehydration, and orthostatic hypotension.

Results: Fifty patients out of 118 patient encounters (42 percent) were reviewed for the SGLT2 inhibitor MUE. Forty-nine patients (98 percent) received a SGLT2 inhibitor prior to admission, and 41 patients (84 percent) patients were receiving canagliflozin as their SGLT2 inhibitor upon admission. Review of EMR data demonstrated the following percentages of adverse events: 0 percent ketoacidosis, 6 percent UTIs, 2 percent genital yeast infections, 4 percent pancreatitis, 4 percent hyperkalemia, 0 percent hypotension, and 6 percent hypoglycemia. All adverse drug reactions were categorized as having a possible association with canagliflozin or the SGLT2 inhibitor used prior to admission according to the Noranjo Algorithm. One of 3 patients had canagliflozin discontinued while the patient's CrCl was less than 30 mL/min. One patient presented with dehydration, and another patient presented with orthostatic hypotension. Neither patient's SGLT2 inhibitor was discontinued upon hospital admission. Two patients were admitted with orthostatic hypotension secondary to dehydration. Both patients received one dose of canagliflozin during hospitalization before the medication was discontinued.

Conclusion: SGLT2 inhibitors used prior to or during hospitalization had a possible association with some of the adverse drug events previously documented in the literature. Processes should be initiated to ensure SGLT2 inhibitors are discontinued when patients present with CrCl less than 30mL/min, dehydration, or orthostatic hypotension.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-067

Poster Title: Intravenous immunoglobulin use at an academic medical center: a retrospective observational study to validate current practice and shape future management

Primary Author: Samantha Delibert, University Of Rochester Medical Center Strong Memeorial Hospital; **Email:** samantha.delibert@gmail.com

Additional Author (s):
Eric Kanouse
Travis Dick

Purpose: Intravenous immune globulin (IVIG) is a blood product purified from pooled donors that needs to be managed proactively to ensure appropriate use and maximize outcomes. IVIG is the standard of care for patients with primary immunodeficiency disease and certain hematologic and autoimmune disorders. However, it has been estimated that over 50 percent of IVIG use nationwide is for off-label indications. The objective of this study was to conduct a comprehensive medication use evaluation regarding IVIG at an academic medical center as part of a quality improvement initiative to assess practice patterns and adherence to institutional guidelines, in addition to identifying ways to maximize the value of this therapy.

Methods: The study protocol was deemed exempt by the Institutional Research Subjects Review Board. The health system's electronic medical record system was used to identify patients who received IVIG between May 1, 2015 and December 31, 2015. No gender-specific or age enrollment restrictions applied in this study. Data were reviewed to characterize current practice patterns and evaluated to determine if use was supported by an FDA labeled indication, institutional guidelines, the Clinical Guidelines for Immunoglobulin Use authored by the United Kingdom Department of Health, or other published primary literature to formulate use criteria and standardize dosing. Alignment with published or institutional guidelines, ordering service, dosing patterns and assessment of weights used to dose IVIG, hospital length of stay, and frequency of rounding were assessed. Descriptive statistics were used throughout and financial impacts of varying IVIG practice patterns were evaluated. An interdisciplinary group was identified to evaluate results and update institutional guidelines and criteria for use.

Results: Ninety-three patients aged 16 weeks to 90 years old (61 percent adult, 39 percent pediatric) received IVIG during the study period. Sixty-one patients (66 percent) received IVIG

dosing in accordance with institutional guidelines while 39 (42 percent) received IVIG for an FDA approved indication. The majority of IVIG doses were ordered off label (N=138, 58 percent). The top off label indication documented was hypogammaglobulinemia. Fifty-one percent of the 93 patients reviewed were ordered weight-based regimens in accordance with institutional guidelines. Almost half of the adult IVIG orders were not rounded in accordance with institutional guidelines. Approximately $10,000 would have been saved by following institutional rounding recommendations. Thirty percent of patients who received IVIG had a length of stay less than 3 days. Results precipitated a multidisciplinary discussion that led to a new guideline and incorporation of an orderset into the electronic medical record to improve future adherence to institutional guidelines where value can be maximized.

Conclusion: One-third of IVIG doses were not ordered in accordance with institutional guidelines and/or published literature. Prescribing patterns for IVIG were inconsistent based on dosing weight and indication for use. Engagement of key stakeholders led to the development of a guideline that could be incorporated into an orderset in the electronic medical record to guide appropriate use of this scarce, costly resource.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-068

Poster Title: Evaluation of the use of liposomal bupivacaine in a community hospital

Primary Author: Isha Desai, St. Joseph's Wayne Hospital; **Email:** desaisha@gmail.com

Additional Author (s):
Samia Fawzi
Lynette Richards

Purpose: Liposomal bupivacaine (LB) is approved for administration into the surgical site to produce postsurgical analgesia. According to labelling, the liposomal suspension provides analgesia up to 72 hours therefore reducing postsurgical opioid exposure and minimizing the adverse side effects of opioids. The objective of this medication use evaluation was to assess the utilization of LB, pain scores and opioid consumption at a 200 bed geriatric niche community hospital.

Methods: A retrospective chart review was performed on patients who underwent any surgery and received LB from April 22, 2015 to December 30, 2015. Information collected comprised of patient gender, age, weight, type of surgery, dose of liposomal bupivacaine administered, pain medications administered within 48 hours post-surgery, pain scores, and pain medication prescriptions at discharge.

Results: Fifty-five patient medical records were reviewed. Sixteen patients were excluded as there was no administration documentation. LB was documented as administered in 39 patient charts (27 women). Eighty-five percent of patients who received liposomal bupivacaine received the approved maximum dose of 266 milligrams while the other 15 percent received a lesser dose (66-173 milligrams). Surgical procedures included 25 total knee arthroplasty, 7 total hip arthroplasty, 4 bilateral knee arthroplasty, and 3 miscellaneous surgeries. The average of the first pain score 4.7. The average pain score on day 1 and day 2 post-surgery was calculated as being 3.4 and 3.1 respectively with pain scores ranging from 0 to 10 throughout each day. Total pain medication administrations within 48 hours averaged 12.77 (3 to 21) per patient. Pain medications administered included ketorolac, pregabalin, celecoxib, acetaminophen, naproxen, in addition to several opioids. Immediate release oxycodone, hydromorphone, oxycodone/acetaminophen, and morphine were administered 42, 58, 37, and 23 times

respectively within 48 hours post-surgery. Twenty-four out of 39 patients received at least 1 prescription for an opioid post discharge.

Conclusion: Though LB is approved for any surgical procedure, it is formulary approved for use in bunionectomy and hemmorhoidectomy procedures. Clinical trials suggest pain scores trended down with the use of LB but those findings were not determined to be statistically significant. In this assessment, pain scores in patients treated with LB trended similarly to that in those clinical trials. Further studies should be conducted to evaluate effect on opioid consumption, prescribing patterns, and clinical outcome compared to a control group. Limitations of this study include the retrospective nature, different charting/documenting programs and styles, lack of a control group, inconsistent timings of when pain scores were taken, and variable history of pain medication consumption and tolerance in patients prior to surgery.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-069

Poster Title: Usefulness of intravesical botulinum toxin in the treatment of overactive bladder

Primary Author: Belen Escudero vilaplana, Pharmacist; **Email:** belenmaria.escudero@salud.madrid.org

Additional Author (s):
Virginia Saavedra Quirós
Blanca Basagoiti Carreño
Maria Luisa Ibarra Mira
Amelia Sánchez Guerrero

Purpose: Around 25% of the Spanish population older than 40 have symptoms of overactive bladder(OB) more frequent with age. Intravesical botulinum toxin injection(IBTI) is considered an alternative in refractory patients to anticholinergic drugs(AD). Our purpose is to evaluate the effectiveness of the IBTI in OB treatment.

Methods: Retrospective longitudinal study. Reviewed the effectiveness of intravesical BTA in OB treatment from the beginning of its use at our hospital (March 2010) until July 2015. We evaluated the following variables: sex, age, pathophysiology of disease, previous drug treatments, toxin type, number of administrations, administered dose, interval between administrations, response.
Response was defined as the absence of OB symptoms more than 6 weeks.

Results: 20 women and 3 men with an average age of 68 (41-81) years. 8 had neurological overactive bladder(NOB), 11 idiopathic overactive bladder(IOB) and 1 as result of the placement of tape transobturadora. In addition, it was used in 2 cases of urinary incontinence and 1 functional detrusor obstruction. All IBTI were performed using BT type A. Maximum recommended dose per session (300 IU) never was exceeded. Average dose used was 192 (100-300)UI. The majority of patients (74%) received a single administration.5 was the maximum number of administrations received in a patient. In all cases, the interval between administrations exceeded 3 months. 39% of patients had been received herbal medicine and all had received AD, with the exception of 2 patients (contraindicated for glaucoma). AD included: solifenacin (70%), Fesoterodine (57%), tolterodine (39%), Oxybutynin (13%), chloride trospium

(13%). In addition, 13% had received beta-3 adrenergic receptor antagonists (mirabegron). In 2 patients prievios treatment were not specified. In terms of effectiveness BT treatment, 4 patients did not experience any improvement, 10 had little response (less than six weeks) and 7 obtained it. 2 patients were loss to medical follow up. The average duration observed was 80 days, 4 NOB and 3 IOB.

Conclusion: In our limited experience, we showed any response after ITBI in 74% of the patients. However, we found an average duration of treatment than that described in the literature, so we should individualize each case.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 4-070

Poster Title: Intravenous acetaminophen: are we doing it right?

Primary Author: Sandra Ferrara, CompleteRx; **Email:** sferrara@gcrmc.org

Additional Author (s):

Purpose: When intravenous (IV) acetaminophen was introduced in 2010, it was deemed an important advancement for patients unable to take anything by mouth (NPO). However, the cost of IV acetaminophen remains significantly higher than for the oral route. Additionally, there has been no clear proof that IV acetaminophen provides better pain relief than alternate routes. The purpose of this abstract is to determine whether or not the providers in our 99 bed hospital have been ordering the drug judiciously and in so doing using the best and most economically appropriate route.

Methods: A report was generated to ascertain the total doses of IV acetaminophen withdrawn from the automated dispensing cabinets (ADC) from June 1, 2015 to May 31, 2016. Chart review was used to determine patient's dietary standing (regular diet versus liquid only or NPO). Wholesaler records were reviewed for cost and it was determined that the average cost per vial of IV acetaminophen to our facility is $34. The cost for an approximately equivalent dose in oral tablets (975 mg) is 3 cents.

Results: A total of 477 doses of IV acetaminophen were removed from the ADC during the period examined. Excluded from further analysis were NPO and liquid only diet patients (which accounted for 234 (49%) of doses dispensed), as it was determined that the drug was being used appropriately in this population. Patients who were identified in their charts as being able to sustain a regular diet accounted for 243 doses (51%) at an approximate cost of $8,250.

Conclusion: There is a real advantage to having IV acetaminophen available when a patient is NPO or on a liquid only diet. However, when considering the significant cost difference between IV and oral acetaminophen, a closer examination of route of administration of acetaminophen should be continually reviewed as the patient's diet advances. In the case of this study, patients who were able to take medications by mouth continued to receive IV acetaminophen resulting in missed savings of over $8250.

Submission Category: General Clinical Practice

Session-Board Number: 4-071

Poster Title: Online continuous education sources to develop pharmacists' knowledge and skills: an integrative review

Primary Author: Hani Abdelaziz, Hamad Medical Corporation; **Email:** alsedace@gmail.com

Additional Author (s):
Dania Alkhiyami
Sara Mustafa
Adham Mohamed
Rasha Alanany

Purpose: Continuous education (CE) in the health care system has a great impact on advancing pharmacy professional practice. Unfortunately, the search for proper and valid CE programs to meet educational objectives can be challenging and will be time consuming. The purpose of this study was to identify, evaluate and provide a list of valid and reliable web-based sources for Internet-based continuous education (IBCE) programs to assist and motivate pharmacists worldwide in improving their skill endeavors.

Methods: A multilevel search strategy was conducted to identify websites for major academic and professional organization through a web search using different general search engine (Google, yahoo) and literature search engine (OVID-MEDLINE,PubMED). Additionally, a standardized template email was developed by the research team and sent to experts in different health care –related academic institutions and organizations around the globe to recommend a list of the best IBCE according to their knowledge. Five pharmacists evaluated all websites independently. The validated programs were categorized by sources/type and a descriptive analysis of data was performed.

Results: During the study period 79 websites were collected and categorized by source into specialised areas (n = 14), professional organizations (n = 17), universities (n = 23), and educational networks (n = 25). The presented tables of data included CE program names, website address, country of providing CE programs, mode of study (Online vs. Online –Live mixed), and affordability (Free vs. Paid). Furthermore, around 17 sources provided certified programs and more than 26 certified programs were identified. These certified programs

targeted multiple therapeutic areas such as medication management services, diabetes, anticoagulation, critical care, hospital pharmacy, education and many others.

Conclusion: This study provides a concise list of reliable CE programs source in different therapeutic areas and this will help pharmacists in advancing their skills and knowledge.

Submission Category: General Clinical Practice

Session-Board Number: 4-072

Poster Title: Development of an intravenous-to-oral route conversion program at a Saudi tertiary care hospital

Primary Author: Mohammed Almeziny, Prince Sultan Military Medical City; **Email:** meziny@hotmail.com

Additional Author (s):
Hadeel Albalawi

Purpose: An intravenous-to-Oral Route Conversion Program was developed to switch from IV to PO as soon as it safe to do as well as, to provide an oral/enteral dosage form with equal effect and comparable bioavailability to intravenous form, this could reduce medication cost, hospital length of stay and avoid the added risks associated with continuing intravenous therapy. The purpose of this study is to describe the economic impact of introducing a Intravenous-to-Oral Route Conversion Program in a Saudi Tertiary Care Hospital.

Methods: Pharmacy, Infectious Diseases (ID) and gastroenterology departments developed a policy and procedure. The policy and procedures defined criteria of conversions and specified medications. The criteria of conversions consists of three major areas, intact and functioning GI tract, indicators for improving clinical status and the exclusion criteria.
Pharmacy system generates on daily bases a report for all medications that specified by policy and have been started before 72 hours. The assigned pharmacist works only during weekdays. The pharmacist will evaluate the patient to determine suitability for the IV to PO switching if the patient meets the criteria, the pharmacist will discuss the patient's clinical status and suitability for IV to PO therapy switch with primary medical team. Pharmacist will write in the patient's clinical note that the patient fulfils the criteria for IV to PO therapy switch. If the primary medical team wish to extend the IV therapy based on reasonable ground. Pharmacist will review the patient's chart in 24 hours.

Results: Data were collected prospectively between 1st of January to 30th of April 2016. The pharmacist was able to see 938 patients. 704 patients met the defined criteria whereas 234 did not meet the defined criteria. 527 patients were converted to PO medications while 177 patients continued their IV treatment. The reasons for not converting patients who met the

criteria were as follow 2 cases the in charge nurse refused to give the bleep of the primary medical staff, 140 cases the primary medical staff did not respond to the bleep and 35 cases unjustified reasons. The highest converted medication was Esomeprazole with 188 prescriptions. The program has permitted the hospital a global saving of SAR 105,992.42 (USD 28,265) for these drugs during the period of time considered. The cost did not include the labour cost (pharmacy and nursing), beds and consumable materials e.g. syringes, gloves, infusion pump etc. The number of patients who exceeded 72 hours was 14,760 patient however, the pharmacist was able to review 938 patients therefore, the missed opportunity was 93.89%.

Conclusion: Intravenous to oral therapy conversion program represents a cost-effective strategy that also minimizes intravenous therapy complications and facilitates earlier hospital discharge without compromising patient care. Appropriate oral medication use produces equivalent clinical outcomes, causes fewer complications, less patient inconvenience, and is generally less costly. It is anticipated that expansion of the program to allow pharmacist to automatic discontinuation of medications that meet the defined criteria will result in even greater cost savings for the hospital. In addition, conduct continuous education for healthcare professionals to increase awareness about the program may increase the benefit of the program.

Submission Category: General Clinical Practice

Session-Board Number: 4-073

Poster Title: Effects of a pharmacist's participation in a transitions-of-care program on 30-day readmission rates in patients with chronic obstructive pulmonary disease (COPD) and pneumonia

Primary Author: Jessica Bente, Saint Barnabas Medical Center; **Email:** jbente@barnabashealth.org

Additional Author (s):
Dawn Howard
Jennifer Costello

Purpose: In 2014, an Advanced Practice Nurse (APN) was hired to start the Transitions of Care (TOC) Program. The TOC APN targets high-risk patients with a primary focus on chronic obstructive pulmonary disease (COPD) and pneumonia. The majority of time spent by the APN focused on medication management, which led to the creation of a TOC pharmacist position in June 2015. The pharmacist provides medication management, while the APN provides health self-management interventions. The purpose of this study is to examine the effects of a pharmacist's participation in a TOC team on 30-day readmission rates in patients with COPD and pneumonia.

Methods: This study was conducted from June 2015 to December 2015 and was approved by the Institutional Review Board. Patients included in this study were 18 years of age or greater and had a primary admitting diagnosis of COPD or pneumonia. Elements of the TOC program included inpatient disease-state education, inpatient medication reconciliation, discharge phone call 24-48 hours after discharge, follow-up phone call once weekly up to 30 days, and a home visit or clinic visit typically within 2 weeks of discharge. Patients were removed from the TOC program if their discharge disposition was to a sub-acute rehabilitation (SAR) facility, nursing home, select assisted living facilities, or any other skilled nursing facility. Patients were also removed if they were discharged with hospice services or had advanced dementia with no available caregiver. Patients could also opt-out of TOC services at any time. The primary outcome was 30-day readmission rates for all Medicare patients admitted with a primary diagnosis of COPD or pneumonia. The statistical test utilized to compare groups was the Chi-square test. Secondary outcomes included a composite outcome of 30-day readmission rates of all patients with COPD and pneumonia who participated in the institution's TOC program

(Medicare and non-Medicare patients), number of medication reconciliations performed by the pharmacist, number of home visits performed by the pharmacist, and number of medication errors identified by the pharmacist.

Results: From January 2014 to May 2015, 70 out of 247 Medicare patients (28.34%) with a primary diagnosis of COPD were readmitted within 30 days. Since the implementation of the TOC pharmacist, from June 2015 to December 2015, 19 out of 107 Medicare patients (17.76%) with a primary diagnosis of COPD were readmitted within 30 days ($p=0.045$). From January 2014 to May 2015, 58 out of 333 Medicare patients (17.42%) with a primary diagnosis of pneumonia were readmitted within 30 days. Since the implementation of the TOC pharmacist, from June 2015 to December 2015, 19 out of 109 Medicare patients (17.43%) with a primary diagnosis of pneumonia were readmitted within 30 days ($p>0.05$).
From June 2015 to December 2015 a total of 351 patients were evaluated for the TOC program. There were 205 patients with a diagnosis of COPD or pneumonia enrolled in the TOC program and 32 patients were readmitted (15.61%). The TOC pharmacist performed 98 medication reconciliations, identified 117 medication errors, and participated in 38 home visits for the patients enrolled in the TOC program.

Conclusion: This study demonstrated that the addition of a TOC pharmacist led to a statistically significant decrease in Medicare readmission rates for patients with COPD. Although there was no significant decrease in pneumonia readmission rates, the sample size may not have been large enough to detect a difference. Additionally, the acute nature of pneumonia versus the chronic management needed for COPD may have affected patient care needs, thus making these methods ineffective for decreasing pneumonia readmission rates.. Future studies with a similar model may prove to reduce readmission rates for patients with other chronic disease states.

Submission Category: General Clinical Practice

Session-Board Number: 4-074

Poster Title: Palatability profile of patiromer, a once-daily oral potassium binder for the treatment of hyperkalemia

Primary Author: Melanie Brenner, Relypsa; **Email:** mb8815@yahoo.com

Additional Author (s):
Wade Benton
Natalie Panov
Charles Du Mond
Dahlia Garza

Purpose: Palatability of orally administered medications is an important factor contributing to patients' treatment adherence. Unpleasant products' taste and smell as well as the frequency of administration are common culprits of non-adherence. Some currently available medications are poorly utilized by patients due to palatability issues. Patiromer is a once-daily, sodium-free, non-absorbed potassium binder approved for the treatment of hyperkalemia. Patiromer is available as a powder for oral suspension, packaged in single-use packets containing 8.4 g, 16.8 g, or 25.2 g of patiromer, which should be reconstituted with 1/3 cup of water prior to administration. Results of patiromer's palatability assessment are presented.

Methods: Palatability evaluation was conducted in a subset of patiromer-naïve healthy subjects (N=62) enrolled in 5 patiromer drug-drug interaction studies using a verbal questionnaire to rate formulation parameters on the attributes of odor, taste, and texture. Odor and taste were assessed separately as pleasant, neutral, or unpleasant; texture was evaluated as smooth, silky, rough, or gritty (scales not validated). The questionnaire was administered by a trained healthcare provider, utilizing the subject's fluent language, and consisted of two parts: the first question was posed immediately prior to patiromer dosing to evaluate the odor of the formulation. Two subsequent questions were posed post-patiromer dose to evaluate the taste and texture. The study results were analyzed descriptively.

Results: Sixty-two subjects were enrolled and completed the study; 35 (56%) were male and 52 (84%) were white. Positive reactions to patiromer's odor and taste were reported by 56 (90%) and 60 (97%) subjects, respectively. Of these, 6 reported a pleasant odor, 18 a neutral odor,

and 32 no odor, while 8 reported a pleasant taste, 12 reported a neutral taste, and 39 reported no taste. Eight (13%) subjects reported an unpleasant experience with either taste or odor. Only one subject found both the taste and odor unpleasant. The texture was described as silky by 7 (11%) subjects, smooth by 6 (10%) subjects, rough by 9 (15%) subjects, and gritty by 40 (65%) subjects.

Conclusion: In the study, 90% or more of subjects reported positive palatability experiences with patiromer in terms of odor or taste; the product was described as gritty by 65% of subjects. These results suggest that the taste and odor of patiromer may not impact patient acceptance and adherence with this once-daily oral potassium binder.

Submission Category: General Clinical Practice

Session-Board Number: 4-075

Poster Title: Challenges and benefits of converting annual progress examination to electronic format

Primary Author: Michelle Caetano, University of Rhode Island College of Pharmacy; **Email:** michellethomas07@gmail.com

Additional Author (s):
Norma Owens

Purpose: After the adoption of electronic software for exam administration, our annual progress examinations needed to be converted into the electronic format. More than simply importing the items into the software, a lengthy process was undertaken to categorize each item into multiple domains to enable more robust analysis of student performance across different content areas and level of question complexity.

Methods: Over 10 years ago, our college developed an annual progress examination known as the "Milestone Exam" The exam is administered each year to P1, P2, and P3 students with 60 different items on each exam to reflect the course content delivered during the previous academic year. This exam was developed by college faculty, and is updated and administered annually by members of the College Assessment Committee. The College began to use ExamSoft for exam administration in 2012. To convert the Milestone Exam into electronic format, the authors developed a process to review each item across all 3 exams, and to categorize ("tag") each item with different information across 5 domains. The domains were: Course number, course topic, curricular content area (ACPE Appendix B), skill level (using Bloom's Taxonomy), and the College of Pharmacy Student Learning Outcomes. All 180 exam items were compiled into an excel spreadsheet that used a series of drop-down menus to select from the category choices for each of the 5 domains. Two faculty members were provided with the spreadsheet and independently reviewed each exam item and selected a categorization in each of the 5 domains. The two faculty members would then meet and compare the categories they had assigned. When differences arose, the faculty members would discuss their choices and come to a consensus decision.

Results: This process of categorization allowed for a much more in-depth analysis of the strengths and weaknesses of individual students and the larger cohort. In years past, the data

analysis we were able to get from optical mark recognition combined the achievement scores of the therapeutics material taught in the fall (infectious diseases) with the therapeutics material taught in the spring (central nervous system agents) . On average, the scores were acceptable, however following the conversion to electronic exam delivery, we were able to better analyze the outcomes because of the robust categorization on each item, and discovered that students were performing poorly on the infectious disease topics and were performing much better on the central nervous system agents material. With this information, we were able to discuss areas and ideas for possible improvement in the infectious disease curriculum.

Conclusion: The categorization function of electronic exam software allows for much more robust analysis of student performance on exams. An exam item can be categorized in many different ways, providing many opportunities analyze exam data, as well as providing individual students with a better understanding of areas of strength and weakness.

Submission Category: General Clinical Practice

Session-Board Number: 4-076

Poster Title: Interprofessional simulation education from pre-operative to community care

Primary Author: Nicole Cieri, D'Youville College School of Pharmacy; **Email:** necieri@yahoo.com

Additional Author (s):
Kirsten Butterfoss
Stephanie Brian
Karen Mlodozeniec

Purpose: Interprofessional education (IPE) is widely recognized as a model for meeting the challenges of preparing a workforce skilled in patient-centered care and driven to improve patient outcomes. In order to develop a working model that meets the core competencies of IPE and fosters patient-centered collaboration across professions, an interprofessional education committee (IPEC) comprised of faculty and students from numerous healthcare professions was formed. The objective was to evaluate the degree to which a three-phased curriculum navigating the continuum of care addressed these core competencies.

Methods: Seven health professions (chiropractic, dietetics, nursing, occupational therapy, physicians' assistant, pharmacy, and physical therapy) participated in three phases that occurred over the course of a semester across the continuum of care. The students followed two standardized patients (SPs) played by community actors throughout the curriculum. 15 interprofessional faculty facilitated and debriefed at each of the three phases. Students completed 1 minute evaluations following the simulation and a post-curriculum survey. Phase-one included a demonstration of two profession-specific skills, a chart review, and a preoperative history in interdisciplinary pairs. Phase-two in the curriculum included a four-hour simulation session in the acute care hospital setting, intensive care unit hospital setting and home care setting. Continuum across the curriculum was ensured by building upon the complaint and historical information gathered from phase-one, and keeping students within their assigned interprofessional groups. Four scenarios were designed for this phase with a focus on professional tasks and embedded challenges such as a medication error, and opportunities to collaborate. After each scenario, learners participated in debrief and discussion. Phase-three included "a year later" follow-up discussion with the SPs and presentations by community programs utilized by the patients including the Veterans Affairs and Silver Sneakers. Students completed evaluations following the simulation.

Results: The seven hour curriculum had 115 interprofessional student participants, 17 of which were pharmacy student volunteers. The majority of learners strongly agreed that each of the phases contributed to their appreciation of other professions and that they were able to share about their own profession. Communication, recognizing roles and responsibilities, and teamwork were recognized as core learning experiences gained through the curriculum.

Conclusion: The student evaluation of the curriculum revealed that several core competencies were addressed by participation in the three phases. Communication among the seven health professions was regarded as the most important aspect. Students' ability to recognize and understand the roles of the other professions ranked next in combination with teamwork. Student learners described that they enjoyed the ability to see and respect what others do, "appreciating the importance of other professions," and that all of the represented professions were important in patient care.

Submission Category: General Clinical Practice

Session-Board Number: 4-077

Poster Title: Rare disease, costly drug: the case of eculizumab for atypical hemolytic uremic syndrome (aHUS)

Primary Author: Nathan Dahl, Mayo Clinic; **Email:** dahl.nathan@mayo.edu

Additional Author (s):
Juliana Perez Botero

Purpose: Atypical hemolytic uremic syndrome (aHUS) is a rare and life-threatening complement mediated thrombotic microangiopathy (TMA) with high rates of complications. Prompt diagnosis and treatment with complement blockade is key in controlling the hemolysis and preventing permanent end organ damage. This case outlines the clinical course of one aHUS patient from initial presentation to diagnosis including treatment selection, goals of therapy and financial considerations which are particularly relevant given the very high cost of treatment.

A 62 year old Caucasian male with a past medical history of hypertension, dyslipidemia, obesity, and chronic obstruction pulmonary disease was transferred to our facility from an outside hospital for management of TMA refractory to plasma exchange. He developed progressive fatigue over several months and was later found to be anemic and thrombocytopenic, which was presumed to be autoimmune and was started on treatment with steroids. One month later, he developed worsening anemia and oliguric acute kidney injury with a serum creatinine of 11 mg/dL requiring hemodialysis for volume management. Laboratory studies were remarkable for evidence of microangiopathic anemia. A bone marrow biopsy was hypocellular with mild erythroid hyperplasia and no dysplastic features. Plasma exchange (PLEX) was started due to concern for thrombotic thrombocytopenic purpura (TTP) but an ADAMTS13 level was not obtained and steroids were continued. His hospitalization was complicated by pneumonia, Clostridium difficile infection, and herpes simplex viral infection all treated with appropriate antimicrobials. After six daily sessions of PLEX, hemolysis was ongoing and renal function remained unchanged. The patient received a dose of rituximab and was transferred to our facility for further work-up and management. Additional tests were ordered given suspicion for aHUS including ADAMTS13 levels which were low but greater than ten percent and without presence of an inhibitor (drawn six days after last PLEX), serologic complement evaluation (low total and alternate pathway complement activity) and complement mutations (negative for known pathogenic mutations). A kidney biopsy revealed extensive thrombotic microangiopathy

with minimal tissue scaring. Given the extent of the renal compromise with enough viable renal parenchyma, ongoing TMA and consumed complement in the setting of a subacute presentation, treatment with eculizumab for aHUS was initiated planning to complete four to six weeks of treatment and reassessing for renal recovery.
Eculizumab is a recombinant humanized monoclonal antibody that acts as a complement inhibitor by specifically binding with high affinity to complement protein C5 and thereby inhibiting complement-mediated TMA in patients with aHUS. Approved dosing for aHUS is eculizumab 900 mg intravenously given weekly for four weeks and then transitioning to 1200 mg every two weeks starting on week five. Response to eculizumab therapy is mainly evaluated clinically. It is important to note that eculizumab comes with serious infection risk including meningococcal infections. If possible, patients should receive the meningococcal vaccination two weeks prior to starting therapy unless the risks of delaying therapy outweigh the risk of infection. The financial toxicity associated with this treatment is also high. Each 900 mg dose costs roughly $25,000 with no clear end point in therapy and patients in clinical trials receiving therapy ranging from 26 to 129 weeks. Endpoints used in clinical trials include change in platelet count, hematologic normalization and TMA response as determined by changes in serum creatinine and need for dialysis and PLEX. The decision to treat and for how long should made on a case by case basis and carefully weighing all the risks and potential benefits while keeping in mind clear goals of treatment.

Methods:

Results:

Conclusion:

Submission Category: General Clinical Practice

Session-Board Number: 4-078

Poster Title: Diabetic ketoacidosis associated with olanzapine therapy

Primary Author: Stephen Dolley, CompleteRx; **Email:** steve.dolley@dmh.state.ma.us

Additional Author (s):
Anna Morin
Stephen Larose

Purpose: The relationship between psychiatric illness, use of antipsychotic agents and the development of type two diabetes mellitus (type 2 DM) is likely multi-factorial and poorly understood. Patients with schizophrenia may be predisposed to the development of type 2 DM independent of psychotropic medication therapy. Glucose dysregulation reported with the use of certain second generation antipsychotics (SGAs) can further place patients at risk for new onset or exacerbation of pre-existent diabetes. Rare cases of diabetic ketoacidosis (DKA) induced by SGAs have been reported. The risk of DKA is associated with a longer duration of SGA exposure and, in some cases, DKA is the first sign of an SGA-associated metabolic disturbance.

This case report describes the onset of DKA in a 39-year-old male residing in a long term care inpatient psychiatric facility with diagnoses that included schizoaffective disorder (bipolar type), a history of substance abuse, head trauma, hypertension and hypercholesterolemia. There was no documented history of diabetes. Olanzapine was begun on March 20, 2015 and titrated to a dose of 15mg daily on April 28, 2015. On July 28, 2015 the patient complained of episodes of vomiting, headache, being unsteady on his feet and feeling hot and thirsty; blood pressure was elevated (170/120 mmHg standing) and the QTc interval was prolonged (514 mm/sec). He denied chest or stomach pain, shortness of breath or diarrhea. Staff described the patient as not doing well psychiatrically and seemingly more confused. Fluoxetine therapy was initiated the day prior and serotonin syndrome was suspected. The patient was transferred to an acute care facility where he was hydrated and received anti-emetic medication. Blood pressure remained elevated, but QTc normalized. Serotonin syndrome was ruled out and the patient was returned to the inpatient psychiatric facility. The following day, the patient complained of weakness and an inability to stand or walk. He experienced vomiting with intermittent retching. Vomitus was guaiac positive, blood pressure was 106/58 mmHg (sitting) and QTc was prolonged at 524 mm/sec. He denied abdominal pain or feeling hot. He was returned to the acute care facility where he presented as hypertensive (167/117 mmHg); with a prolonged QTc interval of

521 mm/sec, a serum glucose of 1951 mg/dl, a HbA1c of 13.3 percent, a serum creatinine of 4.39 mg/dl and a creatinine kinase (total) of 2254 U/L. He was diagnosed with metabolic encephalopathy in the setting of DKA, acute renal failure and a prolonged QTc interval. He was admitted to the intensive care unit for stabilization and treated with aggressive intravenous fluid resuscitation and an insulin drip. Once stabilized, he was transferred to the general medical service. The patient returned to the inpatient psychiatric facility on August 6, 2015. His mental status had returned to baseline. Blood pressure was 120/84 mmHg, QTc interval was 470 mm/sec, serum glucose was 405 mg/dl and serum creatinine was 0.98 mg/dl. Olanzapine, which was continued during the acute care hospitalization, was discontinued upon return to the inpatient psychiatric facility. Risperidone was initiated. He was prescribed a basal insulin regimen that included detemir and aspart insulin and a sliding scale insulin regimen of insulin aspart. Metformin was titrated to a dose of 1000mg twice daily. Blood glucose finger stick readings improved rapidly. All insulin was discontinued by August 19, 2015. HgA1C was 7.5 percent on September 24, 2015. Metformin was adjusted down to 500mg morning/1000mg bedtime, a dose he received until discharge on October 8, 2015.
DKA is a rare yet potentially fatal adverse effect associated with olanzapine therapy. It is important that clinicians and patients are aware of and patients are monitored for the signs and symptoms of DKA.

Methods:

Results:

Conclusion:

Submission Category: General Clinical Practice

Session-Board Number: 4-079

Poster Title: The development of a new focus area list including STOPP/START at Odense University Hospital

Primary Author: Marie-Louise Duckert, Clinical Pharmacist; **Email:** marie-louise.duckert@rsyd.dk

Additional Author (s):
Louise Smed Groenkjaer

Purpose: At Odense University Hospital the clinical pharmacists are conducting medication reviews at many clinical wards. For medication reviews they used different focus areas regarding rational pharmacotherapy. The relevance and evidence of these focus areas were maintained by the pharmacists. As the number of focus areas rose, the updating became time consuming. When Screening Tool of Older People's Prescriptions/Screening Tool to Alert doctors to Right Treatment (STOPP/START) version 2 (Denis O'Mahony et al. 2014) were published the geriatrics encouraged the clinical pharmacist to use these. Then purpose of this project was to merge the STOPP/START with the pharmacists own focus areas.

Methods: All the focus areas that the clinical pharmacists used at conducting medication reviews were collected. Hereafter all the focus areas that could also be found in the STOPP/START system were identified. The rest of the focus areas were reviewed according to relevance and evidence, and it was thereafter decided which should be kept. Then all the focus areas were categorized after the same system as in STOPP/START. All the local focus areas and the STOPP/START were then written in a new list called the Focus Area List at Odense University Hospital (FAL-OUH) After this all focus areas including the STOPP/START were provided with information about which substances and/or pharmacological group the area covered. Each focus area was also provided with a note saying how to register the focus area in the clinical pharmacists' local database. Finally a standard sentence to be used in the electronic patient record was developed for each area.

Results: A total of 85 focus areas were collected from the clinical pharmacists, 15 of which could also be found in STOPP/START. The remaining 70 focus areas were reviewed according to relevance and evidence, and it was thereafter decided to keep 34 of these and deselect the rest. 20 of the 34 remaining focus areas could easily be fitted under the STOPP/START

categories, while 14 focus areas were concerning specific pharmaceutical knowledge and how to prescribe drugs in the patient's medical record. These 14 focus areas were given their own category. The (FAL-OUH) now covered at total of 147 focus areas, of which 113 were the original STOPP/START. All 147 focus areas were provided with information about which substances and/or pharmacological group the area covered. This information was added to make the screening easier. Each focus area was also provided with a note saying how to register the focus area in the clinical pharmacists's local database. Finally a standard sentence was developed for each area. These sentences could be used by the clinical pharmacists in their work with the medication reviews, when writhing in the electronic patient record.

Conclusion: The process of merging the local focus areas with STOPP/START was a long process involving many discussions about the content and how to make the clinical pharmacists use the FAL-OUH in their daily work. However the result was of great importance for the clinical pharmacists work with medicine reviews, and the process of updating the FAL-OUH was made easier because the STOPP/START is frequently updated by the authors. The clinical pharmacists found the FAL-OUH of clinical relevance and easy to use.

Submission Category: General Clinical Practice

Session-Board Number: 4-080

Poster Title: Ensuring safe and appropriate use of personal insulin pumps for patients during hospitalization

Primary Author: Sarah Eagleston, Sparrow Hospital; **Email:** sarah.eagleston@sparrow.org

Additional Author (s):
Linda Stasiuk

Purpose: Continuous Subcutaneous Insulin Infusion (CSII; insulin pump) therapy for the management of type 1 diabetes mellitus can provide several advantages over multiple daily injection regimens. Better glycemic control, mealtime flexibility and fewer hypoglycemic episodes with CSII has led to a significant increase in use of CSII in recent years, particularly in the pediatric population. However, as use increases and pump technology progresses, the risks these patients encounter upon hospital admission are significant. Staff unfamiliarity with CSII and the high-alert nature of insulin necessitate clearly defined and comprehensive policies and procedures to ensure safe use of insulin pumps during hospital admission.

Methods: Our 733-bed teaching hospital is part of a multi-campus health system servicing a variety of pediatric and adult patients. . A system-wide, multidisciplinary policy was created to define key aspects of inpatient insulin pump use. Patient assessment, procedures and documentation and a patient agreement form construct the basis of the policy. Contraindications to use of CSII during hospital admission, instructions on chart documentation, management of pump malfunctions, patient monitoring and management surrounding surgeries or procedures are outlined. A mandatory electronic order set and barcode scanning and patient identification processes were also developed. Because of the emphasis on collaboration with the patient and preserving their autonomy in self management, patients using insulin pumps were consulted for feedback prior to finalization.

Results: Evaluation of reported insulin pump-related adverse events uncovered the system's omission of structural and process of care measures related to patient-managed insulin pumps. This multidisciplinary quality improvement initiative resulted in the implementation of structural measures, process measures, and patient/caregiver engagement measures to proactively prevent insulin pump-related ADEs. Structural measures include identification of patients on insulin pumps, bed rail signage, mandatory patient-managed insulin CPOE order set,

infusion set disconnection and reconnection instructions/education and pharmacy-generated barcoded insulin pump wrist band and mechanism. Process of care measures include criteria for continuation/discontinuation of patient managed insulin pump, documentation process for MAR, method for reporting pump malfunctions, and process for facilitating pre-operative insulin orders by anesthesiology. Equally important, patient/caregiver engagement measures and agreement form were developed to define their respective role in managing their CSII therapy while in the hospital setting. Evaluation of reported ADEs after implementation of these measures is forthcoming.

Conclusion: Proper management of CSII during the transitions of a hospital admission is essential to providing excellent patient care. It is anticipated that the system-wide policy will greatly improve safety of these high-risk situations.

Submission Category: General Clinical Practice

Session-Board Number: 4-081

Poster Title: Survey on reconstitution of freeze-dried vials in pharmacy practice in the United States

Primary Author: Ekaterina Efimova, MCPHS/Pfizer; **Email:** ekaterina.efimova@mcphs.edu

Additional Author (s):
Bakul Bhatnagar
Jacob Mattox
Adam Craig
Paul Belliveau

Purpose: There has been increased attention to the challenges encountered during reconstitution of freeze-dried pharmaceuticals (e.g. antibiotics and highly concentrated proteins) in the past two decades. However, there are only limited published reports on reconstitution challenges in the clinical setting. Currently, unless specified in the package insert, there are no standardized reconstitution practices across different pharmacy practice sites. The purpose of this study was to identify vial reconstitution techniques and challenges encountered during the reconstitution process to develop best practices for mitigation of reconstitution issues.

Methods: Following IRB approval, a 31-question electronic survey was developed using Qualtrics and administered via an email invitation to the members of the Section of Inpatient Care Practitioners within ASHP Connect. The survey questions were in multiple choice and text entry. The survey recorded participant demographics covering job title, type of practice site, employment duration, level of education, and training in reconstitution. In addition, the survey collected information on the reconstitution techniques (rate and manner of diluent addition, the use of reconstitution aids), utilization of package inserts, longest duration of reconstitution encountered, definition of “complete” reconstitution and the most common method of reconstitution (manual vs. automated). The survey also captured respondent preferences for reconstitution times.

Results: A total of 164 respondents provided informed consent and participated in the survey. The majority of respondents were pharmacists (77 percent); 83 percent were employed in an inpatient setting, and 45 percent had been practicing (as a pharmacist or technician) for 20+

years. The vast majority (90 percent) reported that reconstitution was performed mostly by technicians at their practice sites. Thirty-three percent of the respondents indicated that their site's aseptic training did not include training in reconstitution. Seventy-three percent of study participants utilized reconstitution aids such as vial adapters and needleless transfer devices. While manual reconstitution was the most common method of reconstitution for 89 percent of the respondents, a variety of approaches, such as upright vial swirling, tilting and swirling, shaking, were employed to perform reconstitution in absence of instructions. Other differences in reconstitution practices included diluent injection location and rate. Although 97 percent found dose preparation instructions in package inserts to be helpful, 37 percent indicated that they "sometimes/rarely" referred to the inserts. The respondents also indicated that while some package inserts included specific reconstitution instructions, other inserts lacked detailed directions, thereby leading to potential reconstitution challenges such as incomplete dissolution, increased reconstitution time, or compromised product quality.

Conclusion: The survey revealed differences in personnel training for performing reconstitution and also identified variability in reconstitution techniques across practice sites. This suggests there are no standard techniques for reconstitution and presents the need for developing best reconstitution practices. The lessons learned from the survey will assist pharmaceutical manufacturers in creating user-friendly instructions that will ensure consistency in reconstitution techniques across pharmacy practice settings.

Submission Category: General Clinical Practice

Session-Board Number: 4-082

Poster Title: Comparison of phenobarbital and benzodiazepine treatment for alcohol withdrawal syndrome (AWS)

Primary Author: Stefanie George, University Hospitals Geauga Medical Center; **Email:** stefffgeorge@gmail.com

Additional Author (s):
Matthew Reale
Mate Soric
Jessica Cather

Purpose: Alcohol is one of the most widely used addictive substances. Consuming alcohol regularly can lead to alcohol dependence causing a physical reaction to the body in the absence of alcohol. Benzodiazepines remain the gold standard treatment for alcohol withdrawal syndrome (AWS). While benzodiazepines are extremely effective in controlling AWS symptoms, decreased sensitivity and resistance have occurred in the setting of long-term alcohol use. Phenobarbital has been utilized as alternative therapy given the mechanism of action is similar to benzodiazepines. The objective of this study is to examine outcome differences in AWS patients being treated with phenobarbital compared to benzodiazepines.

Methods: A retrospective chart review was done at two urban hospitals to compare the differences in patient outcomes between AWS treatment using phenobarbital and benzodiazepines. Patients were identified by an ICD-9 code and assessed via the electronic medication administration record. The primary outcome measured was length of treatment. Secondary outcomes assessed total amount of benzodiazepines used, change in level of care, and rate of adverse outcomes associated with each treatment. Data collected included medication ordered, dose, route, admission location, mean alcohol usage prior to arrival defined by number of drinks per day, treatment duration, falls, seizures, delirium tremens, amount of medication needed, change in level of care, and patient demographics. Descriptive statistics were utilized for patient demographics while the student's T-test was used to analyze continuous data.

Results: A total of 90 patients were included for statistical analysis with 42 patients in the phenobarbital group and 48 patients in the benzodiazepine group. Baseline characteristics of age, gender, and drinks per day did not differ between the groups. However, more patients in the phenobarbital group were treated by an addiction specialist physician (88% vs. 12.5% $p < 0.0001$). The primary endpoint evaluating treatment duration in days was approaching statistical significance, though showed no difference between the groups (2.8 days vs. 3.4 days $p=0.0674$). Total use of benzodiazepine treatment did differ between the groups with phenobarbital having a mean of 0.8 mg of benzodiazepine used per hospital stay versus 29.4 mg in the benzodiazepine group ($p < 0.0001$). No difference was found between rate of seizures/DTs (0% vs. 8.3% $p=0.4880$) or change in level of care (4.7% vs. 12.5% $p=0.4878$). There was a difference in the rate of falls showing an increase in the benzodiazepine group (0% vs 14.6% $p=0.0099$).

Conclusion: When comparing the duration of treatment between phenobarbital and benzodiazepines for AWS, there was no significant difference between the groups. However, the data with phenobarbital regimens did show decrease the overall need for benzodiazepine therapy and rate of falls occurring with patients. Phenobarbital remains a viable option for treating mild to moderate AWS. Though, Larger studies are needed to conclude the benefit of using phenobarbital over benzodiazepines.

Submission Category: General Clinical Practice

Session-Board Number: 4-083

Poster Title: Impact of corticosteroid dosing on length of stay and readmission rates in acute chronic obstructive pulmonary disease exacerbations

Primary Author: Brad Hein, The Christ Hospital; **Email:** brad.hein@thechristhospital.com

Additional Author (s):
Kelly Laake

Purpose: Systemic corticosteroids are an integral component of the treatment of acute chronic obstructive pulmonary disease (COPD) exacerbations. Current Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines recommend 40 mg of prednisone daily for 5 days for the treatment of COPD exacerbations. Current American Thoracic Society (ATS) guidelines also recommend prednisone 30-40 mg for up to 10 days, with the option to switch to an equivalent intravenous dose if the patient's response is less than adequate. Despite these evidence-based recommendations, COPD exacerbations are often treated with much higher doses of intravenous steroids. The purpose of this study was to compare the efficacy and safety of high versus low dose steroids for COPD exacerbations.

Methods: This institutional review board-approved retrospective chart review evaluated patients admitted for COPD exacerbations and treated with steroids. Patients were excluded if they were less than 40 years old, admitted to the intensive care unit, and if they had a secondary pulmonary diagnosis, such as pulmonary embolism or pneumonia. Patients were categorized into high-dose (80 mg of prednisone equivalents or greater daily) vs low dose (less than 80 mg of prednisone equivalents daily). 80 mg was chosen as the cutoff because, although guidelines would suggest 40 mg, the authors' experience deemed it unlikely enough patients could be categorized into the low dose group to make meaningful conclusions. Data was collected on: demographics, smoking history, COPD exacerbations in the last year, outpatient COPD regimen and comorbidities of asthma and diabetes. Steroid dose, route and duration were also collected. Compliance with guidelines was evaluated based on steroid recommendations previously detailed. Efficacy and safety data collected included length of stay, hyperglycemia (blood glucose greater than 180 mg/dL), and 30 day readmission for COPD exacerbation. Data was evaluated using t- and chi-square tests where appropriate.

Results: 152 patients were included in the analysis, with 45 patients stratified to the low-dose group and 107 patients in the high-dose group. For both groups, the average age was 67 years, 68 percent of patients were female and 68 percent of patients were Caucasian. There was no significant difference between the study groups for any of the baseline characteristics. The average daily steroid dose in the high dose group was 237 mg and in the low dose group, 47 mg. The average duration of steroid therapy was 12 days in the high-dose group vs 9 days in the low dose group (p less than 0.05). Overall, 11 percent of patients were treated according to GOLD and ATS guidelines. The length of stay in the high dose group was 4.3 days versus 3.6 days in the low dose group ($p = 0.08$). 19 percent of patients were readmitted with 30 days for COPD exacerbation in the high dose group vs 13 percent in the low dose group ($p = 0.42$). More patients in the high dose group experienced hyperglycemia than in the low dose group (59 percent versus 44 percent, $p = 0.10$).

Conclusion: The results of this study support the use of guideline-recommended doses of steroids for acute COPD exacerbations. Given that more side effects are expected with higher doses and longer duration of therapy, the lowest effective dose should be utilized. These results are consistent with other studies that have evaluated high versus low steroid doses. These results should be validated with a prospectively designed study.

Submission Category: General Clinical Practice

Session-Board Number: 4-084

Poster Title: Impact of pharmacist interventions on safety and cost savings

Primary Author: Sara Ibáñez García, Hospital General Universitario Gregorio Marañón, Instituto de Investigación Sanitaria del Hospital Gregorio Marañón; **Email:** sara.ibanez@salud.madrid.org

Additional Author (s):
CARMEN RODRIGUEZ-GONZALEZ
MARIA LUISA MARTIN BARBERO
ANA HERRANZ ALONSO
MARIA SANJURJO SAEZ

Purpose: Prescribing errors (PE) are frequent, cause significant harm and prove costly. It is well recognized that pharmacists are a key element for safe prescription of drugs through the interception of PE during the validation process. Few studies demonstrate the impact of pharmacist interventions.
The objectives of this study were to characterize the severity and cost of the potential outcome of PE and to develop an economic analysis.

Methods: We performed a prospective observational study of all prescriptions made during 6 months in a 1,300-bed tertiary teaching hospital provided with a computerized physician order entry (CPOE) tool combined with a basic clinical decision support system (CDSS).
An independent team analyzed the PE intercepted through the pharmacist validation. The severity of each error was categorized using the NCC-MERP index. Each error was assigned a probability to cause an adverse drug event (PAE) in the patient: 0 (nil), 0.01 (very low), 0.1 (low), 0.4 (medium) or 0.6 (high). Cost avoidance was based on the product of the PAE and the cost of an adverse drug event (set at €6,857, taken from a review conducted by the Spanish Ministry of Health).
An economic analysis was performed from the hospital perspective using the salary of a pharmacist and the cost avoidance estimated.
The institutional review board approved this study, and the informed consent was not required.

Results: 484 PE were intercepted: 36.2% of PE were classified as being of minor severity, 59.1% as moderate and 4.7% as serious. The most common type of moderate-serious PE found was excessive dose (30%,94/309), insufficient dose (20%, 62/309), and omission (19%, 58/309).The most frequent families of drugs involved were antineoplastic agents (22.3%, 69/309) and antimicrobials (17.2%, 53/309).
In the cost avoidance analysis, 57 of the interventions (49%) were assigned a PAE of 0.6, 12 (10%) a PAE of 0.4, 34 (29%) a PAE of 0.1, 10 (9%) a PAE of 0.01, and 3 (3%) a PAE of 0. These results led to a total cost avoidance of €291,422. The economic analysis showed a return on investment of 1.7.
The overall inter-rater agreement was moderate for the severity (kappa =0.57; $p < 0.005$) and strong for the PAE (kappa=0.77; $p < 0.005$).

Conclusion: PE persist despite the implementation of a CPOE system combined with a CDSS. Pharmacists add important value in preventing PE, and their interventions are financially beneficial for the institution.

Submission Category: General Clinical Practice

Session-Board Number: 4-085

Poster Title: Assessing anaphylactic reactions among patient-reported medication allergies

Primary Author: Anna Kabakov, Midwestern University Chicago College of Pharmacy; **Email:** akabak@midwestern.edu

Additional Author (s):
Richard Wenzel

Purpose: Allergies to medications are prevalent and approximately 12% of medication errors arise from allergy issues. Poorly documented allergy information is routinely recorded within patients' medical records and accurate allergy data is essential to patient care and safety. Inaccurate or incomplete allergy information fosters inappropriate avoidance of potentially effective drugs as well as the use of inferior medications. The purposes of this study were to: classify each patient's allergy as meeting (or not meeting) the definition of anaphylaxis, compare allergies and reactions with documented information, and identify the amount of time that has passed since the allergy occurred.

Methods: The institutional review board approved this study. All patients admitted to the general medicine floor or inpatient headache unit during weekday hours were interviewed. The patient had to be greater than 18 years old and have had no documented altered mental status. A pharmacist obtained written consent and then interviewed each patient, asking:
1) Which medication(s) do you have an allergy to?
2) What was the reaction you experienced after taking this/these medication(s)?
3) How much time elapsed between when you took the medication and when you experienced the above reaction?
4) How much time has elapsed since you have had this experience (i.e. when was the last time you took this medication and experienced this reaction)?
The pharmacist then compared the patient's verbally-expressed allergies and reactions to his or her electronic medical records' data.

Results: There were 270 patients interviewed about medication allergies. The preliminary data shows that only 5% of the reported medication allergies fit into a standard definition of anaphylaxis. The data shows that 51% of patients did not report a medication allergy (i.e. No Known Allergies). Furthermore, 46% of patients who reported a medication allergy did not have

a match between verbally reported and documented medication allergy data. In addition, 38% of patients reported a reaction that was not the same as the reaction documented in the electronic health record.

Conclusion: The preliminary results show that 51% of patients do not have any medication allergies. Anaphylaxis to a medication needs to be carefully assessed as only 5% of patients had true anaphylaxis to a medication. It is important to ask the patient and document medication allergies and reactions on each admission as we witnessed that approximately 38% and 46% of patients did not have the same documented medication as was stated and the same documented reaction as was stated, respectively.

Submission Category: General Clinical Practice

Session-Board Number: 4-086

Poster Title: Ensuring patient safety at discharge with the Danish cross-sectorial personal electronic medicine profile (CPEM)

Primary Author: Fjóla Karlsdóttir, Clinical Pharmacy Unit of Odense University Hospital; **Email:** fjola.karlsdottir@rsyd.dk

Additional Author (s):
Jolene Henriksen

Purpose: The importance of minimizing medication errors at the time of discharge from hospital is of great concern for the patient´s recovery from hospitalization. In spring 2015, the Medical ward (Svendborg Hospital, Denmark) requested clinical pharmacists to facilitate the discharge process regarding medication. The ward was especially challenged by implementation of a new interactive medication system CPEM. Hence, the ward wanted a better overview of the medication changes during hospitalization and furthermore, increased patient safety regarding correct CPEM across sectors. The clinical pharmacist´s assignment was to recognize the medical changes made during hospitalization and assure discharge with a correct CPEM.

Methods: In May 2015, one clinical pharmacist started a project at the Medical ward assuring discharge with a correct CPEM. Hospitals, general practitioner and nursing homes get information about the patient´s actual medication status through the CPEM. The Medical ward consists of 36 beds within three professions, Respiratory medicine, Gastroenterology and Endocrinology. A minimum of 2 physicians are present at each unit. The clinical pharmacist was present in the ward 25 hours weekly (Monday to Friday). The clinical pharmacist constructed a journal note in the electronic patient journal regarding new prescriptions, changed dosages, discontinued medications plus the actual medication status at patient discharge. The physician and the clinical pharmacist had a dialog concerning the medication changes made during hospitalization. In addition, the clinical pharmacist pointed out the prescriptions in the CPEM which were no longer of interest. After verbal consent from the physician, the pharmacist deleted these prescriptions on behalf of the physician. This was carried out to help the physicians to update the CPEM correctly.

Results: In average, the clinical pharmacist discharged around 4 patients a day and assisted with approximately 30 to 40 percent of all patients discharged from the ward. They assisted the physicians in deleting the prescriptions which were no longer current in the CPEM. The physicians indicated that they had more clarity of the patient´s current prescriptions and in that way, the clinical pharmacists contributed to a better overview for the physicians to make medical decisions at the time of discharge. The clinical pharmacist became more integrated in the Medical ward´s daily challenges under the project. This resulted in increased collaboration across professionals and thereby, more medical related issues for the clinical pharmacist to solve. The staff at the Medical ward expressed satisfaction concerning the clinical pharmacist´s daily work.

Conclusion: A new clinical task was developed in a Danish Medical ward. Clinical pharmacists set medication in focus and give the physicians a better overview over changes made during hospitalization. Furthermore, they ensure safe medication information across sectors and thereby contribute to patient safety at discharge where loss of medication information is minimized. This task is now implemented on a daily basis at the Medical ward, and the clinical pharmacist works 30 hours a week.

Submission Category: Geriatrics

Session-Board Number: 4-087

Poster Title: Introduction of individualized patient medication cabinets to improve drug supply and administration

Primary Author: Mariosa Kieran, Mater Misericordiae University Hospital; **Email:** mkieran@mater.ie

Additional Author (s):
Susan Potter
Ciara Dowling
Ciaran Meegan

Purpose: The Post-Acute Care Services (PACS) is an off-site facility caring for 74 patients in 3 units. PACS patients are primarily frail and elderly with multiple co-morbidities requiring a high number of medications.
PACS nursing staff order drugs. In October 2014, problems in relation to drug supply and administration were identified; a high level of over-ordering, significant time involvement with drug administration and nurses administering drugs to patients not directly under their care.
The aim of this study is to improve;
• Stock control in the PACS
• Safety and efficiency of drug administration

Methods: A business case was successfully submitted to the MMUH CEO regarding introduction of patient medication cabinets (PMCs) at each bedside in the PACS. When PMCs were introduced;
• Drug trolleys were removed
• Nursing staff administered drugs to patients directly under their care.
• Guidelines on drug storage and supply for PMCs were introduced.
Key measurements pre- and post-implementation were;
• Drug issues and supplies
• Drug round timing
• Staff satisfaction surveys

Results: The PMCs were introduced to the first unit in January 2015 and a second unit in May 2015.

- Drug returns reduced by 83% in the first 6 months post-implementation.
- Drug round timing reduced by 25 minutes per unit per day.
- Staff survey results indicate that nursing staff find the PMCs a safer and more time efficient method of drug administration. However, nurses were still being interrupted during drug administration.

Conclusion: Introduction of PMCs in the PACS improved stock control, drug administration timing and staff satisfaction. Areas for future research include reducing interruptions during drug administration and development of a patient-assisted drug administration policy.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 4-088

Poster Title: Cost-effectiveness of outpatient parenteral iron therapy (OPIT) program

Primary Author: Mohammed Almeziny, Prince Sultan Military Medical City; **Email:** meziny@hotmail.com

Additional Author (s):
Dalia Abdelatif

Purpose: According to the hospital policy all parenteral medications must be administered in a hospital setting therefore, the patient needs to be admitted before medication is administered. In many cases, the only reason for patient hospitalization is patient requirement for parenteral therapy. The pharmacy and obstetric and gynecology (OBS/GYN) developed an Outpatient Parenteral Iron Therapy (OPIT) service. The aim of this study is to examine the safety and cost-effectiveness of an OPIT service in PSMMC, using outpatient' infusion center models of service delivery

Methods: All pregnant women attending OBS/GYN unit with iron deficiency anemia, requiring parenteral iron therapy and the only reason for hospitalization is their requirement for parenteral iron therapy will be referred to OPIT service.
There are many reports on the incidence of life-threatening reactions associated with parenteral iron therapy infusion therefore, patients who met the criteria for OIPT were admitted and received the first dose in the hospital then referred to OPIT unit. Equation (1) was used to calculate the total iron deficit while 14 gm/dl is the target hemoglobin level.
Total Iron deficit (mg) = 0.66 X body weight (kg) X [100-(Hgb(g/dL) X 100/ 14)] Equation (1)
On each visit, patient vital signs were measured and a doses of 200 mg iron sucrose in 250 mL sodium chloride 0.9% were administrated. Patients were monitored closely for any sign of adverse effect mainly allergy reaction, after the completion of maintenance dose post OPIT follow up were done through laboratory investigation to confirm program benefit.
Statistical method and data analysis
Descriptive statistics were generated using Microsoft Excel 2007. The following data were collected for each referred patient weight ,age , gestational week , referring physician code and bleep , Hematocrit (HCT%) ,MCHC,HGB, Red blood cell Distribution Width (RDW) , ferrtin ,MCV, number of doses, assumed number of admission days

Results: Data on clinical activities and outcomes were collected prospectively on 54 episodes of treatment administered in OPIT service between 1st of Jan and 30th of March 2016. Cost-effectiveness was calculated by comparing real costs of OPIT with estimated inpatient costs for these patient episodes. 20 patients were referred with the following values the average age was 30 years, average HGB was 8.78 g/dl and average ferritin was 16.64 µ/l. 74 doses were prepared and 54 doses were administrated. Total number of missed doses were 14 bags (200mg) which equivalent to 287.84 SAR (USD 76.76) . The main reason for missing doses was no show up to OPIT clinic. The daily cost of admission at PSMMC is 1100 SAR (USD 293.33) the approximate cost reduction was 492,000 SAR (USD 131,200) due to admission avoidance.
The program faced many obstacles, these obstacles can be submersed as follow the number of referred patient was low (10.4%) from patients who met Inclusion criteria due to lack of awareness among OBS/GYN staff. The second obstacle around 30% of OPIT patient were referred late which limit the benefits of the OPIT program

Conclusion: Using OPIT service program is safe and clinically effective, with low rates of complications. OPIT is cost-effective when compared with equivalent inpatient care in the tertiary hospital setting.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 4-089

Poster Title: Implementation of dose error-reduction software on infusion pumps in a community hospital

Primary Author: Grant Bunston, St. Mary's General Hospital; **Email:** grant.bunston@gmail.com

Additional Author (s):

Purpose: Medication safety has been a key focus of organizational improvements at our hospital. In order to improve patient safety at the point of care, infusion pumps with dose error reduction software was implemented across the organization. Previously only selected critical care medications had drug library settings and therefore did not force safe intravenous medication administration, identify near misses or standardize infusion practices across the organization. As the new infusion pumps were implemented, the dose error reduction software was applied to all medications administered intravenously in the hospital.

Methods: Using the safety principles of forcing functions, automation, and standardization, a comprehensive drug library was built. The library includes standard concentrations of medication dilutions, hard and soft limits for infusion times and doses, and specific drug advisory warnings. A team of practitioners including pharmacists, nurses, vascular access nurses, respiratory therapists, biomedical technicians, information technologists, and physicians was assembled to review all aspects of the drug library. During the library building and vetting, inconsistent infusion practices were identified. These included variations in drug dilutions, administration rates and dosing. The vetting process allowed the team to standardize drug administration in these areas. Wireless capabilities of the pump allowed for continuous quality improvement reports that were analyzed post pump implementation. Various metrics including dose error reduction software compliance, hard limit attempts, and soft limit attempts allowed the team to make improvements to the drug library to ensure compliance with the library and to identify areas where education and further standardization needed to occur to ensure safe and consistent infusion practices.

Results: In the 15 months since implementation (March 2015 to June 2016), compliance with using the drug library has been over 98 percent. 1.7 percent of programmed infusions exceeded a hard limit. A soft limit was exceeded in 5 percent of infusions, resulting in a change of dose programmed to within soft limits 20 percent of the time.

Reviewing the pump programming in classes of high risk medications such as narcotics, electrolytes, anticoagulation, and insulin demonstrated the value of the dose error reduction software. Hard and soft limit analysis demonstrated that the programming of narcotic infusions often exceeded recommended dosing. Concentrated electrolytes, in particular potassium, were attempted to infuse at faster than recommended rates. Programming for insulin and heparin infusions demonstrated both over and under dosing.
Potential adverse events associated with infusing vancomycin too quickly were prevented by using the hard limits in the dose error reduction software. A 20 percent change in the programming after reaching soft limit warnings also demonstrates the value of dose error reduction software in preventing pump programming errors.

Conclusion: Forcing functions are the most effective means to ensure patient safety. The implementation of infusion pumps with dose error reduction software has improved patient safety. A complete drug library with soft and hard limits for drug concentrations and rates of infusions has prevented errors that may have caused patient harm such as key stroke errors, incorrect bolus and infusion doses, and incorrect infusion times. By reviewing data available through the wireless continuous quality improvement reports, our clinical team is able to review errors and implement changes in real time.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 4-090

Poster Title: Reducing smart pump alarms in a neonatal intensive care unit: challenges in a unique environment of care

Primary Author: Kelly Burch, Mercy Children's Hospital St. Louis; **Email:** kelly.burch@mercy.net

Additional Author (s):
Joan Kohorst
Jonathan Lakamp

Purpose: We addressed the safety of clinical alarm systems by adjusting settings within the smart pump software, and quantified the frequency, character and response to alarms and alerts across our health system. To improve further, we wished to assess whether the frequency of air-in-line, door open and free-flow alarms could be improved with modest changes in nursing work flow in a single unit. Infusion device noise has even more impact in NICU, since the noise is annoying to parents, and may have adverse developmental outcomes for preterm infants.

Methods: We invited a consultant from the infusion device vendor to assess our practices. She recommended six adjustments to routine clinical practice, none of which required marked changes in workflow. These were: maintaining adequate head height of 20 inches above the pump, locating the pump correctly relative to the infant, seating the IV tubing securely in the air detector, priming tubing slowly, tapping the container to consolidate microbubbles, and putting the pump on pause prior to opening the door. These recommendations were communicated to NICU staff through the weekly newsletter, twice daily shift huddles, and the NICU medication committee. Modest amounts of bedside coaching were provided. Significant reduction in alarms for some patients were quickly noted, and thoroughly discussed in relation to the change in workflow. A reporting strategy was developed which counted the number of each type of alarm (air in line, door open, free flow) on a monthly basis, and compared the alarm frequency to unit census.

Results: We were initially encouraged by the marked decline in both air in line and free flow alarms, during a time of high census. Momentum was not sustained. Some of the recommendations do require specialized attention to implement. For example, head height recommendations may differ due to differences in the types of beds used. Staff changes, both

at the leadership and staff level, require ongoing attention to maintain improvement. Re-emphasis of alarm reduction strategies are ongoing with a multidisciplinary Clinical Practice team, a Nursing Shared Governance group and unit nurse educators.

Conclusion: We found that the frequency of air in line alarms could be decreased markedly by nursing workflow changes addressing the speed of priming, more careful handling of fluids, and proper loading of the tubing into the air in line detector. Door open and free flow alarms are even more easily avoided by putting the pump on pause prior to opening the door. As with any quality improvement project, initially encouraging results must be followed with attention to maintaining the gain.

Submission Category: Infectious Diseases

Session-Board Number: 4-091

Poster Title: Evaluation of incidence and severity of linezolid induced thrombocytopenia at a tertiary hospital facility, Qatar: retrospective cohort study

Primary Author: Eyad Almadhoun, Hamad General Hospital; **Email:** ealmadhoun@hamad.qa

Additional Author (s):
Hassan Mitwally
Walid Mekkawi

Purpose: Linezolid is a synthetic Oxazolidinone antibiotic becomes widely use in the clinical practice due to its broad spectrum coverage against gram positive organisms specially the resistant strains as Methicillin-resistant Staphylococcus aureus (MRSA) & vancomycin resistant enterococcus (VRE).
The most clinically significant adverse event secondary to the use of linezolid is thrombocytopenia.
The aim of this study to evaluate the incidence and the severity of linezolid induced thrombocytopenia (LIT) in our population and also to evaluate the timing of LIT to happened in our population (early or delayed reaction) as a secondary outcome.

Methods: This is a retrospective cohort study including adult inpatients received linezolid either oral or intravenous for 5 days or more from 01/01/201 Till 31/12/2015.
Thrombocytopenia will be defined as drop of platelet count more than 30% from baseline or drop of platelet below than 150,000/µL. The severity of thrombocytopenia will be graded by the Common Toxicity Criteria to describe severity of thrombocytopenia system developed by the National Cancer Institute (NCI), Platelet counts of 75,000 to 150,000/µL are defined as grade 1 thrombocytopenia, 50,000 to _75,000/µL as grade 2, 25,000 to _50,000/µL as grade 3, and below25,000/µL as grade 4 thrombocytopenia, In which higher grade indicate more severe reaction.
Data were collected using approved data collection sheet and were analyzed using SPSS version 21.

Results: 604 patients were included initially, 20 patients were excluded because they are pediatric patients.
Among 584 patients, only 200 patients received linezolid for five of more days. (146) were male and (43%) were female .mean age was 55 years old among all patients. 105 patients (52.5%) developed thrombocytopenia .43 patients developed grade 1 thrombocytopenia ,38 patients developed grade II ,14 patients developed Grade III Thrombocytopenia and 10 patients developed Grade III based on National Cancer Institute (NCI) classification .

Conclusion: In terms of studies utilizing a standardized definition in the National Cancer Institute (NCI) classification for thrombocytopenia. At dosing strategies of 600 mg twice daily for a duration of five days or more.
Linezolid found to be associated with high incidence of causing thrombocytopenia ranging from grad I to Grade IIII in severity .in most of cases this thrombocytopenia was reversible after discontinuing linezolid and it was not associated with significant clinical outcome

Submission Category: Infectious Diseases

Session-Board Number: 4-092

Poster Title: Evaluation of the epidemiology and treatment of healthcare-associated infections in a community teaching hospital

Primary Author: Andrew Aziz, Hunterdon Medical Center; **Email:** andrew.aziz09@gmail.com

Additional Author (s):
Rani Madduri
Ashmi Philips
Mini Varghese

Purpose: Patients with risk factors for healthcare-associated infections (HAIs) are empirically treated with broad-spectrum antibiotics. Overestimation of the number of resistant pathogens in healthcare settings may play a role in the over-utilization of broad-spectrum antimicrobials. The purpose of this study was to examine the epidemiology and risk factors associated with HAIs and determine the impact of pharmacist-driven de-escalation.

Methods: This was a prospective cohort study at a community teaching hospital from February to April 2016. Patients included in the study were aged 18 years or older, admitted to a medical/surgical unit, and received at least one dose of antibiotics within the first 48 hours of hospitalization to treat a suspected HAI. Once microbiological studies resulted, pharmacy evaluated the causative organism and susceptibility patterns, and when necessary, made recommendations regarding antimicrobial therapy. The primary outcomes were epidemiology of the isolated pathogens and risk factors for HAIs. The secondary outcomes were the number of stewardship interventions performed by pharmacy, duration of antimicrobial therapy, and length of hospital stay.

Results: Forty-three patients were included in this study and 54 pathogens were isolated, of which only 50 percent were classified as HAI-associated. The most common HAI-associated pathogens were Pseudomonas aeruginosa, Escherichia coli and Klebsiella pneumoniae. Among the 43 patients, 39 (90.7 percent) had at least one underlying risk factor for a suspected HAI. The most common risk factors identified were prior hospitalization, prior antimicrobial therapy, and residence in a nursing home or extended care facility. Adjustment in antimicrobial therapy was warranted in 72.1 percent of patients. The average time to adjustment was 2.38 days. Pharmacy interventions resulted in cost savings of 11,715 dollars.

Conclusion: The study found that only 50 percent of isolated pathogens were classified as HAI-associated, which suggests that not all HAIs require treatment with broad-spectrum agents. Due to the prevalence of resistant organisms, empiric broad-spectrum therapy may be necessary, and close monitoring of these patients is imperative.

Submission Category: Infectious Diseases

Session-Board Number: 4-093

Poster Title: Impact of pharmacist-facilitated restriction of daptomycin in an inpatient community hospital

Primary Author: Sara Badaglialacqua, Cardinal Health; **Email:** sara.badaglialacqua@cardinalhealth.com

Additional Author (s):
Mike Mesdaghi

Purpose: High utilization of daptomycin led to development of criteria for use to be enforced by pharmacists at the time of order entry. Previous to this program, daptomycin was restricted to infectious disease physicians. However, this restriction of daptomycin did not enhance appropriate prescribing and daptomycin was often used first line. Medication use evaluations conducted on daptomycin supported that enforcement of criteria for use would be instrumental in ensuring that daptomycin was being used for resistant infections where other agents would not be appropriate and also provide cost savings to the hospital.

Methods: In order to effectively require daptomycin to go through a stringent screening process, daptomycin was designated as a non-formulary drug, prompting prescribers to submit a detailed request for the drug if its use was required. A screening form was created to assist the pharmacists in determining if daptomycin was being used for an appropriate indication. The screening form included a section for patient demographics, microbiology, and contraindications to other therapy (e.g. linezolid, ceftaroline). Starting in March 2015, all daptomycin orders that were received were required to undergo pharmacist screening before dispensing. After one year of this screening process, a comparison was made between diagnosis related groups who had high daptomycin use in year one (March 2014-Feb 2015) to that same diagnosis related group in year two (March 2015-Feb 2016). The outcomes analyzed included inpatient mortality, length of stay, and the average cost of anti-MRSA/VRE therapy.

Results: Re-classification of daptomycin to non-formulary status significantly decreased utilization. Analysis of financial data and outcomes data comparing the diagnosis related groups between year one and year two demonstrated no negative impact on in-patient mortality, a decreased average length of stay, and a decrease in drug costs for anti-MRSA/VRE agents.

Conclusion: Incorporation of pharmacist screening of restricted antibiotics as part of an antimicrobial stewardship program may have a beneficial impact on proper selection of antimicrobial agents. In addition, this process may also provide a cost-savings to the hospital by decreasing the over-use of antibiotics intended for resistant infections.

Submission Category: Infectious Diseases

Session-Board Number: 4-094

Poster Title: Impact of pharmacist antimicrobial stewardship interventions on clostridium difficile infection rates in a large health system

Primary Author: Sarah Beaty-Vandemark, Providence Health & Services; **Email:** sarah.beaty@providence.org

Additional Author (s):
Jarrod Brubaker
Dan Laferriere
Thomas French

Purpose: Antimicrobial stewardship (AMS) programs increase the appropriate use of antibiotics by interventional efforts designed to optimize clinical outcomes, minimize the development of resistance, and limit adverse drug effects. In addition, AMS interventions aim to decrease the overall utilization of antibiotics, which is believed to reduce the incidence of clostridium difficile infection (CDI), especially drugs known to cause the highest risk, such as fluroquinolones and clindamycin. The purpose of this study was to identify and quantify the AMS interventions across a large health system to determine the potential impact of AMS activities on CDI rates.

Methods: : A retrospective study of AMS programs across Providence Health and Services, 31 hospitals, was conducted to evaluate the clinical strategies, interventions, recommendations and acceptance rates of these activities and their potential impact on CDI rates. The evaluation included surveys, chart review, and analysis of electronic records. Surveys of AMS staff or managers were conducted to understand the strategies in use at each hospital, ratings of how strongly each activity was implemented, and how AMS staff communicated their recommendations to physicians. Chart review using a random sample of AMS records (n=556) and a case-matched control group (n= 542) was completed to evaluate the implementation of AMS recommendations. Charts were reviewed for evidence of changes in antibiotic orders to determine if AMS recommendations were implemented. If an order matching the recommendation was found, the order date, and the ordering provider (physician or pharmacist) who initiated the order, was captured. Analysis of intervention data from December 2015 (n = 3425) was completed to understand variation in documentation practices. To compare the volume of AMS interventions between hospitals, we calculated a total interventions to patient ratio. To determine if a relationship between the volume of AMS

interventions and the rate of CDI existed, the volume of AMS interventions were compared to the hospital-onset standardized infection rate (SIR).

Results: The pharmacists use a variety of communication methods when making recommendations, with the majority using more than one methodology. One-third of the hospitals used progress notes. Two-thirds utilized electronic health record “sticky notes” to communicate recommendations. The majority of facilities use verbal communication, and 5 of 31 use secure text messaging. Hospitals using progress notes had a higher implementation rate, eighty-seven percent versus eighty-one percent. The most frequently used interventions were de-escalation and restriction of targeted antimicrobials. There was a small trend towards an inverse relationship between volume of interventions and hospital-onset standardized infection rate (r value of negative 0.24, p value of 0.24). The case-matched sample demonstrated a statistically significant difference in AMS activities for patients with CDI, 23 percent versus 14 percent (p of 0.042). Significant variation in the use of the internal documentation system was found.

Conclusion: AMS activities as measured by the interventions, recommendations, and acceptance rates appear to have an impact on CDI rates. This is the first evidence at Providence Health and Services that pharmacy-driven AMS interventions demonstrated such an impact, and the significant acceptance rate of this work. This evaluation also demonstrated significant variation in method of documentation of the interventions by pharmacy staff. Opportunities identified for improvement include promoting standardization of intervention type, documentation of all antimicrobial reviews, including those not warranting recommendations, and documentation of provider response to these recommendations.

Submission Category: Infectious Diseases

Session-Board Number: 4-095

Poster Title: Taking an antibiotic time-out: impact of a seven-day automatic stop order on duration of antibiotics

Primary Author: Stephen Bienemann, The Mount Sinai Hospital; **Email:** stephen.bienemann@mountsinai.org

Additional Author (s):
Patricia Saunders-Hao
Jashvant Poeran
Madhu Mazumdar
Gopi Patel

Purpose: Antimicrobial stewardships are an effective way of limiting the overuse we see with antibiotics. The CDC lists the "antibiotic time out" as a core element of hospital antibiotic stewardship programs. At our institution, an automatic seven-day stop order on all intravenous (IV) antibiotics was implemented in June 2015. The objective of this study is to determine the impact of the seven-day antibiotic stop order on the overall days of antibiotic therapy by comparing number of orders continued beyond day seven pre and post implementation.

Methods: A retrospective review of medication administration records was conducted between March 2015 and December 2015. All patients with ≥ 1 day of standing IV antibiotic therapy were included. An electronic best practice advisory, alerts prescribers in our electronic medical record on days 5, 6, and 7 of therapy. This alert provides the prescriber with information about when the specific antibiotic order will discontinue. Data was collected 3 months prior to implementation and compared to 6 months post implementation. Data collected included medication name, dose, order start date and time, order end date and time, and duration. Chi-square test was performed with a p-value of < 0.05 showing statistical significance.

Results: Our results showed that there was no difference pre- or post-implementation between number of IV antibiotics orders that ended before day 5. There was a 12.6% increase in number of IV antibiotics orders that ended on days 5-7 of therapy. In addition there was a 7% increase in number of IV antibiotic orders ending on day 7. Lastly, there was a 12.5% decrease in the number of IV antibiotics orders renewed beyond 7 days which was found to be statistically significant (p value < 0.05).

Conclusion: In conclusion, the implementation of a seven day automatic stop order on IV antibiotics caused a statistically significant reduction in the number of antibiotic orders renewed beyond seven days.

Submission Category: Infectious Diseases

Session-Board Number: 4-096

Poster Title: Evaluating compliance with antibiotic guidelines for skin and soft tissue infections in the emergency department

Primary Author: Jared Borlagdan, University of Michigan College of Pharmacy; **Email:** jpborlag@med.umich.edu

Additional Author (s):
Amy Chang
Carol Chenoweth
Tejal Gandhi
Jerod Nagel

Purpose: The University of Michigan Health System developed institutional treatment guidelines for skin and soft tissue infections (SSTIs) which stratify therapy by infection type: non-purulent cellulitis, purulent cellulitis with simple abscess, purulent cellulitis without abscess, animal bites, and complicated SSTIs. For example, these guidelines recommend cefazolin as first-line empiric treatment of non-purulent cellulitis in patients without a severe penicillin allergy. These guidelines also do not recommend gram-negative coverage for empiric treatment of purulent cellulitis. This purpose of this project was to evaluate adherence to institutional SSTI guidelines in the emergency department (ED) and determine the incidence of inappropriate gram-negative therapy.

Methods: The institutional review board approved this retrospective, single-center, cohort study that evaluated treatment regimens for patients admitted from the ED with SSTIs and compliance with institutional guidelines. Gram-negative therapy for non-purulent cellulitis, purulent cellulitis with simple abscess, and purulent cellulitis without abscess was considered inappropriate. Patients greater than 18 years of age and admitted from July 2012 to July 2013 with an ICD9 associated with SSTIs were included. Patients were excluded if they presented with any of the following conditions: osteomyelitis, necrotizing fasciitis, septic arthritis, surgical site infection, preseptal or orbital cellulitis, peripheral IV-associated cellulitis, device infection, fistula or graft infection, gas gangrene, bursitis, perineal infection, or odontogenic infection. Patients were also excluded if their cellulitis was unable to be characterized or if they experienced a concomitant infection during their hospitalization. Patients were stratified into two groups: compliant and non-compliant based on initial therapy in the ED.

Results: 259 patients were included in the study: 128 (49 percent) with non-purulent cellulitis, 11 (4 percent) with purulent cellulitis without abscess, 35 (14 percent) with purulent cellulitis with simple abscess, and 72 (28 percent) with complicated SSTIs. Antibiotic treatment complied with institutional treatment guidelines in 62 (26 percent) patients. The most common reason for non-compliance was use of clindamycin for non-purulent cellulitis in patients without a severe penicillin allergy. Additionally, gram-negative coverage was prescribed for 32 out of 128 (25 percent) patients with non-purulent cellulitis, 0 out of 11 (0 percent) patients with purulent cellulitis without abscess, and 2 out of 35 (6 percent) patients with purulent cellulitis with abscess. Wound cultures were positive in 34 out of 174 (20 percent) patients with non-purulent cellulitis and purulent cellulitis with and without abscess. Only one patient grew a gram-negative pathogen. There was no significant difference in mortality, length of stay, and readmission between compliant versus non-compliant groups. Non-compliance with institutional guidelines demonstrated a 2.667 relative risk (95 percent confidence interval, 0.414 to 17.169, p equals 0.302) for Clostridium difficile infection (CDI), but the incidence was not statistically significant (1.6 versus 4.6 percent, p equals 0.351).

Conclusion: Compliance with institutional treatment guidelines for SSTIs was low in the ED. The two most common types of non-compliance were unnecessary gram-negative coverage and use of clindamycin as first-line therapy for non-purulent cellulitis. These findings demonstrate a stronger need for antibiotic stewardship in the ED for treatment of SSTIs. Larger studies are needed to determine the impact of lack of compliance on clinical outcomes and CDI in these patients.

Submission Category: Infectious Diseases

Session-Board Number: 4-097

Poster Title: Using a readiness checklist and ranking grid to prioritize antimicrobial stewardship initiatives

Primary Author: Justin Clark, Wolters Kluwer; **Email:** jclarkpharmd@yahoo.com

Additional Author (s):

Purpose: As antimicrobial stewardship programs (ASPs) are created and expand across the healthcare landscape, deciding which clinical initiatives should be implemented and when to implement them can be challenging. Using tools such as a readiness checklist and a grid that measures feasibility versus value can be very helpful to the program. Implementing an initiative before the program is ready or choosing one that is not feasible could start the program off in the wrong direction.

Methods: The ASP first conducted a stewardship readiness status check by reviewing four distinct categories – Inventory, Gap Analysis, Plan, and Implementation. An inventory status check allows the ASP to determine existing resources available, the knowledge level of the pharmacy staff, the policies and guidelines currently in place related to stewardship, the technology tools or software available, and usable data within those tools or software. A gap analysis allows the ASP to compare current state of the program to evidence-based and best practice standards. Planning which clinical initiatives to begin implementation and deciding the best way to implement those initiatives completes the readiness checklist.
To determine the clinical initiative to be tackled first, the antimicrobial stewardship committee used a grid that measured feasibility (x-axis) versus value (y-axis). The grid was divided into four sections that represented low value/low feasibility, high value/low feasibility, low value/high feasibility, and high value/high feasibility. An example of how this grid was used: De-escalation had the highest value on the goals of the ASP but had low feasibility, while IV-to-PO conversion was ranked as the most feasible to implement but had low value to the goals of the ASP. Renal dosing, however, was ranked as highest value to the ASP and highest feasibility to implement.

Results: The use of these two tools allowed the ASP to quickly and efficiently decide where to invest time, effort, and resources. The readiness checklist provided insight into missing components of the current ASP, including some basic education needs among the pharmacy

staff, electronic surveillance needs to complete the clinical initiatives, and executive leadership support. The ASP used the grid to plot out all IDSA supplemental strategies and create a plan for moving forward with implementation.

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

Submission Category: Infectious Diseases

Session-Board Number: 4-098

Poster Title: Pharmaceutical care in hepatitis C outpatients: detecting and solving drug interactions

Primary Author: Roberto Collado-Borrell, ; **Email:** roberto.colladob@gmail.com

Additional Author (s):
Alvaro Giménez-Manzorro
Almudena Ribed-Sánchez
Ana Herranz-Alonso
María Sanjurjo-Sáez

Purpose: New direct-acting antiviral (DAA) agents meant a breakthrough in the treatment of hepatitis C virus. High reponse rates are obtained with a low profile of adverse effects experienced. Nevertheles, these DAA agents are not free of drug-drug interactions (DDI), which can significantly reduce their effectiveness or produce adverse events.
The aim of this study is to detect and describe the type and severity of DDIs between DAA and concurrent patient medication and to solve them through pharmacist interventions.

Methods: An observational, descriptive, prospective study was carried out in the outpatients pharmacy consults of a University Hospital. Every patient starting treatment from April 2015-2016 were included.
The patients' concurrent medication was screened by the pharmacist during the interviews carried on in a monthly basis, among an intensive pharmaceutical care program. Potential interactions between DAA and concurrent medications were checked through the Lexi-comp® application and the website http://www.hep-druginteractions.org of the University of Liverpool. Those interactions were classified according to the severity defined by FDA (C, D or X). Recommendations were by pharmacists to avoid clinical significant DDI.

Results: 1082 patients were included (61%men); mean age 59.6 (SD:11.8). 58.4% patients were treated with ombitasvir/paritaprevir/ritonavir+/-dasabuvir, 33.9% with sofosbuvir/ledipasvir and 7.7% with others. The mean number of concurrent medication per patient was 4.1(SD:3.1). 788 DDI were recorded: 57.5% with ombitasvir/paritaprevir/ritonavir+/-dasabuvir, 39.3% with sofosbuvir/ledipasvir, and 3.2% with others. At least one DDI was identified in 386 patients

(49%) According to FDA severity, DDI were classified as follows: type-C(45.6%), type-D(46.7%) and type-X(6.5%).
The most frequent DDI were as follows: cardiovascular agents (36.8%), pump proton inhibitors (PPI) (31%), and antidepressants (10.4%). In most cases the drug interacting with ombitasvir/paritaprevir/ritonavir+/-dasabuvir, was amlodipino, and with sofosbuvir/ledipasvir was omeprazol.
In 300 (38.1%) interactions pharmaceutical intervention was required: 85 (28.3%) interventions were necessary to correct the technique of administration, 98 (32.7%) interventions to improve safety or effectiveness monitoring and 32 (10.7%) to withhold any of the treatments for contraindication.

Conclusion: Patients treated with DDA are polymedicated and almost half of them suffered at least one moderate/severe drug interaction. The most relevant DDI were cardio vascular agents, PPI, and antidepressants. The intensive pharmaceutical care program has proved to be important to detect DDI and improve safety and effectiveness of clinical significant DDI.

Submission Category: Infectious Diseases

Session-Board Number: 4-099

Poster Title: Implementation of a pharmacist-driven hepatitis C management program

Primary Author: Nicole Croyden, Hunterdon Medical Center; **Email:** nicole.croyden@wilkes.edu

Additional Author (s):
Rani Madduri
Joseph Gugliotta
Ashmi Philips
Navin Philips

Purpose: Hepatitis C affects 2 to 3 million people in the United States and can lead to chronic liver disease, cirrhosis, and hepatocellular carcinoma. Treatment involves medications that have high potential for nonadherence due to adverse effects, drug interactions, pill burden, and cost. Participation of pharmacists in management of chronic disease states has been shown to improve patient outcomes and adherence; however, more data is needed for patients treated with newer hepatitis C regimens. The objective of this study is to assess the impact of a pharmacist-driven hepatitis C program on end of treatment response (ETR), patient satisfaction, and medication adherence.

Methods: This single-center, prospective study was conducted from December 2015 through April 2016 at an outpatient Infectious Diseases office. The clinical pharmacist was consulted by an Infectious Diseases physician for patients diagnosed with and seeking treatment for hepatitis C. The primary outcome of this study was the percentage of patients who achieved ETR. Secondary outcomes included time to undetectable viral load, medication adherence, adverse effects, and overall patient satisfaction. Patient charts were reviewed to determine hepatitis C genotype, viral load, and fibrosis score along with significant past medical history and current medications. Recommendations for therapy were based on pertinent patient data, current medications, and the American Association for the Study of Liver Diseases-Infectious Diseases Society of America guidelines. They were communicated to the physician via a written pharmacotherapy note that was placed in the patient's chart. Patients picked up the initial prescription at the office and were counseled by the pharmacist on how to take the medication, the refill process, possible adverse effects, and drug interactions. Follow up was completed through patient phone calls, at which time adverse effects and adherence were addressed. A

survey was given after completion of therapy to determine patient satisfaction with pharmacy services.

Results: A total of six patients were included in the study with an average age of 50 years. Half of the patients were male, 66.6 percent had hepatitis C genotype 1a, and all patients were treatment naïve and received ledipasvir/sofosbuvir for either eight or 12 weeks. End of treatment response was achieved in 66.6 percent of patients. Four of the six patients (66.6 percent) reported adverse effects including headache (50 percent), asthenia (25 percent), and heartburn (25 percent). Adherence rates were 100 percent in five of the six patients; one patient had a 98 percent adherence rate after missing one dose of medication. All patients rated pharmacy services as “good” or “very good” and felt they had adequate contact with the pharmacist over the course of their treatment.

Conclusion: Pharmacists are able to dedicate adequate time to conducting the initial assessment, counseling patients, and providing necessary follow up. Pharmacy involvement in the management of hepatitis C resulted in patient satisfaction and high rates of adherence, which leads to successful treatment.

Submission Category: Infectious Diseases

Session-Board Number: 4-100

Poster Title: A small community hospital experience with fecal microbiota transplantation for clostridium difficile treatment

Primary Author: Michael Dimont, Adventist Medical Center Hanford; **Email:** dimontmb@ah.org

Additional Author (s):
Mina Raju
Boris Reznik
Kristy Fitzgerald
John Choi

Purpose: Clostridium difficile infection (CDI) is an epidemic with increasing incidence, morbidity, and mortality over the past two decades. Despite available treatments for initial moderate and severe CDI, the rate of recurrence ranges from 6-25 percent. Fecal microbiota transplantation (FMT) is an emerging investigational treatment option for CDI. FMT involves transplant of fecal matter from a healthy donor into the GI tract of a Clostridium difficile-infected patient in an attempt to reintroduce indigenous flora that can restore balance to the microbiota and outcompete the virulent strains. At our community teaching hospital in Central California, we have completed a retrospective review of patients identified after implementation of a FMT program which has reduced readmission and reinfection of patients with recurrent CDI.

Methods: Through a major collaboration across Pharmacy, Laboratory, Infectious Disease, and Gastroenterology and with approval from the hospital pharmacy and therapeutics committee, a FMT protocol was implemented in December of 2015. Patients treated under the protocol each had confirmed CDI as defined by a positive stool screen for Clostridium difficile toxin by polymerase chain reaction (PCR) and diarrhea (greater than or equal to three loose or watery stools per day for at least two consecutive days). Each of the patients had at least one prior episode of CDI and had failed treatment with either metronidazole or oral vancomycin during the hospitalization in which FMT was administered. Patients who were immunocompromised, pregnant, requiring vasopressors, or on antibiotics for treatment of infections other than CDI, and patients with toxic megacolon or ileus were excluded from the protocol. A commercially prepared fecal microbiota product was administered which had been collected from healthy donors and tested for infectious disease by the supplier. Informed consent was obtained from

all patients receiving FMT. Preparation for the procedure included a single oral lavage of three to four liters of osmotic laxative. All patients received the FMT via colonoscopic installation into the ileum. A retrospective review of the patient records was done to evaluate readmission and reinfection rates.

Results: After consultation with both a gastroenterologist and an infectious disease physician, four patients received FMT under the protocol between December 2015 and March 2016. After receiving FMT, each of the patients experienced a resolution of diarrhea, fever and leukocytosis within 48 hours after the procedure. Each of the patients was eventually discharged home with no further antibiotic treatment for CDI. None of the patients treated required readmission within 30 days of discharge or have had any documented recurrences of CDI as of May 2016. No complications or adverse effects resulting from FMT were observed.

Conclusion: Although the sample size is relatively small, our preliminary experience with fecal microbiota transplant has been successful and is consistent with other previously published case studies. Further evaluation, including a large-scale controlled clinical trial is warranted to determine the clinical role for FMT in patients with CDI who have failed other available treatment options.

Submission Category: Infectious Diseases

Session-Board Number: 4-101

Poster Title: Clinical outcomes of laboratory-confirmed influenza among hospitalized adults

Primary Author: Ryan Dull, Creighton University; **Email:** ryandull@creighton.edu

Additional Author (s):
Sarah Adie
Linda Ohri
Christopher Destache

Purpose: Influenza vaccination provides moderate protection against infection but its efficacy is substantially reduced when there is a mismatch between circulating influenza and vaccine serotypes. During seasons of low vaccine effectiveness due to antigenic drift, vaccination may reduce influenza outcome severity but supporting data are limited. More than 80 percent of the predominant circulating influenza A (H3N2) viruses in the United States during the 2014-2015 influenza season were antigenically different from the vaccine strain. This yielded an adjusted seasonal vaccine effectiveness of only 23 percent. The objective of this study was to evaluate the association between the 2014-2015 seasonal influenza vaccine and influenza severity among hospitalized patients with laboratory-confirmed influenza infection.

Methods: The Creighton University IRB approved this study as exempt. A retrospective chart review of patients admitted to a legacy Catholic Health Initiatives (CHI) hospital in the Omaha-Council Bluffs metropolitan area with laboratory-confirmed influenza infection between October 1, 2014 and April 30, 2015 was performed. Adults older than 19 years of age were included if influenza was diagnosed using a rapid antigen immunoassay or multiplex polymerase chain reaction assay. Patients were excluded if there was no documented vaccine history, administration of the seasonal influenza vaccine occurred less than 14 days prior to admission, transfer from a non-CHI Health hospital, received neuraminidase inhibitor therapy prior to admission, or re-hospitalized during the study interval. The primary outcome, severe influenza, was defined by inpatient mortality, intensive care unit admission, and/or hospital discharge to a higher level of care. Patient demographic and clinical data were analyzed by influenza vaccination status. Descriptive statistics were analyzed using student's t-test, chi-square test, or Fisher's exact test, where appropriate. Multivariate logistic and linear regression models evaluated the association between influenza vaccination and severe influenza, influenza complications, 30-day readmission, and hospital length of stay (LOS), adjusted for covariates of

gender, race, and high-risk features. Data are presented as percentage or mean plus or minus the standard deviation.

Results: Of the 156 adults hospitalized with laboratory-confirmed influenza, 111 (71 percent) received the 2014-2015 seasonal influenza vaccine at least 14 days before admission. Unvaccinated patients were younger (64 plus or minus 21 years vs. 77 plus or minus 17 years; P less than or equal to 0.01), had a lower rate of neurologic disease (13.3 percent vs. 32.4 percent; P equals 0.02) and a higher rate of alcohol abuse (11.1 percent vs. 2.7 percent; P equals 0.045). The financial pay category between groups was significantly different (P equals 0.046). After controlling for covariates, vaccination was not associated with a reduction in severe influenza (OR 0.891, 95 percent CI 0.335 to 2.369; P equals 0.817), pneumonia (OR 0.303, 95 percent CI 0.085 to 1.077: P equals 0.065) or hospital readmission (OR 2.481, 95 percent CI 0.668 to 9.225; P equals 0.175). Vaccination was associated with a lower odds of respiratory failure (OR 0.351, 95 percent CI 0.142 to 0.866; P equals 0.023) and a shorter LOS in the hospital (0.22 days; P equals 0.003).

Conclusion: The 2014-2015 seasonal influenza vaccine was not associated with lower odds of severe influenza but vaccinated patients had significantly reduced incidence of respiratory failure and a shorter hospital LOS.

Submission Category: Infectious Diseases

Session-Board Number: 4-102

Poster Title: Extended versus intermittent infusion of piperacillin/tazobactam in critically ill patients: a prospective clinical trial

Primary Author: Sheung Yin Fan, Pamela Youde Nethersole Eastern Hospital, Hospital Authority; **Email:** sheungyincarol@gmail.com

Additional Author (s):
Hoi Ping Shum
Wing Yee Cheng
Yat Hei Chan
McShirley Leung

Purpose: The bactericidal effect of piperacillin/tazobactam is maximized by maintaining the free drug concentration above the minimum inhibitory concentration (MIC) for greater than 50 percent of the time. Pharmacokinetic and pharmacodynamic studies have revealed that extending the infusion time of piperacillin/tazobactam could greatly increase the probability of attaining this target for pathogens with high MICs. Few small-scale, randomized clinical trials have investigated the clinical outcomes of extended infusion of piperacillin/tazobactam, and all have demonstrated inconsistent results. The objective of this study was to determine whether extended infusion of piperacillin/tazobactam would improve the clinical outcomes of patients.

Methods: An open-label, prospective clinical trial was conducted in a 22-bed Intensive Care Unit (ICU) in a regional hospital in Hong Kong. Patients were eligible if they (1) were 18 years of age or older, (2) either had received a diagnosis of bacterial infection or suffered from neutropenic fever, and (3) received treatment of piperacillin/tazobactam for at least 48 hours, either empirically or according to the latest culture sensitivity results performed within five days, and (4) agreed to participate by providing written informed consent. Exclusion criteria were (1) pregnancy, (2) more than 48 hours of treatment with effective antibiotics (defined by specimen culture sensitivity results, within five days of initiation of piperacillin/tazobactam), or (3) concomitant use of β-lactam antibiotics. Eligible patients received either extended 4-h infusion (EI) or non-extended 30-min infusion (NEI) of piperacillin/tazobactam. All recruited patients were followed for at least 14 days after treatment assignment. The primary outcome was the 14-day mortality rate after initiation of piperacillin/tazobactam. The secondary

outcomes included the in-hospital mortality rate, time to defervescence, duration of mechanical ventilatory support, length of stay in the ICU, and length of hospital stay.

Results: From December 1, 2013 to August 31, 2015, 367 patients were assigned to EI (N equals 182) or NEI (N equals 185) groups. No significant differences in baseline demographics and clinical characteristics were found between the groups, except that significantly more patients were using immunosuppressants in the EI group (p equals 0.02). Both groups demonstrated similar 14-day mortality (11.5 percent vs. 15.7 percent, p equals 0.29). The mean time to defervescence was significantly reduced in the EI group (4 days versus 6 days, p equals 0.01). There were no differences in other secondary outcomes. In post hoc subgroup analysis, a 14-day mortality benefit was demonstrated in patients in the EI group who were infected with susceptible organisms (9.4 percent vs. 22.2 percent, p = 0.03) and diagnosed with respiratory tract infection (8.9 percent vs. 18.7 percent, p equals 0.02).

Conclusion: In summary, our study demonstrates a similar 14-day mortality rate for patients who receive either EI or NEI of piperacillin/tazobactam. Our study, however, suggests that the 14-day mortality benefit is most pronounced in subgroups of patients in the EI group who suffer from bacterial infections with susceptible pathogens identified or diagnosed with respiratory tract infection. This would potentially change the current practice of how piperacillin/tazobactam is administered for the treatment of infection.

Submission Category: Infectious Diseases

Session-Board Number: 4-103

Poster Title: Impact of methicillin-resistant staphylococcus aureus nasal polymerase chain reaction guided stewardship on utilization of vancomycin and linezolid in healthcare-associated pneumonia

Primary Author: Christopher Fronczek, Morton Plant Hospital; **Email:** christopher.fronczek@baycare.org

Additional Author (s):
Lynne Krop
Lawrence Davila
Kathleen Shannon
Nicholas Piccicacco

Purpose: Methicillin-resistant Staphylococcus aureus (MRSA) remains a common pathogen in the epidemiology of the healthcare-associated pneumonia (HCAP). Current guidelines recommend empiric use of MRSA agents, such as vancomycin and linezolid, paired with an anti-pseudomonal beta-lactam. Antibiotic streamlining is frequently based on prescriber judgment as respiratory cultures are often difficult to collect or do not produce a predominant organism. MRSA nasal polymerase chain reaction (PCR) results have demonstrated strong negative predictive value in determining negative MRSA respiratory cultures. The purpose of this study was to evaluate the impact of MRSA nasal PCR results as a stewardship tool in the treatment of HCAP.

Methods: This investigation was an institutional review board-approved, pre-post intervention cohort study. Study groups consisted of patients admitted from Sept 2014 to April 2015 for Group 1 and from Oct 2015 to March 2016 in Group 2, who received empiric inpatient HCAP therapy. Patients included were greater than 18 years old and required a negative MRSA nasal PCR result in the intervention group and either a negative or no result in the historical group. Exclusion criteria included: MRSA coverage for indication outside of pneumonia, mortality within 48 hours of antibiotic initiation, documented severe beta-lactam allergy, severe neutropenia (ANC less than 500), and patients with pulmonary abscess or empyema. Our institution's stewardship team conducted a daily review of patients receiving HCAP therapy and available MRSA nasal PCR results and made subsequent stewardship recommendation upon a negative result. The primary outcome was duration of MRSA active therapy. Secondary

outcomes evaluated included total duration of inpatient antibiotics, hospital and intensive care unit (ICU) length of stay (LOS), ventilator days, mortality, 30-day readmission, and adverse events. Continuous variables were analyzed by Mann-Whitney U and categorical variables by Chi-square tests. A sample size of 64 patients per arm was calculated to detect a two-day difference in MRSA agent utilization with a power of 0.8 and an alpha of 0.05.

Results: During the study period, 128 patients were enrolled and evaluated. Sixty-four patients in the intervention group were compared to 64 patients in the historical control. Baseline demographics were similar in the two groups with the exception of the historical control having a higher proportion of males, more infectious disease consultations, and higher peak procalcitonin level. Stewardship interventions, based on negative MRSA nasal PCR results, lead to a reduced median time on MRSA therapy from 3.5 to 1.2 days (p-value less than 0.01). Total time on inpatient antibiotic therapy (6.2 vs. 5.0 days, p-value equal to 0.01) and length of stay (8.0 vs. 6.0, p-value less than 0.01) were also significantly decreased in the intervention group. ICU LOS and ventilator days were similar between groups. There were no differences observed in safety endpoints, as measured by mortality, 30-day readmission, or adverse events. The high negative predictive value outlined in the literature was supported with no patients in the intervention group producing MRSA in respiratory culture.

Conclusion: Utilization of MRSA nasal PCR result as a stewardship tool led to a 2.3-day reduction in time on empiric MRSA therapy. This study demonstrates that MRSA colonization, as assessed by nasal PCR test, can be used safety and effectively to facilitate early discontinuation of empiric MRSA therapy in the treatment of HCAP.

Submission Category: Infectious Diseases

Session-Board Number: 4-104

Poster Title: Improvement of outcomes and reduction of cost in pneumonia care by modifying a care protocol through an antibiotic stewardship multidisciplinary team in a non-academic community hospital

Primary Author: Nathan Goracke, Rice Memorial Hospital; **Email:** nathan.goracke@rice.willmar.mn.us

Additional Author (s):
Carlos Franco Palacios
Michael May
Carnita Allex
Lucio Minces

Purpose: Antibiotic stewardship is of great relevance at multiple levels including safety, patient outcomes, cost savings and prevention of antibiotic resistance. Our hospital is a 100 bed, community based, non-academic facility. An antimicrobial stewardship subcommittee was created in 2013. Among many stewardship interventions, the pneumonia care protocol was modified. Herein we described the results of this intervention.

Methods: Data was compared from 1/1/12 through 12/31/12 (standard period) versus 6/1/13 through 5/31/15 (intervention period) after the protocol was modified. The modifications were completed with a multidisciplinary subcommittee, which included pharmacist, infectious disease physician, infection preventionist, registered nurse, microbiologist, administration and other representative physicians. The changes included, but were not limited to, substitution from ceftriaxone to ampicillin-sulbactam for community acquired pneumonia, de-escalation of dual therapy for health care associated pneumonia, decreasing the use of blood cultures and other testing, and increasing the use of sputum cultures. These changes were approved by the patient safety committee before implementation. Protocol use, mortality, length of stay, readmission rates, and cost were analyzed and compared. Patient demographic data was also compared in the two groups. Statistical analysis was used as necessary.

Results: 162 patients were treated for pneumonia in the one year standard period prior to the new pneumonia protocol and 358 patients were treated in the two year intervention period after the new protocol was introduced. The protocol was used in 75 and 77 percent of cases in

the standard and intervention pneumonia protocol periods, respectively (p=0.7). Mortality did not differ between the standard and intervention periods, 3.9 percent versus 3.1 percent respectively (p=0.79). The overall length of stay was not significantly different in the two periods 3.9 days versus 3.7 days. Rate of 30 day readmission did not significantly differ (10 versus 13 percent in standard versus intervention period, respectively p=0.4). The average overall cost savings for each pneumonia patient was 480 dollars, in which savings of 60 dollars (12.5 percent) was from anti-infective agents. During the two year intervention period, antimicrobial cost savings of 21,500 dollars and total cost savings of 172,000 dollars were estimated compared to the standard period.

Conclusion: Antimicrobial stewardship interventions on the pneumonia care protocol saved approximately 86,000 dollars per year. Patient outcomes remained similar in our small, non-academic, community hospital. This shows the benefits of an administration supported, multidisciplinary team approach in antimicrobial stewardship at any level. Longer term analysis will provide further insight of the impact of this intervention, including effect on regional resistance pattern.

Submission Category: Infectious Diseases

Session-Board Number: 4-105

Poster Title: Improved antibiotic cost in patients receiving antibioitcs through a multidisciplinary antimicrobial stewardship team in a non-academic, rural, community hospital

Primary Author: Nathan Goracke, Rice Memorial Hospital; **Email:** nathan.goracke@rice.willmar.mn.us

Additional Author (s):
Carlos Franco Palacios
Carnita Allex
Lucio Minces

Purpose: Antibiotic Stewardship Programs (ASP) decrease resistance, toxicities, cost, and improves outcomes. An ASP was created after recruitment of an infectious disease physician (ID) in our 100-bed community hospital. We present the results of our ASP interventions.

Methods: Retrospective comparison of data from 1/1/15 - 4/30/15 (pre intervention) vs. 8/1/15 - 11/30/15 (intervention) of patients ≥ 18 years old. A three month "washout" period was established. Changes were approved and implemented by our multidisciplinary ASP. Interventions included pharmacist and ID collaboration on patients on antibiotics, de-escalation, intravenous to oral transition, and increasing ID consultations. Length of stay (LOS), mortality, readmission rates, intensive care unit (ICU) LOS, and cost were compared. Variables adjusted for overall changes for the two periods. Statistical analysis was completed when necessary.

Results: A decreased amount of patients received antibiotic therapy in the intervention group versus the preintervention group. 62 percent of patients received antibiotics in the preintervention group versus 57 percent in the intervention group (P=0.01). Mortality, overall length of stay, and 30 day readmission rate did not differ between the two groups. The average cost of antimicrobials per patient decreased from $134 to $93 per patient from the intervention to preintervention group. Cost savings based on antibiotics alone is approximately 23,000 dollars in this four month study period.

Conclusion: ASP interventions significantly reduced antibiotic use, while not worsening patient outcomes. Conditional cost savings on antimicrobials are estimated at approximately $69,000 per year. These interventions show the positive benefits of a multidisciplinary ASP in a small, non-academic, community hospital. Longer term analysis will provide further insight of the impact of our ASP interventions, including effect on regional resistance pattern.

Submission Category: Infectious Diseases

Session-Board Number: 4-106

Poster Title: Pharmacist-led antimicrobial stewardship in a rural community hospital

Primary Author: Paul Green, CompleteRx, Upper Allegheny Health System; **Email:** dr.paul.green@gmail.com

Additional Author (s):
Ashley Halloran
Chelsey Rashid

Purpose: Over the past several decades, antimicrobial misuse has led to a growing amount of innate resistance to the commonly available treatments of infectious diseases. In an attempt to combat this trend, major national and worldwide healthcare organizations are now calling for Antimicrobial Stewardship Programs (ASP) to be established in all hospitals. In smaller and rural hospitals that do not have a formal infectious disease department or provider, pharmacists are ideally suited to spearhead these new efforts. Our program was developed to provide pharmacist-led antimicrobial stewardship guidance at a 186-bed rural community hospital.

Methods: The ASP pharmacists assess patients admitted with infectious processes. They assist providers in determining appropriate empiric therapy and ensure that all antimicrobials are appropriately dosed and monitored. The pharmacists follow these patients throughout their stay to ensure that the empiric therapy continues to be appropriate and necessary. Patients are transitioned from intravenous to oral medications by the pharmacists as soon as they meet the required clinical criteria in accordance with hospital policy. Finally, the pharmacists make recommendations regarding de-escalations or changes in therapy based on culture and sensitivity data and other clinical indicators and provide assistance with transitions of care as the patient's status evolves.
We commenced tracking data in collaboration with the Healthcare Association of New York State (HANYS) Antibiotic Stewardship Collaborative in September 2015 which assessed meropenem, cefepime, and piperacillin/tazobactam using days of therapy per 1,000 facility-wide days present. In January 2016, we also began working with the Hospital & Healthsystem Association of Pennsylvania Hospital Engagement Network (HAP-HEN) by reporting defined daily dose (DDD) per 1,000 patient days for fluoroquinolones. These programs dictated the specific units for the data to be tracked thereby leading to some variance in how our results are reported. The collected data and its analysis are in line with other published studies to

determine the effectiveness of ASPs and the proposed future requirements of various governing bodies.

Results: While true assessment of antibiotic utilization has been compounded by numerous national shortages, most notably piperacillin/tazobactam, we were able to demonstrate significant improvements. Between September 2015 and April 2016 our rates of use of meropenem and cefepime improved from 114.3 to 30.9 and 90.54 to 63 days of therapy per 1,000 facility-wide days present respectively. However, upon its return to a readily available status, our utilization of piperacillin/tazobactam has seen an increase from no use to 247.3 days of therapy per 1,000 facility-wide days present in the same time period. In a similar dichotomy, our fluoroquinolone use is split with a trend towards decreased use of ciprofloxacin from 86.3 to 59 DDD/1,000 patient days while our levofloxacin utilization has crept up from 164 to 186 DDD/1,000 patient days during the first four months of 2016.

Conclusion: While our pharmacist-led ASP is still in its infancy compared to those at many large tertiary centers, we are already showing promising results with respect to the utilization of broad-spectrum antimicrobials and fluoroquinolones. Our study demonstrates that success can be achieved even in a small rural hospital setting. The data on which we have reported here reflect only a glimpse of the possible other improvements that can be made in the other aspects of antimicrobial stewardship in which we are already beginning to implement our pharmacists as our program continues to evolve.

Submission Category: Infectious Diseases

Session-Board Number: 4-107

Poster Title: Clinical decision support and antimicrobial stewardship: impact on the largest not-for-profit health system in the United States

Primary Author: Roy Guharoy, Ascension health; **Email:** roy.guharoy@ascension.org

Additional Author (s):
Danielle Sebastian
Florian Daragjati
Karen Smethers
Mohamad Fakih

Purpose: Antimicrobial stewardship is essential to curb the development of multi-drug resistant organisms and associated adverse patient care outcomes. Prospective monitoring, source directed treatment and real time interventions based on clinical changes and microbiologic findings are the keys to the success.

Methods: A clinical decision support system with standardized rules was implemented at 57 hospitals with the goal to assist pharmacists making real time therapeutic interventions and optimize infectious disease management. The rule algorithms were built with the interface between laboratory, microbiology, medication profile, vital signs, surgery and radiology reports. Examples include bug-drug mismatch, targeted antibiotic utilization criteria compliance, Methicillin Sensitive Staphylococcus aureus (MSSA) streamlining, antibiotic review (broad spectrum and niche agents) at 72 hours, penicillin allergy assessment, penicillin sensitive Enterococcus faecalis on vancomycin or linezolid, positive culture review at 72 hour, laxative use in patients with Clostridium difficile infection, and duplicate anaerobic/atypical/beta-lactam use. We also established specific dosing rules for renally excreted antimicrobials and intravenous to oral conversion rules. All rule algorithms were developed by clinical experts. Pharmacists worked with the physicians to make necessary changes and documented interventions.

Results: The clinical decision support system was implemented in a sequential manner in 57 hospitals between January and December 2015. There were 33,366 interventions, with stewardship rules accounting for 30% (n=10,024), renal dosing 54.7% (n=18,260), and IV to oral conversion 15.2% (n=5,082). Broad spectrum and niche agents review and intervention at 72

hours represented 39.6% of the interventions related to antimicrobial stewardship rules (Table). Calculated savings from the therapeutic changes were $2,278,61

Conclusion: Real-time clinical decision support tools are associated with improved compliance with appropriate antibiotic use, deescalation, discontinuation of therapy, intravenous to oral route conversion, safer dosing practices, and lower cost. The implementation leads to appropriate therapy and compliance with best practices.

Submission Category: Infectious Diseases

Session-Board Number: 4-108

Poster Title: Hospital patient days and anti-MRSA agent use in the era of active antimicrobial stewardship programs in a large health system

Primary Author: Roy Guharoy, Ascension health; **Email:** roy.guharoy@ascension.org

Additional Author (s):
Mohamad Fakih
Florian Daragjati
Karen Smethers
Dan Leffler

Purpose: The goals of Antimicrobial stewardship programs (ASPs) are to improve rationale utilization, reduce antimicrobial resistance, optimize therapy and patient outcomes. We assessed the impact of antimicrobial stewardship in our health system on the utilization of anti-MRSA agents based on hospital patient days.

Methods: We evaluated the use of ceftaroline , vancomycin, clindamycin, daptomycin, linezolid and tigecycline (defined daily dose (DDD)/1000 patient days) at 85 facilities based on stratified annual patient days (≤25,000; 25,001 to 50,000; 50,001 to 100,000; and >100,000). We assessed the impact of our recently implemented antimicrobial stewardship program (established criteria for use, local adoption, and direct engagement of outlier hospitals) by comparing fiscal years July 1, 2014 – June 30, 2015 (FY ’15) and July 1, 2015 ¬¬- March 31, 2016 (FY ’16 YTD) inpatient data.

Results: The patient days for FY’15 and FY’16 YTD were 3,656,268 and 2,678,512, respectively. Individual facility Anti-MRSA agent use showed a trend of reduction systemwide (n=85 hospitals) from 171.2 to 145.7 (p=0.090). Antimicrobial stewardship programs had a significant impact on reduction of DDD/1000 patient days at for facilities ≤ 25,000 patient-days/ year. Vancomycin use increased for 25,001-100,000 patient days/year facilities. For both fiscal years combined, ceftaroline , vancomycin, clindamycin, and daptomycin were used more in facilities with ≤25,000 than >25,000 patient-days/ year ($p < 0.001$).

Conclusion: System-wide implementation of antimicrobial stewardship programs had a significant impact on small facilities utilization of anti-MRSA agents. In some situations, the reduction in some anti-MRSA agents led to an increase in vancomycin use.

Submission Category: Infectious Diseases

Session-Board Number: 4-109

Poster Title: Antimicrobial stewardship programs lead to reduction in antibiotic use and cost savings: results from the largest not-for-profit U.S. health system

Primary Author: Roy Guharoy, Ascension health; **Email:** roy.guharoy@ascension.org

Additional Author (s):
Mohamad Fakih
Florian Dargjati
Dan Leffler
Karen Smethers

Purpose: Antimicrobial stewardship (AS) plays a critical role in reducing resistance and improve patient care outcomes. A system approach fosters accountability and encourages standardization at the hospital level. We have established a Center of Excellence for Antimicrobial Stewardship and Infection Prevention for implementing of AS best practices. We describe the impact of establishing AS programs at the system and hospital levels on antibiotic use and cos comparing fiscal year '15 (baseline) and '16 (post implementation) data

Methods: Each hospital developed physician-pharmacist co-led AS teams to ensure compliance with evidence based antimicrobial use, culture orders and standardized disease management process Evidence-based indications for use were developed for Aztreonam, Ceftaroline, Daptomycin, Linezolid, Tigecycline and Ertapenem. In addition, utilization over time by defined daily dose/ 1000 patient days (DDD/1000 pt. days) were shared with each facility monthly to identify successes, opportunities and develop plan of action.

Results: There was a drop in systemic antibiotics from 941.8 (FY '15) to 853.4 (FY '16) DDD/ 1000 patient-days (9.4% reduction), and $2.4 million savings (annualized). There were significant reductions in the use of Aztreonam, Ceftaroline, Daptomycin, Ertapenem, Linezolid and Tigecycline (range 18%-35%). Total annualized cost avoidance secondary to the criteria based utilization of targeted agents was $5.4 million.

Conclusion: System-wide implementation of stewardship program leads to strong collaboration between pharmacists and providers and rationale cost effective antimicrobial use.

Submission Category: Infectious Diseases

Session-Board Number: 4-110

Poster Title: Health-system compliance with CDC core elements of hospital antibiotic stewardship programs: a two-year review

Primary Author: Oscar Guzman, Cardinal Health; **Email:** oscar.guzman@cardinalhealth.com

Additional Author (s):
Kate Shea
Jessica Sun
Karen McConnell

Purpose: In 2014, the Centers for Disease Control and Prevention (CDC) released a guidance tool for hospitals titled Core Elements of Hospital Antibiotic Stewardship Programs (ASPs) and recommended that all acute-care hospitals implement antibiotic stewardship programs in order to meet the urgent need to improve antibiotic use in hospitals. The CDC document summarizes seven core elements of successful hospital ASPs (leadership commitment, accountability, drug expertise, action, tracking, reporting, and education) which complement existing regulatory requirements and national guidelines for antimicrobial stewardship. Investigators sought to assess compliance with these 7 core elements before and after implementation of a comprehensive system-wide antimicrobial stewardship program.

Methods: This multi-site, retrospective study compared compliance before (November 2014) and after (January 2016) implementation of the ASP. Using a basic Likert scale [0=not present, 1= very limited, 2=partial, 3=established, 4=well established/optimal, (-) not available], antimicrobial stewardship activity within the seven core elements was assessed for 15 individual hospitals and the entire health system. The main outcome variable was the ASP stewardship score (ranging from 1 – 4). We compared the outcome variable on two different time points to determine if any change was seen after program implementation. Multivariate analysis was performed to evaluate factors affecting the outcome. A Wilcoxon Rank Sum Test was used to compare the ASP score pre- and post-intervention.

Results: All 15 hospitals participated in the system wide initiative. There were significant improvements in the ASP stewardship score in 2016 compared to 2014 ($p < 0.001$). For the individual core elements assessed, significantly enhanced compliance was demonstrated in 2016 vs 2014 for Leadership Commitment (2.1 vs. 3.3, $p = 0.001$), Accountability (1.8 vs 2.7, p=

0.03), Drug Expertise (2.2 vs. 3.3, p= 0.008), Actions (1.4 vs. 2.5, p= 0.001), Outcome Tracking (1.1 vs. 2.5, p < 0.0001), Program Reporting (1.2 vs. 2.6, p= 0.0001) and Education (1.1 vs. 2.6, p < 0.0001), pre-intervention score vs. post-intervention score respectively.

Conclusion: Implementation of a comprehensive system-wide antimicrobial stewardship program increased compliance with the seven CDC Core Elements of Hospital Antibiotic Stewardship Programs in a multi-hospital system. The next steps identified to expand the program include; determine hospital and system ASP priorities, present findings to hospital and system administration and identify next action steps to be taken.

Submission Category: Infectious Diseases

Session-Board Number: 4-111

Poster Title: Impact of student pharmacists on outcomes of an antimicrobial stewardship program in a community teaching hospital

Primary Author: David Ha, KGI School of Pharmacy/Pomona Valley Hospital Medical Center; **Email:** david_ha@kgi.edu

Additional Author (s):
Maria Saleh
Yi-Chih Chiu
Jacqueline Vo
Daniel Gluckstein

Purpose: Antimicrobial Stewardship Programs (ASPs) are quality improvement initiatives traditionally directed by infectious diseases (ID) physicians and ID-trained pharmacists. ASPs seek to promote the appropriate use of antimicrobial medications with the goal of improving patient outcomes, preventing antimicrobial resistance, and reducing unintended consequences of antimicrobial use. The availability of practitioners with ID training is insufficient to meet growing national need for ASPs. Engaging pharmacy students in ASP activities may augment program impact, however, literature to support this is limited. This study seeks to demonstrate the impact of student pharmacists on outcomes of an ASP in a community teaching hospital.

Methods: This is a retrospective, observational study approved by the hospital institutional review board. The institution is a 453-bed community teaching hospital in which the ASP began in 2012 as a hospital policy. The primary intervention of the ASP was daily rounds between the ID physician and pharmacist with recommendations regarding antimicrobial therapy provided directly to hospital physicians by the ID physician or ID pharmacist. In July 2014, advanced pharmacy practice experience student pharmacists were incorporated into ASP activities and in August 2014, an ID pharmacist was incorporated. Five days per week, student pharmacists were assigned patient cases to review after initial pre-screening by the ID pharmacist. On these cases, the student pharmacist was recorded as the primary assessor. Other primary assessors included the ID pharmacist or ID physician and resident physicians. Under the supervision of the ID pharmacist and ID physician, student pharmacists presented cases on ASP rounds thereby generating recommendations.

Intervention data was collected from July 2014 to December 2015. Number and percentage of recommendations made of which the primary assessor was a student pharmacist was used to describe the overall contribution made to ASP interventions by student pharmacists. Antimicrobial utilization data was collected from January 2013 to December 2015. Acceptance rates of recommendations and antimicrobial drug utilization was used to demonstrate the impact of the ASP and of student pharmacist incorporation.

Results: From July 2014 to December 2015, a total of 893 recommendations were made. Of those, 546 (61%) had a primary assessor of student pharmacist, 205 (23%) ID Pharmacist or ID physician and 142 (16%) resident physician. Acceptance rates of recommendations were 79% overall and 78% for those whose primary assessor was a student pharmacist. Prior to incorporation of student pharmacists and an ID pharmacist, anti-pseudomonal antimicrobial utilization increased 33% from 1,848 days of therapy per 1000 patient days (DOT/1000PD) in the first quarter of 2013 to 2,456 DOT/1000PD in the second quarter of 2014. After incorporation of student pharmacists and an ID pharmacist, anti-pseudomonal antimicrobial utilization decreased 21% from 2,333 DOT/1000PD in the third quarter of 2014 to 1,844 DOT/1000PD in the fourth quarter of 2015.

Conclusion: Student pharmacists in advanced pharmacy practice experiences can make substantial contributions to ASPs when adequate structure and clinical support for their activities are provided.

Submission Category: Infectious Diseases

Session-Board Number: 4-112

Poster Title: Effect of food on the pharmacokinetics of unboosted and boosted tenofovir alafenamide

Primary Author: Camtu Ho, Gilead Sciences, Inc.; **Email:** camtu.nguyen@gilead.com

Additional Author (s):
Joseph Custodio
Yongwu Shao
Xuelian Wei
Brian Kearney

Purpose: Tenofovir alafenamide (TAF), an antiretroviral agent with a favorable pharmacokinetic (PK) and safety profile versus tenofovir disoproxil fumarate (TDF), is being developed for HIV treatment when administered as part of an unboosted or boosted antiretroviral regimen. Across two healthy subjects studies, the effect of food on TAF PK was evaluated following administration of the fixed-dose combination emtricitabine/TAF (F/TAF 200/25 mg [unboosted]) or the single-tablet regimen elvitegravir/cobicistat/F/TAF (E/C/F/TAF 150/150/200/10 mg [boosted]).

Methods: Study 1 evaluated F/TAF (n equals 40). Study 2 evaluated E/C/F/TAF (n equals 42). Treatments were administered in a randomized, open label, single dose, crossover manner, either following a 10 hour fast or following a standardized high-calorie/high-fat meal (~800 kcal; 50 percent fat), separated by a 7 day washout. Intensive PK was collected and statistical comparisons were conducted by geometric mean ratios (GMR) and associated 90 percent confidence intervals (CI) with fed conditions as test and fasted conditions as reference. Safety was assessed throughout.

Results: All treatments were well tolerated. The majority of adverse events (AE) were mild (Grade 1). One AE-related discontinuation occurred in Study 1 following fasted F/TAF administration (Grade 2 neutropenia). Following F/TAF under fed conditions, unboosted TAF exposure was increased 75 percent (AUCinf GMR (90 percent CI): 175 (164, 188)), versus fasted. Following E/C/ F/TAF under fed conditions, boosted TAF exposure was increased 18 percent (AUCinf GMR (90 percent CI): 118 (109, 126)), versus fasted. The smaller food effect observed with E/C/F/TAF, compared to F/TAF, is attributed to the increased TAF availability when

administered in the presence of the booster, cobicistat, which inhibits intestinal P-gp mediated efflux of TAF.

Conclusion: Overall TAF exposure was increased when administered under fed conditions, versus fasted. Observed changes in TAF PK are not considered clinically relevant based on the wide range of TAF exposure associated with efficacy established in the clinical development programs for TAF-containing products.

Submission Category: Leadership

Session-Board Number: 4-113

Poster Title: Stepping into the future: innovative and advanced roles for pharmacy technicians

Primary Author: Annette Davis, University of Michigan Health Systems; **Email:** avdavis@umich.edu

Additional Author (s):
Denise Propes
Chadi Abbas

Purpose: The Pharmacy Practice Model Initiative (PPMI) supports and suggests assigning medication distribution, as well as other tasks to pharmacy technicians that have received appropriate education and training. The University of Michigan Pharmacy has deployed technician resources in a variety of advanced and innovative roles in order to allow pharmacists to devote more time to drug therapy management and other clinical activities.

Methods: The University of Michigan is using pharmacy technician resources in over twenty advanced roles including, transitions of care, pharmacy management, medication reconciliation and history, research, drug procurement, recruiting and training, database and computer application specialists, financial services, home health care and many more. The pharmacy houses its own training facility where new staff is taught aseptic technique and computer skills by other technicians. University of Michigan also offers a pharmacy technician career advancement ladder, that requires technicians to complete specific activities at each level in order to achieve a more advanced position and/or more responsibility.

Results: Using pharmacy technicians in many different distribution roles, as well as other activities provides pharmacists throughout the health system an opportunity to be more readily involved in medication therapy recommendations that can improve patients' quality of care and outcomes. These unique roles not only provide pharmacy technicians with the opportunity to advance their skills and knowledge, but have resulted in increased technician job satisfaction.

Conclusion: Using properly trained pharmacy technicians in advanced and innovative ways benefit patient care by providing pharmacists with time to become more involved with drug therapy management and other clinical activities. These roles have also provided technicians

with increased knowledge and skills and resulted in improved quality of all pharmacy services throughout the health system.

Submission Category: Oncology

Session-Board Number: 4-114

Poster Title: Actual body-weight chemotherapy dosing for obese patients: moving away from dose-limiting regimens

Primary Author: Aghavny Bebirian, Beth Israel Deaconess Medical Center; **Email:** abebi1@stu.mcphs.edu

Additional Author (s):
Zaven Norigian

Purpose: Dosing chemotherapy in obese patients has been controversial since there have been no standards published on how to dose these patients appropriately. Limited doses may compromise the efficacy of chemotherapy and result in lower cure rates. Recently, the American Society of Clinical Oncology (ASCO) published guidelines regarding appropriate chemotherapy dosing for obese adults. These guidelines address the limited doses of chemotherapy obese patients were receiving and now recommends dosing these patients based on actual body weight. The purpose of this study was to investigate Beth Israel Deaconess Medical Center (BIDMC) oncology team's compliance with these new guidelines.

Methods: Men and women over the age of 18 who met the obese BMI criteria of >30 and received chemotherapy from January 2015 through March 2015, and December 2015 were included. Patients who received chemotherapy for non-cancer related illnesses were excluded from this study. Patient information was gathered in a retrospective manner from BIDMC's online medical records software. Data collection included patient demographics comprising of sex, weights (adjusted body weight (ABW), ideal body weight (IBW), and actual body weight), BSA, BMI, diagnosis, regimen, dose reduction percentage, and patient status. Secondary measures determined if the patient remained on schedule throughout the course of treatment. Descriptive statistics were used to analyze results.

Results: Out of 1148 patients, 292 had a BMI >30. The average BMI was 34.5 (27.2 – 55.1) with a mean weight of 211 pounds (140-393). The majority of patients were females (n=163). Only 6 of the 292 patients were dosed using ABW while others were dosed properly by actual body weight. Among the 665 individual regimens administered, 36% (n=241) of these regimens were reduced among 90 patients. The average dose reduction due to adverse reactions was 26%. Of the 90 patients that had a dose reduction, 12 patients (13.3%) had a dose reduced that was

reflective of their ABW, but none were reflective of IBW. Over half the study population is still receiving chemotherapy (n=160). Fifteen percent remain in remission (n=44), 16% are in palliative care (n=46), and 14% are deceased (n=42). Oxaliplatin, leucovorin, and carboplatin were reduced most.

Conclusion: The healthcare team is appropriately dosing chemotherapy for obese cancer patients since a majority were found to be dosed by actual body weight. Positive treatment trends for obese cancer patients is foreseeable by continuing to abide by ASCO's new guidelines. Although there are no conclusive trends on survival and patient outcomes at this time, data needs to be collected prospectively for further evaluation. In conclusion, BIDMC should continue dosing obese cancer patients using actual body weight unless other circumstances dictate otherwise.

Submission Category: Oncology

Session-Board Number: 4-115

Poster Title: Head-to-head evaluation of closed-system transfer devices in a health-system oncology clinic

Primary Author: Jay Brown, Novant Health; **Email:** brown08@email.campbell.edu

Additional Author (s):
Rolanda Davis-Lowery
Brian Wallace

Purpose: The goal of this project was to evaluate the safety of a new closed-system transfer device (B. Braun OnGuard) versus a legacy closed-system transfer device (BD Phaseal) in a head-to-head comparison of the two products in a live environment.

Methods: The new closed-system transfer device was evaluated by a 2-week pilot within a medium-size oncology clinic in both pharmacy and nursing areas. Baseline contamination was measured via wipe testing through a validated third-party for six oncolytics - 5-fluorouracil, cyclophosphamide monohydrate, doxorubicin hydrochloride, etoposide phosphate, irinotecan hydrochloride, and paclitaxel. Testing was conducted inside the vertical flow hood, on the floor in front of the vertical flow hood, IV room tables and pass-through areas, and the area on and in front of one of the patient chairs. After baseline wipe testing was completed, two-step decontamination was performed to the work spaces. The new closed-system transfer device was used for a total of two weeks during periods of normal clinic volume. All cleaning was performed per USP 797 and health-system policies and procedures throughout the entirety of the pilot. At the conclusion of the pilot, wipe testing was performed to the same area as the baseline testing to evaluate for changes in contamination associated with the new closed-system transfer device.

Results: Baseline sensitivity of the wipe testing was 5 nanograms for each oncolytic tested. 62 preparations were made with the tested oncolytics over the two-week period, Contamination was detected with both B.Braun OnGuard and BD Phaseal on the floor in front of the vertical flow hood (cyclophosphamide monohydrate, 19.1 nanograms (B.Braun) versus 41 nanograms (BD)) and on the floor in front of the patient chair (5-fluorouracil, 17.1 nanograms (B.Braun) versus 32 nanograms (BD); cyclophosphamide monohydrate, 12.2 nanograms (B.Braun) versus 35.6 nanograms (BD)). All other areas tested for all other oncolytics were undetectable.

Conclusion: B.Braun OnGuard closed-system transfer device is non-inferior to BD Phaseal, as demonstrated in live environment testing and confirmed by third-party wipe testing. B.Braun OnGuard can be considered safe for use by both pharmacy and nursing personnel.

Submission Category: Oncology

Session-Board Number: 4-116

Poster Title: Evaluation of the use of rivaroxaban in cancer patients

Primary Author: Angela DeBerardine, The Mount Sinai Hospital; **Email:** adeberardine@gmail.com

Additional Author (s):
Kendra Yum
Gina Caliendo
Joanne Meyer

Purpose: Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is a common complication in cancer patients and the preferred anticoagulant is low molecular weight heparin (LMWH). However, a subgroup analysis of cancer patients suggests that rivaroxaban has similar efficacy in secondary prevention of VTE but with less major bleeding than LMWH. Currently, rivaroxaban is being prescribed for secondary prophylaxis of VTE in patients with cancer but there is limited data for its use. The objective of this study was to evaluate the rate of bleeding and VTE in cancer patients on rivaroxaban for secondary prophylaxis.

Methods: A retrospective chart review of patients with cancer on rivaroxaban was performed with data obtained from the institution's electronic medical record. Patients were included in the study if they had a diagnosis of cancer and were prescribed rivaroxaban for secondary prophylaxis of DVT or PE. Patients were excluded if they did not have cancer, did not have a history of DVT or PE, had received less than 2 doses of rivaroxaban, or less than 2 months of follow-up data. Demographic data for age, sex, serum creatinine, recent surgery, oncologic diagnosis, year of oncologic diagnosis, and concurrent chemotherapy were collected. Data was also collected on the dosage of rivaroxaban patients were receiving and the duration of rivaroxaban use. The outcome data that was collected included VTE recurrence, major and minor bleeding, and mortality at 6 and 12 months. Descriptive statistics were analyzed on all data collected.

Results: Fifty-five patients met inclusion criteria for the study out of 2492 patients who received rivaroxaban from November 1, 2012 to June 30, 2015. The median age was 64 (IQR 55.5) and 56% of patients were female. The majority of patients received the FDA-approved

treatment dosing of rivaroxaban. However, 24% received a lower than FDA-approved dose. The median treatment duration was 12 months (IQR 6).The overall survival at 6 months and 12 months were 77% and 56%, respectively. One patient experienced a major gastrointestinal bleed (2%) and 2 patients experienced minor bleeds (4%). No patients experienced a DVT but 2 patients (4%) had a PE and 2 patients (4%) experienced other adverse effects.

Conclusion: The observed rates of bleeding and recurrent VTE were low and safety and efficacy results in our patient population were also consistent with previously published studies. Rivaroxaban may be a reasonable option for secondary prophylaxis in patients with cancer. However, prospective studies are warranted to evaluate the relative safety and efficacy of rivaroxaban compared with other anticoagulants as secondary VTE prophylaxis for cancer patients.

Submission Category: Oncology

Session-Board Number: 4-117

Poster Title: Real value of monitoring liver function tests in patients with localized breast cancer receiving AC protocol followed by weekly paclitaxel

Primary Author: Raul Diez-fernandez, HOSPITAL UNIVERSITARIO DE GETAFE; **Email:** raul.diez@salud.madrid.org

Additional Author (s):
Alberto Onteniente-Gonzalez
Laura Lopez-Esteban
Santos Enrech-Frances
Teresa Molina-Garcia

Purpose: AC protocol (doxorubicin and cyclophosphamide) followed by weekly paclitaxel (AC-wPTX) is a standard adjuvant treatment in women with operable breast cancer.
Taxanes and anthracyclines are mostly metabolized by the liver and thus routine clinical practice recommends monitoring liver function tests (LFTs), together with other analytical parameters, before initiating this protocol and on each course while treatment is given.
A retrospective analysis was conducted in our center aiming to quantify the incidence of impaired liver blood tests in patients with localized breast cancer receiving AC-wPTX protocol. Its value on protocol monitoring and dose adjustment was also assessed.

Methods: One hundred and ninety-four patients over seven years were identified from the chemotherapy prescription database and included in the analysis. LFTs (AST, ALT, bilirubin) results were collected for all patients during AC-wPTX treatment and impaired results were classified using CTCAE 4.0.
According to LFTs results, patients were considered deemed well to receive treatment when ALT /AST < 10xULN (Upper Limit of the Normal range) and bilirubin < 2xULN (normal upper range: AST=40 U/L, ALT=78 U/L, Bilirrubina=1 mg/dL).

Results: In 20 patients, anthracyclines were contraindicated and they were treated only with adjuvant paclitaxel. Altogether, patients were given 682 courses of AC and 2,266 courses of wPTX.

Grade 2 (moderate severity, CTCAE 4.0) or higher increase in the level of LFTs was observed in one (0.1%) and 16 (0.7%) cycles during AC and wPTX treatment respectively.
However, no patient showed LFTs increases that would make necessary a dose adjustment while on AC protocol. During wPTX administration, bilirubin levels were above 2xULN in only 2 (0.09%) courses and transaminases levels were higher than 10xULN in just one (0.04%) course of chemotherapy.

Conclusion: Dose adjustments due to LFTs impairment were only necessary in an extremely low number of courses during AC-wPTX treatment. LFTs monitoring on each course of chemotherapy might not be necessary.

Submission Category: Oncology

Session-Board Number: 4-118

Poster Title: Impact on pharmaceutical costs from a bone-modifying agent criteria for oncology patients at a community outpatient infusion center

Primary Author: Brenda Egan, Cardinal Health; **Email:** brenda.egan@cardinalhealth.com

Additional Author (s):
Nisha Pherwani

Purpose: The use of bone-modifying agents (BMAs) to delay the onset of skeletal-related events in solid tumors such as breast and prostate cancer is standard practice in the metastatic stages and represents a significant financial impact on pharmaceutical budgets of the hospital. After a reimbursement analysis and literature review of current practice guidelines and cost-effective studies, an evidence-based denosumab criteria for use was implemented. This analysis was conducted to assess the financial impact of a criteria-driven selection of bone-modifying agents before and after program implementation.

Methods: There were two phases to this drug use evaluation. The first phase included a retrospective review of patients receiving bone-modifying agents during a 13-month time frame from January 2013 through January 2014. Indications, appropriate dosing and reimbursement profiles were reviewed. In regards to reimbursement, the majority (65%) of the patient population's payor source at this hospital site has historically been Medicare. The remaining patient's payors were a mixture of other third party commercial payors with extensive variations and unpredictability in reimbursement. For this reason, only CMS reimbursement profiles were used for analysis. Additionally, a literature search on several cost-effective studies and leading practice guidelines comparing denosumab and zoledronic acid were reviewed. The second phase was to validate, using purchase data, the financial impact post-implementation of a bone-modifying agent criteria for use program.

Results: Thirty patients received bone modifying agent therapy. Seventeen patients received zoledronic acid for multiple myeloma, breast, prostate, and lung cancers. Eleven patients received denosumab for breast, prostate and lung cancers. Two patients received pamidronate for multiple myeloma and hypercalcemia. All agents were dosed appropriately based on indications. Renal dose interventions occurred in two zoledronic acid patients. Twenty-five of 30 patient reimbursement profiles between January 2013 and January 2014 were accessible

and analyzed. Eight of 14 zoledronic acid patients (57.1%) and 9 of 11 denosumab patients (81.8%) had Medicare coverage. The zoledronic acid premixed ready-to-use 4mg/100mL solution cost $76 and reimbursed $105.42 with a net profit of $29.42. In contrast, denosumab 120mg/1.7mL subcutaneous injection cost $1,734 and reimbursed $1,690.91 with a net loss of $43.09. According to the American Society of Clinical Oncology and National Comprehensive Cancer Network, all three BMAs are recommended for prevention or treatment of bone metastases from solid tumors without one agent being preferred over another. Various cost-effective studies analyzing denosumab against zoledronic acid found denosumab's benefits do not outweigh institutional costs or patient's ultimate out-of-pocket costs. Total of $111,818 was spent on BMAs in 2014 vs. $49,129 in 2015 for a 56.1 percent decrease in expenditures.

Conclusion: Substantial savings in pharmaceutical costs were noted when a bone-modifying agent criteria for use was implemented. Given the extraordinary out-of-pocket costs that cancer patients experience during their treatment journey, the clinicians, armed with information from their site's reimbursement specialists, should engage in open and transparent discussions with their patients that include full disclosure of varying treatment options as per current evidence-based guidelines and their corresponding financial implications. This will allow the patient to participate in making informed decisions alongside their healthcare providers.

Submission Category: Oncology

Session-Board Number: 4-119

Poster Title: Optimizing the care of head and neck cancer patients in a community ambulatory care center: a multidisciplinary approach

Primary Author: Lisa Farah, University Hospitals Geauga Medical Center; **Email:** lisa.farah@uhhospitals.org

Additional Author (s):
Amanda Myers
George Brown
Rachael Lerman
Mehran Saboori

Purpose: Although advances have been made in the treatment of patients with head and neck cancer, management of adverse outcomes from surgery, radiation, and chemotherapy remains persistently challenging. In January 2015 our institution created a Head and Neck Task Force, consisting of a multidisciplinary team of healthcare professionals, who follow all head and neck cancer patients during and after their active treatment. The goals of the task force are to: assist the patient to complete treatment, manage medication side effects, manage complications arising from surgery and/or radiation, and improve quality of life.

Methods: An oncology certified nurse with additional training in the treatment of head and neck cancer conceptualized the Head and Neck Task Force. Members include this nurse, two oncology pharmacists, a radiation oncologist, radiation oncology nurse, dietitian, speech language pathologist, perioperative nurse, social worker, rehabilitation manager, physical therapist, respiratory therapist, infusion center nurse manager, patient navigators, and a patient access representative. We meet once monthly to discuss treatment logistics and process improvement. This is followed by a detailed review of patients via multidisciplinary table rounds format. Additionally, the oncology pharmacists and oncology nurses meet at least weekly to strategize resolution of ongoing patient care issues as patients return to the outpatient infusion center and/or radiation oncology. Patients receiving radiation therapy and/or chemotherapy are initiated on regularly scheduled intravenous hydration with antiemetics in our infusion center if they exhibit any of the following: hypotension, fatigue, poor skin turgor, poor capillary refill, tachycardia, or poor oral intake. Patients are physically assessed at each infusion center visit, and the oncology nurses utilize these opportunities to

reinforce teaching and circumvent complications. Furthermore, oncology pharmacists are involved in optimizing chemotherapy regimens, addressing medication administration issues, smoking cessation, thyroid function regulation, drug interaction screening, pain management, and medication counseling. As maintaining adequate nutrition is challenging, a dietitian consult is initiated on all patients.

Results: 27 patients have been followed by the Head and Neck Task Force since its inception. Excluding admissions for disease progression, admissions for complications from radiation occurred in only 12 percent of patients. This is in sharp contrast to data from the National Institutes of Health, which showed overall admission rates of 27-32 percent in radiation patients. The Task Force has insured baseline TSH measurements and physician referral for subsequent thyroid function monitoring in 100 percent of radiation patients. Pharmacists completed medication reconciliation on 79 percent of patients receiving medications at our infusion center (n equals 24). Pharmacists also made 5 chemotherapy-related interventions and 13 non-chemotherapy related interventions. Patients with an Eastern Cooperative Oncology Group (ECOG) performance score of 2 or greater are referred to the Survivorship Training and Rehab (STAR) program for rehabilitation. 37 percent of patients have been referred to the STAR program. The task force facilitates a surgical consult for proactive placement of a percutaneous endoscopic gastrostomy (PEG) tube in patients receiving concurrent radiation and chemotherapy. In addition, once patients approach the ability to meet their full caloric needs via oral intake, we recommend PEG tube removal to prevent long term complications from prolonged PEG tube feedings.

Conclusion: Head and neck cancer patients can benefit from a multidisciplinary team of healthcare professionals, who work together to coordinate the many complex aspects of their care. Patients visit our institution frequently during their treatment and are therefore closely monitored by oncology nurses and other team members. As integral members of this team, the oncology pharmacists provide a unique and valuable perspective on the various treatment options for these patients. Furthermore, adherence to treatment plans can be a very challenging and grueling process. The oncology pharmacists are well equipped to recommend pharmacologic interventions to assist with symptom management.

Submission Category: Oncology

Session-Board Number: 4-120

Poster Title: Plasma levels of trastuzumab in gastric cancer: case report

Primary Author: Jonathan Garcia, Complejo Hospitalario Universitario de Canarias; **Email:** jonathangnz@gmail.com

Additional Author (s):
Fernando Gutierrez Nicolas
Gloria Julia Nazco Casariego
Guillermo González de la Fuente
Maria Micaela Viña Romero

Purpose: INTRODUCTION
The regimen of trastuzumab with 5-fluorouracil or capecitabine and platinum compound has become the standard first-line treatment for patients with HER2-positive GC. However, HER2 suppression has not proved as satisfactory as expected. In the ToGA trial, the overall response rate with the addition of trastuzumab was less than 50%. A possible explanation for these poor results is low plasma levels of the drug during treatment in some patients. Recents investigations have showns that patients with minimum plasma concentrations (Cmin) below 11.4 g / mL in the first cycle, showed worse progression-free survival (PFS) and overall survival (OS) than patients who with higher plasma concentrations of trastuzumab.
In this paper we describe the plasma concentrations of trastuzumab and clinical response to treatment shown by a patient diagnosed with metastatic HER2-positive GC.
CASE REPORT
A 48 year-old man, weighing 82 kg, with diagnosis of advanced gastric cancer (stage IV), initial ECOG of 0 and HER2 positive (FISH technique > 6 signals / cell, immunohistochemistry IHC 3+), which iniciated treatment with XELOX (capecitabine 1000 mg / m2 / 12h day 1 to 14, oxaliplatin 130mg / m2 day 1) plus trastuzumab (6 mg / kg every three weeks, with initial loading dose of 8 mg / kg)10
Plasma levels of trastuzumab were determined just before administration of each dose (Cmin), as from the second administration of the drug, using ELISA in accordance with the manufacturer's specifications (SHIKARI® Q-TRAS). Trastuzumab Cmin levels were below 20 ug / mL after administration of the first two cycles of chemotherapy (12.3 mg / mL and 10.1 ug / mL respectively). It was not until the third administration of trastuzumab that the Cmin exceeded 20 ug / mL (23.2 ug / mL). After two months of treatment, thoracoabdominal CT scan showed a

partial response with a decrease in the size of the antrum-pyloric mass as well as the size and number of liver metastases. Despite this early response after 4 cycles, a new CT scan confirmed disease progression with an increase in pyloric antrum-mass and liver metastases. This prompted a change to second-line treatment with paclitaxel-ramucirumab. Thus, trastuzumab was associated with PFS of 5.6 months.

DISCUSSION

This paper describes the case of a patient diagnosed with metastatic HER2-positive GC treated with XELOX and trastuzumab. The patient showed rapid disease progression with a PFS of 5.6 months, which is comparable to that shown by the group of control patients in the ToGA study (5.5 months). In our case, the addition of trastuzumab did not provide all the clinical benefit expected of it. We believe the poor response may be attributable to the low plasma concentrations of the drug in the first two cycles (12.3 and 10.1 mg / mL, respectively). This is based on the fact that the minimum therapeutic concentration of trastuzumab necessary to block all HER2 receptors is considered to be 20 ug / ml13. A first dose of 8 mg / kg iv or 600 mg subcutaneous trastuzumab has been established as necessary to ensure a Cmin of at least 20 ug / ml. In many cases these levels are not achieved in patients with GC, as in the present case. The present case also suggests that monitoring plasma levels of trastuzumab could be a potential tool to optimize treatment by individual dose adjustment.

Methods:

Results:

Conclusion:

Submission Category: Oncology

Session-Board Number: 4-121

Poster Title: Polymorphisms in drug transporter genes and risk of relapse among stage II or III colorectal cancer patients treated with capecitabine

Primary Author: Xandra Garcia-Gonzalez, Hospital General Universitario Gregorio Marañón; **Email:** xandra.garcia@salud.madrid.org

Additional Author (s):
Maria I Garcia-Garcia
Ana Herranz-Alonso
Maria Sanjurjo
Luis A Lopez-Fernandez

Purpose: To identify those patients with colorectal cancer at higher risk of disease relapse after adjuvant chemotherapy with capecitabine may help personalize their treatment and choose alternative therapies when appropriate. The aim of this study was to evaluate the association between several Single Nucleotide Polymorphisms (SNPs) in genes involved in drug transport and Disease Free Survival (DFS) in colorectal cancer patients treated with capecitabine-based adjuvant chemotherapy.

Methods: Prospective/retrospective multicentre study in a cohort of adult patients with stage II and III colorectal cancer that received capecitabine-based adjuvant chemotherapy.
Demographic, disease-related and treatment-related variables were registered.
DNA was isolated from peripheral blood samples and six polymorphisms (rs1128503, rs2032582, rs1045642, rs4148551, rs3742106 and rs3805114) in ABCB1, ABCC4 and ABCC5 drug transporter genes were genotyped using different validated techniques.
DFS was estimated by the Kaplan-Meier method. The relationship between polymorphisms and DFS was explored using Cox regression model, with tumour stage, sex and hospital as co variables.
This study was approved by the institutional ethics committee and informed consent was obtained from all patients.

Results: 137 patients from three hospitals were enrolled. 76.6% of the patients received capecitabine in combination with oxaliplatin (XELOX regime), and the remaining 23.4% in

monotherapy. The median number of chemotherapy cycles received was 8 (range, 1 to 16). The median follow-up time was 21 months (range, 1 to 119). At the cut-off date, 35 patients had relapsed (25.5%).Patients harbouring the ABCC4 rs4148551 AA genotype had a 12-month DFS of 83% compared with 93.5% in those carriers of GA/GC variants (HR, 1.53; 95%CI, 1.08-2.15; p=0.017). Patients with the AA homozygous genotype in ABCC4 rs3742106 also had a significantly shorter DFS than heterozygous or homozygous carriers of the C allele: 12-month DFS 84.3 vs 93.2% (HR, 2.21 95% CI, 1.11-4.40; p=0.024). No statistically significant association was found between DFS and the polymorphisms studied in ABCB1 and ABCC5.

Conclusion: Our findings suggest that the SNPs ABCC4 rs4148551 and ABCC4 rs3742106 may be useful as pharmacogenetic predictors of tumour relapse in colorectal cancer patients treated with capecitabine-based adjuvant chemotherapy. However, these are preliminary results that need to be validated in larger cohorts with longer follow-up.

Submission Category: Oncology

Session-Board Number: 4-122

Poster Title: Toxicity 5-fluorouracil associated mutation 1896T>C in the dihydropyrimidine dehydrogenase (DPYD) enzyme: a case report

Primary Author: Guillermo Gonzalez de la Fuente, University Hospital of the Canary Islands; **Email:** ggonzalezdlf@gmail.com

Additional Author (s):
Fernando Gutierrez
Itamar Gonzalez
Gloria Julia Nazco
Ruth Ramos

Purpose: Purpose
5-fluorouracil (5-FU), widely used drug in the treatment of intestinal tumors, is metabolized by the enzyme dihydropyrimidine dehydrogenase (DPYD). In this paper we have described the genetic profile for DYPD in a patient who developed severe toxicity following administration of 5-FU.
Methods
67 year old woman diagnosed with metastatic colon adenocarcinoma starting treatment with antineoplastic regimen mFOLFOX-6. Genomic DNA was obtained from peripheral blood of a drop deposited on a filter paper card (Schleicher and Schuell 903) and dried at room temperature1. The following polymorphisms of DPYD were determined: 2A, *2B, *3, *7, *8, *9B, *10, *11, *12, *13, 1896T>C, 2846A>T, 496A>G . The genetic characterization was performed using the LightCycler®480 platform and allele specific by fluorescent HybProbe®.
Results
After administration of the first cycle, the patient shows some symptoms of toxicity with colic type pains, no diarrea. However, after administration of the second cycle, the patient develops grade 4 gastrointestinal toxicity, accompanied by neutropenia grade 3 (criteria of Common Terminology Criteria for Adverse Events (CTCAE) version 4.03), that they require hospitalization and treatment with hematopoietic growth factors and electrolyte support. Toxicity has appeared to be related to a deficiency in the DPYD enzyme activity, so he was made a pharmacogenetic analysis, which showed a heterozygous mutation in the rs17376848 (1896T>C). This genotype is associated with a phenotype of partial deficiency in activity compared DPYD wild genotype and therefore a decreased metabolism of 5-FU. It was decided

together with the medical team and following the recommendations of the American Society for Clinical Pharmacology and Therapeutic, a reduction of 50% of doses of mFOLFOX-6 in the 3rd cycle, after which, no toxicity were objectified. In the 4th cycle, doses of 5-FU and folinic acid were increased to 75% of the initial dose, and oxaliplatin 100%, with the idea of maintaining this dosage until the end of treatment. The patient received a total of 8 cycles with good tolerance, being in a situation of stable disease (RECIST version 1.1) when was finished treatment.

Conclusion

The determination of the polymorphisms that override the activity of the enzyme responsible for the metabolism of 5-FU (DYPD), has been shown as an effective tool to prevent the occurrence of severe toxicity in these patients. Future studies allow us to analyze whether implementation of this determination, prior to drug administration, is an efficient health strategy.

References

1 Ramos-Díaz R, Gutiérrez-Nicolás F, et al. Validation of a fast and low-cost alkaline lysis method for gDNA extraction in a pharmacogenetic context. Cancer Chemother Pharmacol. 2015;75(5):1095-8.

2 Caudle KE, Thorn CF, Klein TE, Swen TE, McLeod HL, Diasio RB and Schwab M. Clinical Pharmacogenetics Implementation Consortium Guidelines for Dihydropyrimidine Dehydrogenase
Genotype and Fluoropyrimidine Dosing. Clin Pharmacol Ther. 2013 Dec;94(6):640-5

Methods:

Results:

Conclusion:

Submission Category: Oncology

Session-Board Number: 4-123

Poster Title: Study of health outcomes in pancreatic cancer: preliminary results

Primary Author: Guillermo Gonzalez de la Fuente, University Hospital of the Canary Islands; **Email:** ggonzalezdlf@gmail.com

Additional Author (s):
Fernando Gutierrez
Jonathan Gonzalez
Sara Garcia
Gloria Julia Nazco

Purpose: One of the unfinished business of the Spanish public health is to known, in an objective and quantifiable way, the results obtained after the application of a health process. Pancreatic adenocarcinoma is considered one of the cancers with worse survival rates. Today antineoplastic reference are FOLFIRINOX and MPACT (nab-paclitaxel/gemcitabine) regimen. Both have improved both progression-free survival (PFS) and overall survival (OS). From their respective clinical trials have efficacy data, but we know nothing about the effectiveness and costs associated with each of the different schemes of treatment. The aim of this paper is to show the initial data of a project to quantify the health outcomes of pancreatic cancer.

Methods: This is a prospective single-center study, 30 months of patient recruitment, plus an extra year in monitoring them, in which all patients diagnosed with locally advanced pancreatic adenocarcinoma or metastatic, are recruited. The indicators recorded the care process will focus on the hospital stage. Anthropometric parameters and all those who may have an influence on clinical outcome were recorded. As main response variables are recorded PFS, OS. They will be charged both direct costs associated with each antineoplastic scheme as indirect costs, from the perspective of the hospital. The quality of life of patients will be assessed every three months, where possible, through the Euro-Quol 5 survey. A sample size of 40-60 patients is estimated. Being an observational study, the number of patients has been calculated by estimating the usual casuistry the center, without any pre-established hypothesis. All patients signed informed consent for the study.

Results: In the first 10 months of the study, we have recruited a total of 12 patients. Until now, the MPACT and FOLFIRINOX schemes are showing similar effectiveness, without having yet reached a median PFS, with 90% of censored data. FOLFIRINOX seems to be the most toxic scheme, with 80% of patients who required dose reduction and 40% who have needed stimulants colonies. 1 patient each treatment subgroup, required hospitalization due to treatment toxicities. Cost analysis and quality of life provided by each treatment has not been done in this first preliminary study life.

Conclusion: Preliminary results of our study suggest that the regime MPACT provides PFS similar to FOLFIRINOX, with better tolerance. Over the next 20 months, the study will be expanded, and will reveal whether these results reaffirm, also adding the analysis of the quality of life and corresponding cost analysis.

Submission Category: Oncology

Session-Board Number: 4-124

Poster Title: Impact of pharmacist discharge interventions on medication-related readmissions among oncology patients

Primary Author: Lela Hall, Baptist Hospital of Miami; **Email:** lmh0ea@mail.umkc.edu

Additional Author (s):
Anay Moscu
Cathleen Charles
Moe Shwin
Maria Figueroa

Purpose: Oncology patients experience high hospitalization and readmission rates. These admits account for 53% of cancer related expenses, at an estimated cost of $58.6 billion in 2009. Readmissions have been increasingly targeted for reimbursement penalties, with concern that oncology readmissions could become a target. Previous studies within our institution showed 22% of cancer patients experience a medication-related hospital admission with 9.7% of these medication-related admits determined to be preventable. Recent findings indicate pharmacist discharge follow up can lower readmit rates. The purpose of this study was to determine the impact of pharmacist discharge intervention on preventing medication-related readmissions among oncology patients.

Methods: Patients who received chemotherapy during hospitalization for a cancer diagnosis were approached for participation in a study involving pharmacist discharge phone follow up. Patients who provided consent were contacted within 48-72 hours of discharge to assess pain or gastrointestinal symptoms related to their cancer treatment. For symptomatic patients, an algorithm was utilized to provide immediate guidance on how to best utilize current prescription and over the counter medications to resolve these issues. A nurse practitioner for the oncology unit or the oncologist was contacted if further prescription medication was recommended per algorithm. Patients were then contacted within 24 hours and in 5-7 days to reassess symptom resolution.

Results: A total of 23 patients met study eligibility inclusion criteria, with 13 patients providing consent, for a consent rate of 56.5%. Participants had a wide distribution of ages ranging from

19 to 80 years old, with a median age of 50. The study population was evenly spread across both genders, with a slightly higher female demographic (54%). The majority of participants held a hematologic malignancy diagnosis 92.3%, and the median length of stay was 17 days. Of the 13 patients who provided consent, 4 patients underwent a planned readmission for chemotherapy administration (30.8%) and were excluded from the 30 day unplanned readmits. Of the remaining 9 consented subjects, 4 participants (44.4%) had an unplanned readmit. Of the 4 unplanned readmissions, 1 was determined to be preventable (25%), and 3 were determined to be unpreventable (75%). Unpreventable readmissions included anemia (1) and infection (2) despite prophylactic antibiotic use. The single preventable readmit was due to dehydration. Comparing the preventable medication-related readmit rate of 7.7% for patients who received pharmacist intervention, to the preventable medication-related admit rate of 9.7% in patients who did not receive pharmacist intervention , a 2% absolute and 20% relative risk reduction for admit was found.

Conclusion: In comparing medication-related admissions among oncology patients who received pharmacist discharge intervention versus those who had not, a trend toward the reduction in preventable medication-related admissions can be seen, with a 2% absolute and 20% relative risk reduction for admit. Although these findings indicate pharmacist intervention can lower admit rates and contribute to lower cancer related hospitalization costs, it should be noted that the majority of readmissions during this study (61.5%) were for planned chemotherapy administration or for unpreventable medication-related readmissions.

Submission Category: Oncology

Session-Board Number: 4-125

Poster Title: Evaluation of a double-check system in the creation and validation of chemotherapy protocols in a clinical trials unit

Primary Author: M Carmen Herrero, HOSPITAL GENERAL UNIVERSITARIO GREGORIO MARAÑÓN. MADRID.SPAIN; **Email:** carmenhdb@hotmail.com

Additional Author (s):
Paula Arrabal Durán
María Norberta Sánchez Fresneda
Ana Herranz Alonso
María Sanjurjo Sáez

Purpose: Computerization of prescription programs increases efficiency and process safety, but it requires adapting the quality control procedures that prevent errors. In October 2015 we analyze the creation and validation system of Clinical Trials(CT) chemotherapy protocols on our electronic prescribing program. After evaluating the flow diagram for the process, the Failure Mode, Effects, and Criticality Analysis(FMECA) was applied to detect critical points. A checklist was designed, consisting of 14 points that allows the pharmacist to perform a double check of the process. The aim of this study is to assess the quality control system recently implemented in the CT preparation Unit.

Methods: Prospective post-intervention study of quality controls carried out from October 2015-April 2016 in a tertiary hospital. The checklist included the following items: diagnosis, frequency of the cycle, correct drug, dosage, solution, volume of solution, stability of the mixture, route of administration, time of administration, activation of contribution volume, observations of CT protocol, rules of preparation, marked as "Clinical Trial" in the prescription program, and correct presentations associated with drugs. An excel data base was created to record the data collected in the checklist (dichotomous question: yes / no). The error rate (percent) = [incorrect items / total items checked * 100] was calculated. The electronic prescription program used to create the protocols was Farhos® Oncology.

Results: Our hospital has a total of 116 active CT that require preparation. Our average is 13.3 CT dispensations/day, of a total of 142.1 cytostatic dispensations/day. During the study period, 16 onco-hematological CT that require preparation were started in our center, which

represented 15 patients enrolled. 100 percent of CT protocols were checked. 68 schemes of chemotherapy were reviewed, with an average of 4.3 schemes per CT. After double-checking the error rate was 1.6 percent. 16 discrepancies were detected in 16 CT, classified as: 5 related to the stability of the mixture, 4 with CT protocol observations and/or administration discrepancies not included in the prescription, 3 with the frequency of the cycle, 1 with diagnostics, 1 with the route of administration, 1 with time of administration, 1 with the identification of "Clinical Trial". All discrepancies were detected during the double-checking and corrected in the computer application before starting the CT.

Conclusion: The implementation of the FMECA allowed the detection of errors, for which corrective actions were established, such as the implementation of this double checking system. The error rate detected in the study period has been low (1.6 percent of the revised items were incorrect) .The most frequently detected discrepancies were associated with the stability of the mixture, and the observations of the administration. The double-checking system was well accepted by the multidisciplinary team and helps prevent errors that can potentially reach the patient, helping to improve process quality and patient safety.

Submission Category: Pain Management

Session-Board Number: 4-126

Poster Title: Self-management of pain among pharmacy students

Primary Author: David Axon, The University of Arizona College of Pharmacy; **Email:** axon@pharmacy.arizona.edu

Additional Author (s):
Carlos Hernandez
Marion Slack

Purpose: Pain is prevalent among United States (US) adults with an estimated 100-126 million US adults experiencing chronic pain. The objectives of this study were to describe how pharmacy students manage acute and chronic pain, and to determine if these methods differ by gender.

Methods: This descriptive study used data obtained from a 24-item paper-based in-class questionnaire administered to first-, second- and third-year pharmacy students at a single College of Pharmacy in the United States. Students absent from class when the questionnaire was administered were excluded from the study. The questionnaire asked students about their pain frequency, type, intensity, and location. It also explored students' pain management methods, including effectiveness and side effects, and pain management outcomes, including interference with activities of daily living. Demographic information included age, sex, marital status, and year in pharmacy program. Respondents were categorized as having either acute, chronic, or no pain for analysis. Data were compared using independent t-tests for continuous variables and either a chi-square test or Fisher's exact test for categorical variables. The a priori alpha level was 0.05. Logistic regression was performed to identify factors associated with prescription medication use. Independent variables were determined via univariate analysis of all potential variables and included in the logistic regression model if they were statistically significant. Independent variables included type of pain (acute or chronic), number of pain-related emergency department visits in the past five years, and interference with daily activities. The Human Subjects Protection Program approved the study.

Results: A total of 218 pharmacy students completed the questionnaire; 140 reported acute pain, 33 chronic pain, and 45 no pain. Most respondents were aged 19-25 (70 percent), unmarried (79 percent), and female (59 percent). Non-steroidal anti-inflammatory drugs

(NSAIDs) were the most commonly used prescription (acute 34 percent, chronic 58) and over-the-counter (OTC) products (acute 76 percent, chronic 88) amongst both sexes (prescription: males 39 percent, females 38; OTC: males 70 percent, females 83). Chronic pain students used more prescription NSAIDs, muscle relaxants, physical therapy, transcutaneous electrical nerve stimulator, steroid injections, and OTC dietary supplements than acute pain students (p less than 0.05). The most commonly reported non-medical strategy was rest (acute 69 percent, chronic 67). Chronic pain respondents avoided specific activities (p equals 0.020) and participated in physical activity (p equals 0.002) more than acute pain respondents. Males used more opioids than females, whereas females used OTC NSAIDs more than males (p less than 0.05). Effect of pain on daily activities and number of emergency department visits differed significantly between acute and chronic pain groups (p less than 0.05). Logistic regression found pain type, number of emergency department visits, and impact on daily activities were associated with prescription product use.

Conclusion: The majority of pharmacy students sampled had acute rather than chronic or no pain. The most commonly used prescription and OTC product to manage pain was NSAIDs, whilst rest was the most commonly used non-medical strategy. Males used more opioids than females, whilst females used OTC NSAIDs more than males. Logistic regression showed type of pain, number of emergency department visits, and pain impact on daily activities predicted use of prescription products for pain management.

Submission Category: Pain Management

Session-Board Number: 4-127

Poster Title: Impact of liposomal bupivacaine in total hip and knee arthroplasties

Primary Author: Marsha Crader, University of Arkansas for Medical Sciences; **Email:** mfcrader@uams.edu

Additional Author (s):
Willie Capers

Purpose: Liposomal bupivacaine (LB) is approved for postsurgical analgesia in bunioectomy and hemorrhoidectomy procedures. Additional studies continue regarding its potential use for post-op pain in other types of surgeries including orthopedic procedures. A community hospital Pharmacy and Therapeutics Committee approved LB to be temporarily added to the formulary for an inpatient trial period in total knee arthroplasties (TKA) and total hip arthroplasties (THA). The purpose of the trial was to determine if LB should be permanently added to the hospital formulary for multimodal analgesia in TKAs and THAs.

Methods: Medical staff committees approved a 6 month trial of LB compared with total joint mixes, the current practice standard for TKAs and THAs. TKA and THA procedures from June 2015 to November 2015 were retrospectively reviewed. Orthopedic surgeons using LB were required to complete educational modules including appropriate administration technique and safety issues related to LB's 72 hour duration and drug-drug interactions. Five physicians who perform TKAs and THAs were allowed to use LB in their procedures. No patients were excluded. Computer software generated reports were compiled from each patient's electronic medical record. Patient records were reviewed for total administrations of opioids and intravenous acetaminophen (IV APAP), length of stay, and overall medication charges per patient. Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) pain composite scores for the orthopedic nursing unit were also assessed during the same time periods.

Results: Two physicians completed 140 TKAs and THAs 6 months prior to using LB and 102 procedures with LB. The 102 procedures represented 82 percent of the total orthopedic procedures utilizing LB. Since administration technique may influence the potential pain control benefits from LB, only the two physicians using LB more frequently were included in the retrospective review. Oral and intravenous opioids decreased 31.7 percent from 1614 to 1102

administrations. IV APAP was administered 370 times prior to LB and 246 times with LB, resulting in a 33.5 percent decrease in usage. Length of stay decreased 7.7 percent from 2.6 to 2.4 days. Medication costs per patient increased by $574.43 during the 6 month trial period. The average HCAHPS pain composite score increased from 67.2 percent to 73.8 percent when comparing the two 6 month time periods.

Conclusion: The addition of LB to multimodal analgesia in TKAs and THAs led to a decrease in opioid usage and IV APAP. There was a minimal decrease in length of stay. HCAHPS pain composite scores improved on the orthopedic nursing unit with increased utilization of LB. Overall medication charges per patient increased with the addition of LB in TKAs and THAs.

Submission Category: Pain Management

Session-Board Number: 4-128

Poster Title: Assessing the role of intravenous lidocaine infusions for chronic pain in an ambulatory pain management clinic

Primary Author: Omar Eltair, Marra's Pharmacy; **Email:** oeltair@gmail.com

Additional Author (s):
Jennifer Elfman
Joseph Civello
Michelle Matthews

Purpose: Lidocaine is a widely studied local anesthetic and antiarrhythmic agent with potential therapeutic benefits in the treatment of chronic pain. The use of intravenous (IV) lidocaine for chronic pain has been limited due to concerns of cardiac and central nervous system toxicity. Despite this, animal models, in vitro data, and small clinical trials have demonstrated a role for IV lidocaine in alleviating various types of chronic pain including diabetic neuropathy, complex regional pain syndrome, and fibromyalgia. This case series aimed to explore the potential benefits and risks of lidocaine infusions in an ambulatory pain management clinic.

Methods: This case series was performed as a retrospective chart review of a random sample of patients with chronic pain who consented to IV lidocaine infusions at an ambulatory pain management clinic affiliated with a large tertiary care teaching hospital in Boston, MA. After receiving Institutional Review Board approval, the following data was collected from electronic health records for patients who received at least two IV lidocaine infusions for chronic pain between January 2015 to April 2016: patient age, height, weight, BMI, past medical history, type of chronic pain, lidocaine dose, length of infusion, pre and post-infusion pain scores, current and previous analgesic therapy, medication history, pre and post-infusion adverse events and other clinical factors necessary for the evaluation of efficacy and safety of lidocaine infusion therapy in the setting of chronic pain. Patient information was then gathered, de-identified and compared using descriptive statistics to identify potential risks and benefits of IV lidocaine infusion therapy in patients with chronic pain.

Results: Ten patients were included in this analysis. There were 6 females and 4 males with a median age of 48 years. The indication for treatment varied among patients, with 3 patients being treated for chronic back pain, 1 patient with chronic back pain and fibromyalgia, 1 patient

with fibromyalgia, 1 patient had pelvic pain, 1 patient had abdominal pain, 1 patient had complex regional pain syndrome, and 2 patients were listed as having chronic pain. The most common IV lidocaine dose was 500 mg infused over 30 to 45 minutes, and the duration of infusion was extended to 50 minutes in one patient. The average pre-infusion pain score was 6 out of 10 on the numeric rating scale, and the average post-infusion pain score was 3 out of 10, indicating a 30 percent average improvement in pain with IV lidocaine infusion. Half of patients reported adverse events during lidocaine infusion therapy with transient increases in blood pressure (n equals 3) and dizziness (n equals 2) being most prevalent. The average number of lidocaine infusions was 5 per patient (range 1 to 12 infusions). The most common medications used in combination with lidocaine were pregabalin or gabapentin in 7 patients.

Conclusion: The use of IV lidocaine infusions for the management of treatment refractory chronic pain was generally well-tolerated in the patient cases observed and may potentially provide therapeutic benefit in patients who have failed other therapies. Additional controlled studies are needed to decrease selection bias and rule out placebo effect or effect of other concurrent treatment options

Submission Category: Pediatrics

Session-Board Number: 4-129

Poster Title: Heparin-induced thrombocytopenia in pediatric patients: reconciling the 4Ts, HEP score, heparin-platelet factor 4 antibody, and serotonin release assay

Primary Author: Tara Bergland, University of Iowa Hospitals and Clinics; **Email:** tara-bergland@uiowa.edu

Additional Author (s):
Jamie Smelser
Janice Staber

Purpose: The purpose of this study was to look at the use of the predictive scoring systems (4Ts and HEP) the correlation with heparin-platelet factor 4 antibodies (PF4EIA) and serotonin release assay (SRA) results to assist with diagnosis of heparin-induced thrombocytopenia (HIT) in pediatric patients. These tests have never been validated in pediatric patients however the results from this study will help to confirm the utility of these tests. Results from the study should help elucidate optimal tools to assist with evaluation of pediatric patients with suspected HIT.

Methods: This study was a retrospective chart review conducted at an academic tertiary medical center. Patients under the age of 18 who had suspected HIT with a PF4 EIA and/or SRA result completed from March 2009 through July 2015 were included. Eighty-two patients met criteria. The following was collected: platelets (baseline, peak, nadir, and day of HIT testing, documented 4Ts or HEP score, PF4EIA result [positive or negative; of note, our lab reports results >0.4 for the low-dose optical density (OD)], PF4EIA OD results (low and high), SRA result, reason for admission, indication for heparin/enoxaparin, anticoagulation therapy before/after HIT testing, presence of HIT on problem list, presence of heparin allergy, Hematology consult, and bleeding incidence, thrombotic event, and/or death by day 30. Additionally, a 4Ts and HEP score were retrospectively calculated for each patient by the primary author and a pediatric hematologist based on the information available in the medical record. The primary outcome was correlation between predictive scoring systems, 4Ts or HEP, and results of lab tests, PF4EIA and SRA. The secondary outcomes included: description of PF4 EIA optical density units and correlation to predictive scoring systems, 4Ts or HEP, and SRA; correlation of LIP-, primary author- , and pediatric hematologist-calculated 4Ts and/or HEP scores; and description of management of suspected (and subsequently, confirmed) HIT.

Results: Only one of the 82 patients reviewed had documentation of a predictive scoring system by an LIP within the medical record (4Ts). When considering primary author's HIT scoring, 56 percent had a low probability of HIT based on 4Ts vs. 44 percent with HEP. Intermediate and high probabilities were 37 percent and 7 percent, respectively with 4Ts vs. 56% high probability with HEP. Of patients with low 4Ts, none resulted in positive PF4EIA (none received an SRA) and 2 had an equivocal PF4EIA (low-dose 0.425 OD and 0.922 OD, SRA negative and not done, respectively). Of patients with low HEP, none resulted in positive PF4EIA (SRA negative in one patient tested). Of patients with intermediate 4Ts, one resulted in positive PF4EIA (low-dose 2.5 OD; SRA was positive) and one with equivocal PF4EIA (low-dose 0.75; SRA negative). Of the patients with high 4Ts probability, 2 resulted positive PF4EIA (low-dose 0.612 and 0.823 OD; both had negative SRA). Of patients with a high HEP, 3 resulted in positive PF4EIA (low-dose 0.612, 0.823. and 2.5 OD; first 2 with negative SRA, last with positive SRA) and two with equivocal PF4EIA (low-dose 0.92 and 0.75 OD; SRA not done and negative SRA, respectively).

Conclusion: The incidence of HIT was low in this study (1.2%); however, predictive scoring systems can help differentiate patients at low risk for developing HIT (low 4Ts or low HEP (less than or equal to 2)] versus those at higher risk [intermediate or high 4Ts or high HEP (equal or greater than 3)] which require further intervention. These scoring systems have not been validated in pediatric patients but these results suggest they may have a place in assisting with appropriate diagnosis. With a low incidence of HIT in pediatrics it is difficult to validate tests such as 4Ts and HEP.

Submission Category: Pediatrics

Session-Board Number: 4-130

Poster Title: Importance of pharmacist participation in patients with infantile hemangioma treated with propranolol

Primary Author: Saul Castaneda, UABC; **Email:** saulcashe@gmail.com

Additional Author (s):
Hermila Gonzalez
Hermelinda De la Cruz
Jose Luis Sanchez

Purpose: Introduction: Infantile hemangiomas (IH) are the most common benign vascular tumors of childhood, with an incidence of 5-10% during the first year of age. Propranolol is considered the first-line treatment for this condition. Potentially there is a high probability of negative results to therapy, because in many countries there are no treatment protocols or propranolol formulations appropriate for the pediatric population.
The purpose of this study is to evaluate the impact of pharmacist interventions such as detecting, analyzing and solving problems presented during treatment with propranolol in patients with infantile hemangioma.

Methods: A descriptive study was conducted in a group of pediatric patients diagnosed with infantile hemangioma, for a period of 20 months. The participation of the pharmacist consisted of the development of an extemporaneous formulation of syrup propranolol and therapeutic counseling to the child's parents. At each visit to the pharmacy service, family members were interviewed, detecting and classifying the problems related to treatment with propranolol. After analyzing each case, the pharmacist designed an appropriate intervention.

Results: Forty-two children with IH were treated during the period under review. Patient ages ranged from 3 to 11 months old, and were 65% female and 35% male. Twenty-nine problems in 20 patients were detected including inadequate dose (31%), non-adherence to treatment (27.6%), side effects (17.2%), wrong administration (13.7%) and discontinuation of therapy (3.4%). Of the problems detected, 91.3% were resolved. Interventions by the pharmacist in 18 patients were: intensive counseling on adherence to therapy (35%) modification of dosing intervals (25%), and dosage modification (30%). In 95.2% of patients an efficacy to treatment

was obtained compared with 77.2% reported in European studies without pharmacist intervention (P < .001).

Conclusion: Pharmacist intervention and individualized preparation of the drug allowed prevention and solution to problems related to the use of propranolol in patients with infantile hemangioma. It also contributed to greater adherence to treatment which was reflected in the highly successful response to therapy.

Submission Category: Pediatrics

Session-Board Number: 4-131

Poster Title: A multi-facility health system's experience in enhancing patient safety through optimization of computerized provider order entry (CPOE) for pediatric populations: failure mode effect analysis (FMEA) to identify opportunities

Primary Author: Jennifer Harris, HCA; **Email:** jennifer.harris2@hcahealthcare.com

Additional Author (s):
Kara Murray
Caren Fancher
Connie Saltsman
Karla Miller

Purpose: The reporting organization's affiliated hospitals treat more than one million pediatric patients annually. Studies have shown that hospitalized pediatric patients have a three-time higher rate of adverse drug events compared to adult patients. Throughout the organization, CPOE was implemented in a structured wave roll-out from 2010 to 2014. Clinicians using the CPOE system identified a need for special considerations for pediatric patients to be integrated into the technology to aid in better care and risk mitigation.

Methods: The organization assembled a multi-disciplinary team of physicians (pediatricians and neonatologists), nurses, pharmacists, and clinical informatics specialists from across the organization to identify and prioritize pediatric CPOE optimization opportunities. The team conducted a failure mode effect analysis (FMEA) that identified forty-two pediatric and neonatal specific CPOE safety risks and opportunities. Following an analysis of the identified opportunities, the multi-disciplinary team reconvened for a three-day design session to create an action plan for the optimization of the pediatric CPOE system.

Results: Through the FMEA and the design session, the project team was able to identify, prioritize, and develop nine core strategies, including a review and standardization of pediatric CPOE medication orderables. The strategies included the development and deployment of rules to warn clinicians of maximum weight-based doses and weight documentation out of range for the patient's age, and custom electronic health record (EHR) screens to streamline the CPOE ordering of medications that contain administration criteria, specific infusion times, or utilize gestational age for dosing considerations. The core strategies also included the development

and deployment of standardized pediatric CPOE medication orderables and nomenclature within the EHR system. Pilots of these strategies allowed for validation of clinical impact. Education was developed in the form of instructional videos and tip sheets and were distributed to clinicians via branded emails and a dedicated project intranet page. Additionally, a multi-platform analysis and targeted development was completed to assure standardization across the company's four EHRs.

Conclusion: Many CPOE systems were not specifically designed for pediatric medication ordering. Utilizing current technology and targeted development, the project team focused on core strategies to address the opportunities identified by the FMEA. The utilization of FMEA methodology allowed the project team to prioritize the development and implementation of pediatric CPOE optimization strategies.

Submission Category: Pediatrics

Session-Board Number: 4-132

Poster Title: Process improvement in filling pediatric prescriptions requiring powdering

Primary Author: Suejean Kim, Samsung Medical Center; **Email:** sjk1223@gmail.com

Additional Author (s):
Minji Goo
Myungsook Min
Jeongmee Kim
Youngmee Lee

Purpose: When proper formulations of a prescribed dose for weight-based pediatric patients are not available, crushing tablets into powder to meet the exact specific required dose is an inevitable practice in Korean pharmacies. The wide range of different weights of pediatric patients leads eventually to so many different doses of prescriptions. The filling of prescriptions by the powdering process includes many drawbacks, such as the wasting of drugs and more complicated processes and longer time for pharmacists to minimize the risk of error. Therefore, as an efficiency improvement in pharmacy we have carried out the following study.

Methods: After analysis of prescriptions requiring the powdering in house during a one month period, December 2014, we selected 23 pediatric drugs of high frequency prescription and of high degree of dose variation. Each selected drug has been reanalyzed on clinical indication of use, frequency of prescription, dose and dosage, and so on. Based on our analysis we made the recommended dose table in which each dose compromises the certain range of exact original doses to reduce the total number of prescription doses for each drug.

Results: Among 41,155 total prescriptions requiring powdering during the study period, 19,131 cases, approximately 46% of the total, were doses of a tablet that had to be divided into fractions of more than two decimal places. The top 23 drugs of high frequency prescription and of high degree of dose variation were chosen. Ranitidine was found to be the top on the list for number of doses, with 25 different prescribed doses, in just one month.
A table of recommended prescription doses was constructed for each drug, where each dose covers a certain range of original exact doses, after the reanalysis of the selected drugs accompanied with consultation with pediatric doctors.

We have applied our recommended dose in the table to the original prescription data used for our analysis period. The simulation results on each drug have shown that the number of prescription doses was reduced by 30% on average and the doses which required fractions of more than two decimal points were reduced by 76%.

Conclusion: Application of our simplified recommended dose to pediatric patients whose prescription required the powdering process is expected to contribute to efficiency, regarding to time and process in pharmacy, minimization of the risk of error, and cost reduction by wasting less drugs.

Submission Category: Pharmacokinetics

Session-Board Number: 4-133

Poster Title: Evaluating the use of vancomycin in hemodialysis patients at a community hospital

Primary Author: Melanie Flinn, Baylor Scott and White, White Rock; **Email:** melanie.flinn@tenethealth.com

Additional Author (s):
Jacqueline Pitts
Christine Dinh

Purpose: To evaluate the dosing and monitoring of vancomycin in hemodialysis patients at our facility and to determine the utilization of our vancomycin hemodialysis protocol

Methods: A retrospective chart review was performed on hemodialysis patients admitted to our facility between March - April 2016 who were also prescribed vancomycin and received at least one dose and one level. Data collected included demographics, loading dose, initial vancomycin level, subsequent levels, total number of doses given, total number of hemodialysis sessions, hemodialysis interval, length of stay, duration of treatment and completeness of pharmacokinetics monitoring. Only data from patients that received both a loading dose (mg/kg) and had an initial level measured were used to evaluate efficacy of the loading dose to meet a therapeutic level of 15-20 mcg/ml.

Results: A total of 15 hemodialysis patients were given vancomycin between March - April 2016. Two patients had more than one admission within that time, resulting in 18 admissions. The mean age was 57 years old, 10 males (67 percent) and 5 females (33 percent), and average length of treatment with vancomycin was 6.28 days. 16 admissions (89 percent) received an initial loading dose; only 7 (38 percent) received both the loading dose and an initial level with their first hemodialysis session. Of these 7 patients, one level was between 15-20 mcg/ml (14.3 percent), 5 levels were between 5-15 mcg/ml (71.4 percent), and one level was less than 5 mcg/ml (14.3 percent). The only patient within therapeutic range had actually received two loading doses totaling 28 mg/kg. The average of mg/kg loading dose of these 7 patients is 16.57 mg/kg and without the previously mentioned patient, 14.67 mg/kg. Only 6 admissions (33.3 percent) had a complete pharmacokinetic monitoring note. Of the 44 total subsequent levels taken, 4 levels (9.1 percent) were between 15-20 mcg/ml, 37 (84.1 percent) were between 5-15 mcg/ml, and 3 levels (6.8 percent) were below 5 mcg/ml.

Conclusion: Based on our evaluation, improvements should be made to our vancomycin hemodialysis protocol and its utilization at our facility. The loading dose (mg/kg) should be increased as most patients did not meet therapeutic levels. Some limitations were a small sample size and inadequate documentation of vancomycin doses. The vancomycin administration should be moved to the floor to enable confirmation of a dose. One way to improve pharmacokinetics monitoring would be to have hemodialysis schedules sent to pharmacy daily. This would inform pharmacy of the patients that need vancomycin levels drawn that day.

Submission Category: Pharmacokinetics

Session-Board Number: 4-134

Poster Title: Evaluation of blood drug concentration and intracellular IFN-γ and IL-2 expression as surrogate markers for acute rejection and opportunistic infection following kidney transplantation

Primary Author: Takuya Iwamoto, Mie University Hospital; **Email:** taku-iwa@clin.medic.mie-u.ac.jp

Additional Author (s):
Kohei Nishikawa
Yoshiki Sugimura
Masahiro Okuda

Purpose: Advances in immunosuppressive therapies have led to remarkable improvements in kidney transplant outcomes. Therapies combining treatments such as calcineurin inhibitors, mycophenolic acid, basiliximab, and corticosteroid have been responsible in large part for these gains. However, current standards for the pharmacokinetic monitoring of immunosuppressive therapies generally fail to take into account the inter- and intra-individual differences in patient physiology affecting the response to combination immunosuppressive therapies.
In this study, we evaluated blood concentration of immunosuppressive drugs together with IL-2 and IFN-γ levels in lymphocytes as surrogate markers for the risk of acute allograft rejection and opportunistic infection following living kidney transplantation.

Methods: This study was a single-institute, prospective study comprised of kidney transplant recipients who underwent living-donor kidney transplantation at Mie University Hospital between October 2013 and March 2016. All study subjects received tacrolimus, mycophenolic acid, methylprednisolone, and basiliximab. Blood tacrolimus and serum mycophenolic acid AUCs were measured one day prior to transplantation (POD -1) and on postoperative days (POD) 7, 14, 60-90, 120-150. Target AUCs for tacrolimus and mycophenolic acid were 200-250 ngxh/mL (0-24 h) and 30-60 μgxh/mL (0-12 h), respectively. Lymphocyte IL-2 and IFN-γ levels were also measured concurrently. We investigated whether the onset of acute allograft rejection and opportunistic infection can be predicted by the AUC of immunosuppressive drugs or lymphocyte activation markers. The nonparametric Wilcoxon rank sum test, Wilcoxon signed rank test, and Fisher's exact test were used for quantitative analysis of intergroup differences,

where appropriate. This study was approved by the Ethics Committee of Mie University, and written informed consent was obtained from each subject.

Results: Eighteen transplant recipients were included in this study. Of these, only one developed acute allograft rejection. ABO-incompatible transplantation was performed and from the POD 7, the patient received high-dose corticosteroid, immunoglobulin and plasma exchange therapy for acute rejection. Tacrolimus AUC on POD -1 was found to be extremely low (142.8 ngxh/mL); however, mycophenolic acid AUC was within the target range (58.7 μgxh/mL). On the other hand, the lymphocyte activation markers observed in this study failed to provide sufficient indication of immunosuppression status.
Overall 10 patients (55.6%) developed opportunistic infection, including 4 with Polyomavirus BK infection, 3 with Cytomegalovirus infection, 1 with influenza virus infection and 3 with urinary-tract bacterial infection. There was no statistically significant difference between infection (n=10) and non-infection groups (n=8) with respect to the respective AUCs of tacrolimus and mycophenolic acid. The expression levels of IFN-γ-producing NK cell (POD 60), IFN-γ-producing CD4+ T cell (POD -1 and 90), and IFN-γ-producing CD8+ T cell (POD 7, 60 and 90) were found to be significantly higher in the infection group. Furthermore, IFN-γ-producing CD8+ T cell count was found to be significantly elevated coincident to and following infection.

Conclusion: Although acute allograft rejection was observed in only one recipient, low tacrolimus AUC before transplantation may be addressed in high risk recipients, particularly those with ABO-incompatible transplantation. A previous report observed that TNF-α-producing CD8+ T cell levels were elevated following Cytomegalovirus infection in 4 kidney transplant recipients. This report supports the present conclusion that IFN-γ-producing CD8+ T cells also increase coincident with opportunistic infection following kidney transplantation. Thus we feel this work should be of considerable interest to healthcare workers concerned with the safe management of immunosuppressive therapies in organ transplantation cases.

Submission Category: Pharmacokinetics

Session-Board Number: 4-135

Poster Title: Evaluation of pharmacokinetic calculators to estimate vancomycin dosing in Hawaii's Asian population

Primary Author: Michelle Kim, The Daniel K Inouye College of Pharmacy; **Email:** msk@hawaii.edu

Additional Author (s):
Roy Goo
Patrick Chan

Purpose: Vancomycin is renally eliminated therefore empiric dosing is mainly based on a patient's estimated clearance using the Cockroft-Gault method. But uncertainty of this equation's accuracy leads us to further question the accuracy of the pharmacokinetic calculations derived from this estimate. Previous studies analyzed the effects of age, gender, and weight but no studies have assessed the effect of race; a factor possibly significant in predominantly Asian populations, similar to those found in Hawai'i. This study is to determine if the accuracy of commonly-used vancomycin pharmacokinetic calculators are affected by race in a predominantly Asian population in Hawai'i.

Methods: The institutional review board approved this retrospective study of patients admitted to a rural community hospital in Hawaii from January 1, 2012 to December 31, 2013. Patients were included if they received vancomycin and had the following data documented in their electronic medical record: race, age, weight, height, baseline serum creatinine, vancomycin dose received, and vancomycin trough level obtained at steady-state. Patients were excluded if they had a non-steady trough, vancomycin was discontinued prior to the obtainment of steady state, or race was not documented in their medical record. To assess the effects of race, the patient population was categorized into four general racial groups: Caucasian, Asian, Pacific Islander, and other. A total of 382 patient's actual vancomycin trough concentrations were compared to the results from two commercially available pharmacokinetic calculators and a Microsoft Excel based calculator created utilizing the simple bolus-model pharmacokinetic equation.
The end points of this study was to assess the precision and accuracy of two commercially available pharmacokinetic calculators versus computing using the simple bolus equation as well

as assess the effect of race, specifically the presence of Asian descent, on the accuracy of the various methods of calculation.

Results: There was very little correlation between calculated and actual troughs for both Calculators 1 and 2 ($R < 0.01$) and Calculator 3 demonstrated only a slightly stronger correlation (R equals 0.017). All three calculators demonstrated a statistically significant difference between actual and calculated trough levels (p less than 0.0001) although all three calculators also underestimated the actual trough regardless of race. Calculator 1 showed the largest difference of 11.6 milligrams per liter while Calculator 3 showed the smallest difference of 4.8 milligrams per liter.
Race failed to show a statistically significant impact on accuracy for all three calculators (p equals 0.08, 0.05, 0.98), although Calculators 1 and 2 were trending towards significance. The Asian population was also the most inaccurate for all three calculators, having the largest average difference between actual and calculated troughs (17.9 milligrams per liter, 12.9 milligrams per liter, 7.1 milligrams per liter).

Conclusion: The calculated trough levels of vancomycin from all three calculators all underestimated the actual trough levels regardless of race. When factoring in race, the Asian population showed the largest mean difference between actual and calculated troughs for all three calculators. In post-hoc analysis, the two commercially-available calculators showed statistical significant differences in trough levels when comparing the Asian population to the Caucasian population whereas the Excel-based calculator did not. Prospective studies along with an examination of specific PK parameters such as vancomycin volume of distribution and clearance are necessary to confirm these findings.

Submission Category: Pharmacokinetics

Session-Board Number: 4-136

Poster Title: Estimation of the initial dose setting of vancomycin therapy in subjects with microalbuminuria

Primary Author: Hiroshi Kimura, Division of Pharmacy, Ehime University Hospital; **Email:** hkimura@m.ehime-u.ac.jp

Additional Author (s):
Akihiro Tanaka
Shinichi Watanabe
Mamoru Tanaka
Hiroaki Araki

Purpose: Microalbuminuria is an early indicator of renal disease among individuals with type-1 or type-2 diabetes mellitus (DM).The importance of GFR in addition to measurement of urinary albumin excretion in DM patients has been recognized recently. We hypothesized that the probability of failure to achieve targets of vancomycin concentration in serum becomes high in DM patients with albuminuria. In this study, we evaluated the predictive performance of the trough concentration of vancomycin in serum for determination of the initial dose in patients with albuminuria by comparison with patients who did not have albuminuria.

Methods: Data were collected from 52 patients infected with methicillin-resistant Staphylococcus aureus treated with vancomycin at Ehime University Hospital (Ehime, Japan) between April 2010 and March 2015. We excluded patients with disseminated intravascular coagulation and/or multiple-organ failure, as well as those who had undergone hemodialysis. Data comprised body weight, height, age, creatinine concentration in serum, and urinary levels of albumin. Vancomycin concentrations in serum were collected from each patient when they were considered to have reached a steady state. We predicted trough concentrations of vancomycin in serum using vancomycin therapeutic drug monitoring (VCM-TDM; S edition, v1.00; Microsoft® Excel, Shionogi, Osaka, Japan) based on the pharmacokinetic parameters for a Japanese population. Microalbuminuria was defined to be a urinary albumin:creatinine ratio greater than 30. We then compared the predictability of initial dose setting of vancomycin in patients with albuminuria with that in patients without albuminuria according to a previous report.

Results: Calculated mean absolute error (MAE) and 95% confidence interval was 6.1 (5.65–6.51) in the microalbuminuria group and 4.02 (3.59–4.45) in the non-albuminuria group, respectively. Accuracy of prediction in non-albuminuria patients was significantly better than that in the microalbuminuria group because the 95% CI of the MAE did not overlap. There was no significant difference in serum levels of creatinine, age, weight, estimation of vancomycin trough concentration in serum, and actual trough concentration of vancomycin in serum between individuals with microalbuminuria and those without albuminuria.

Conclusion: Differences between predicted trough concentrations and actual trough concentrations of vancomycin were significantly higher in patients with microalbuminuria than in those without albuminuria. Predictive performance of trough concentrations of vancomycin in the serum of patients with microalbuminuria was lower than that in patients without albuminuria.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 4-137

Poster Title: Use of advanced pharmacy practice experience (APPE) evaluations to demonstrate achievement of student learning outcomes

Primary Author: Michelle Caetano, University of Rhode Island College of Pharmacy; **Email:** michellethomas07@gmail.com

Additional Author (s):
Ajinkya Pawar
Norma Owens

Purpose: While skills and behaviors that relate to student learning outcomes are assessed throughout our Doctor of Pharmacy curriculum, our College had not previously used items graded in Advanced Pharmacy Practice Experience (APPE) evaluations to demonstrate achievement of the College's student learning outcomes. As part of our College's preparation for re-accreditation, we undertook an analysis of items on APPE evaluations to demonstrate achievement of student learning outcomes during the 2013 – 2014 academic year.

Methods: This retrospective analysis was approved by the institutional review board. The College has 12 learning outcome statements for our Pharm.D. program. Two or more items graded on APPE evaluations were chosen to demonstrate achievement of each learning outcome. From the evaluations, 37 items were mapped to 11 out of our 12 College learning outcomes. We extracted data from the APPE evaluations used to grade the four different types of required rotations (institutional, ambulatory care, community, and general medicine). Our APPE evaluations were composed of four domains: Professionalism Skills, Communication Skills, Knowledge Base/Data Collection Skills, and Problem Solving/Clinical Judgment Skills. Individual items within each domain were scored using the following scale: 0=No Competency; 1=Very Poor Competency; 2=Poor Competency; 2.5=Below Average Competency; 3=Adequate Competency; 3.25=Moderate Competency; 3.5=Moderately Good Competency; 3.75=Very Good Competency; 4=Excellent Competency. To demonstrate achievement of at least "adequate competency" on each learning outcome, our primary outcome was the proportion of APPE evaluations where the student received a grade of 3.0 or higher on the item being evaluated. Secondary analyses were performed to determine if there were grading differences between faculty and non-faculty preceptors, and if there was any change in grades earned from the first four rotation blocks of the year to the last three rotation blocks.

Results: The class of 2014 included 98 graduates; this provided 383 total evaluations for the analysis. The number of observations of each item varies from 82 to 376 depending on how many of the four required rotations contained that item on the evaluation, and how many preceptors did not evaluate that particular item.
The minimum, maximum, median, and mean grade were calculated for each evaluation item. For all items, scores ranged from 1.0 – 4.0, the mean grade ranged from 3.76 to 3.96 and the median grade ranged from 3.75 to 4.0. For the primary outcome, the proportion of evaluations where the student received a grade of 3.0 or higher on the item being evaluated was over 98% for all items in the analysis (range 98.91% - 100%). In 18 of the 37 items, 100% of students received an evaluation of 3.0 or higher. There were 12 out of 37 items for which non-faculty gave higher grades, and 4 items where faculty grades were higher. Only 2 out of 37 evaluation items showed a statistically significant difference in score from the beginning of the academic year to the end.

Conclusion: This analysis helped us to demonstrate achievement of student learning outcomes using APPE evaluations and informed a redesign of our APPE evaluation forms.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 4-138

Poster Title: Establishing a statewide sterile compounding alliance for review and implementation of sterile compounding regulations related to hospital practice

Primary Author: Jacqueline Costantino, South County Health; **Email:** jcostantino@southcountyhealth.org

Additional Author (s):
Shannon Baker
Lisa Tortora
Jennifer Beaugh
Elaine Wojcik

Purpose: Adherence to sterile compounding regulations is an important process that ensures patient safety. The complexities of United States Pharmacopeia (USP) General Chapter 797 Pharmaceutical Compounding- Sterile Preparation and the impact of the recently published USP General Chapter 800 Hazardous Drugs- Handling in Healthcare Settings guidelines could lead to various interpretations of the regulations. Inconsistency in interpreting these regulations was identified as an issue among hospital pharmacists throughout the state of Rhode Island. This lead to the establishment of the Rhode Island Sterile Compounding (RISC) Alliance as a workgroup dedicated to the review and interpretation of state and federal regulations.

Methods: A group of hospital pharmacists that are responsible for the oversight of sterile compounding met on a biweekly basis. The group included representation from 10 hospitals, accounting for over 2500 inpatient beds. The group was tasked with reviewing the proposed revisions to USP General Chapter 797 Pharmaceutical Compounding- Sterile Preparation and provide feedback to the USP Expert Committee by the January 31, 2016 deadline; reviewing the published USP General Chapter 800 Hazardous Drugs- Handling in Healthcare Settings and discussing its impact on each hospital and assisting in development of an individualized plan; and providing guidance and recommendations based on these reviews to the Rhode Island Board of Pharmacy in the revision of current regulations.

Results: Fifteen pharmacists were invited to participate in the Rhode Island Sterile Compounding Alliance and met over a seven month period. A complete review of the proposed USP 797 revisions was performed, resulting in an 11 page submission document that provided

34 comments to the expert committee. A review of the proposed changes resulted in comments in the following sections: Risk Categories; Reevaluation, Retraining and Requalification; Hand Hygiene; Garb and Glove requirements; Environmental Controls; Constructing Areas to Achieve Easily Cleanable Conditions; Monitoring Air Quality for Viable Airborne Particles; Sampling Surfaces for Contamination; Cleaning Tools; Cleaning and Disinfecting Work Surfaces; Equipment; Components; Creating Compounding Records; Labeling; and Establishing Beyond-Use Dates and In-Use Times. A review of USP 800 provided the group with an opportunity to discuss the impact of changes and the possibility of sharing revised policies. The RISC Alliance found the Rhode Island "Rules and Regulations Pertaining to Pharmacists, Pharmacies and Manufacturers, Wholesalers and Distributors" to be not in alignment with current USP 797 regulations, and proposed changes to the Board of Pharmacy stating that "pharmacies shall comply with USP Chapter 797. Subsequently, the Board of Pharmacy invited several Alliance members to participate in drafting amended language to the regulations.

Conclusion: The formation of the Rhode Island Sterile Compounding Alliance has been instrumental in coordinating sterile compounding efforts among the hospitals in the State of Rhode Island, leading to uniformity in interpretation of the standards and acting as an advocate for sterile compounding practices to the Board of Pharmacy. Assessment of the current regulations was helpful in identifying and correcting knowledge gaps and proved useful as a method to share policies and procedures among a variety of hospitals, especially with the current proposed changes to USP 797 and the newly published USP 800.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 4-139

Poster Title: South Dakota practice advancement initiative hospital self-assessment comparison to the nation

Primary Author: Tadd Hellwig, South Dakota State University College of Pharmacy; **Email:** thaddaus.hellwig@sanfordhealth.org

Additional Author (s):
John Kappes
Tarryn Jansen

Purpose: The South Dakota Society of Health-System Pharmacists (SDSHP) was a recipient of a grant from the American Society of Health-System Pharmacists (ASHP) Research and Education Foundation to advance the ASHP Practice Advancement Initiative (PAI) in South Dakota. A workshop focusing on the PAI was conducted in May 2015 that aimed to help support all health systems in South Dakota to fill out the PAI Hospital Self-Assessment Survey.

Methods: SDSHP was a recipient of a grant from the ASHP Research and Education Foundation to wold a workshop focusing on the PAI in South Dakota. A portion of this workshop was used to help health-systems in the state fill out the PAI Hospital Self-Assessment Survey. Results of the surveys completed by health-systems in South Dakota was then compared to surveys that were completed by health-systems located outside of South Dakota to further identify areas of strengths and opportunities for improvements compared to outside health-systems. A comparison report of South Dakota vs. non-South Dakota health-systems was then created. A particular focus of this comparison report was on individual items that were either +/- 15% difference in results between South Dakota vs. non-South Dakota health-systems.

Results: A total of 36 of the 68 (53%) health-systems in the state have completed this survey. Comparisons of the South Dakota PAI Hospital Self-Assessment Surveys to surveys completed by health-systems outside of South Dakota have identified areas of strengths present in health-systems in South Dakota as well as areas for continued advancement. Areas of particular strength within South Dakota health-systems compared to outside health-systems include: no lack of pharmacist staff impeding development of an optimal pharmacy practice model, pharmacist involvement in development of a patient care plan, pharmacist monitoring of

patient response, pharmacist provide discharge counseling, pharmacist involvement on hospital rapid response teams, pharmacist involvement on CPR teams, implementation of CPOE systems, and use of telepharmacy technology. Areas for continued advancement within South Dakota health-systems include: maximizing roles of pharmacy technicians, involvement of pharmacists in national quality measures, continual medication use evaluations, total number of pharmacists receiving residency training, and need for increased pharmacy technician certification. These results will be distributed to all health-systems in South Dakota and SDSHP will continue to identify opportunities to aid all South Dakota health-systems improve in these areas of weakness.

Conclusion: SDSHP was a recipient of an ASHP Research and Education Foundation grant to help further the PAI in South Dakota. A portion of this grant helped a majority of the health-systems across South Dakota complete the Hospital Self-Assessment. These survey results then helped identify areas of strengths in South Dakota pharmacy practice as well as opportunities for continued improvement. SDSHP is now able to provide focused attention in several areas to help advance the ASHP PAI.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-140

Poster Title: Information required in research reports for inclusion in meta-analysis: cohort studies for evaluating the impact of pharmacist care on diabetes outcomes

Primary Author: Nimer Alsaid, University of Arizona; **Email:** alsaid@pharmacy.arizona.edu

Additional Author (s):
Abdulaali Almutairi
Maryam Fazel
Jeannie Lee
Marion Slack

Purpose: Meta-analysis is a method for using findings reported in the literature to obtain an overall estimate of the impact of an intervention on an outcome, including the impact of pharmacist care on the outcomes of diabetes management. However, to be included in a meta-analysis, study publications need to report quantitative data that can be used in calculations of an overall effect, and report information on the conduct of the study so that risk of bias can be assessed. The purpose of this study is to identify a schema that can be used by investigators to assure that critical information including data for estimating impact and information necessary to assess risk of bias are included in reports of their research.

Methods: A schema was developed by adapting a framework used for randomized controlled trials which described the information needed in the methods, results, and discussion sections to assess internal validity. This framework was adapted for reporting the findings of cohort studies of pharmacists' intervention for the management of diabetes. The items included in the schema were obtained from reviews of Campbell and Stanley's treatment of internal validity and of the Cochrane Collaboration's Effective Practice and Organization of Care criteria. Additionally, factors related to risk of bias from a recent meta-analysis of pharmacists' interventions for diabetes were reviewed for general applicability to risk of bias assessment. To identify the included factors, three investigators reviewed the information, identified factors to include, and met to select the final factors based on consensus. Data were analyzed by constructing a table that delineated the information needed for calculating an effect size and a second table that delineated the information required in the methods, results, and discussion sections for assessing risk of bias.

Results: The primary factors associated with reporting quantitative findings were that data needed for calculating an effect size are available, primarily the mean and standard deviation of the outcome variable, including confidence intervals for odds ratios, and the number of participants in each group. The four primary factors identified for risk of bias were equivalence of groups at baseline on the outcome measure, equivalence of groups at baseline on demographic factors, attrition or dropouts, and risk of contamination of the control group. Because randomization is not used with cohort studies, eligibility criteria must be clearly stated so that participants in each group are similar, a flowchart is needed to show how participants were assigned to groups, a table displaying the demographic characteristics and the baseline values on the outcome variable for each group with p-values is needed to identify any differences between groups, multivariate analysis to control for any differences between groups, and any implications for differences should be commented on in the discussion section. Information should be included in the flowchart to show any attrition, and if there is attrition, a sensitivity analysis should be done and issues with attrition commented on in the discussion section.

Conclusion: In addition to providing quantitative data to calculate effect size, four primary factors were identified for inclusion of reports of pharmacist interventions for diabetes in meta-analyses: equivalence of groups at baseline on the outcome variable and on demographic factors, data on attrition, and data on possible contamination. Summarizing them in a table to use as a schema assures that investigators can recognize and address the issues. Inclusion of the noted information will increase the likelihood that the study will be included in meta-analyses and will increase the impact of the study.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-141

Poster Title: Information required in research reports for inclusion in meta-analysis: cohort studies of pharmacy-supported transition of care and 30-day readmission rates

Primary Author: David Axon, The University of Arizona College of Pharmacy; **Email:** axon@pharmacy.arizona.edu

Additional Author (s):
Lili Zhou
Chinmayee Katragadda
Amanda Harrington
Marion Slack

Purpose: Meta-analysis is a quantitative method for using findings reported in the literature to calculate an overall estimate of an intervention's impact on an outcome, specifically the impact of pharmacy-supported transition of care (TOC) on 30 day readmission rates. For inclusion in a meta-analysis, study reports must provide quantitative data for calculating effect size, and study conduct information for assessing risk of bias. Studies that report quantitative data and study conduct information are more likely to be included in a meta-analysis. The purpose of this study is to describe a schema for investigators to use to assure critical information is available, which includes: 1) data for estimating effect, and 2) information necessary to assess risk of bias associated in cohort designs.

Methods: Consulting a basic text on meta-analysis identified data required for calculating an effect size. A schema was developed for reporting the findings of cohort studies of TOC by adapting a framework for randomized controlled trials that described information needed in the methods, results, and discussion sections for assessing internal validity. The factors included in the schema were obtained from reviews of: 1) Campbell and Stanley's treatment of internal validity, and 2) the Cochrane Collaboration's Effective Practice and Organization of Care criteria. Additionally, the factors identified in a risk of bias assessment for a meta-analysis of pharmacy-supported TOC were reviewed. To identify factors relevant to assessing risk of bias, three investigators reviewed the information, identified factors to include, and then met to select the key factors based on consensus. Data were analyzed by constructing a table for the information needed for calculating an effect size and a table that delineated the information required for assessing risk of bias in the methods, results, and discussion sections.

Results: Data on the number of patients readmitted and number of patients in each group are needed to calculate an effect size. Confidence intervals are needed if odds ratios are reported. Three main sources of bias were identified: 1) selection bias, 2) lack of data on intervention implementation, and 3) attrition or dropouts. In the methods, inclusion criteria must show the same criteria were used for both groups and statistical analysis should indicate multivariate analysis was used to control for any differences. In the results, a flowchart should show the patient flow through both groups. The table reporting patient characteristics should include p-values to identify differences between groups. If there are differences, multivariate analysis findings should be reported. In the discussion, implications of the differences are described. For implementation of the intervention, a description of the intervention should include how data will be collected on implementation, in the methods. Data are reported in the results, and implications are delineated in the discussion. For attrition or dropouts, the methods should contain a description of the process used to identify participants lost to follow-up. Number of patients lost to follow-up should be reported in the results, and any implications described in the discussion.

Conclusion: The schema delineates the 4 most important things to include in a research report. These are adequate data for calculating sample size, an assessment of selection bias, data on the intervention implementation, and reporting attrition or dropouts. Inclusion of this information will increase an investigator's chances of having their study included in meta-analyses involving their area of research and of increasing the impact of their study.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-142

Poster Title: Outcomes of an economic model comparing human regular U-500 insulin 20-mL vials and 3-mL pens in United States hospitals

Primary Author: Wendy Bibeau, Eli Lilly and Company; **Email:** bibeau_wendy_s@lilly.com

Additional Author (s):
April Taylor
Steven Babineaux
Kari Kelton
Sinem Perk

Purpose: Human regular U-500 insulin (U-500R) is five times more concentrated than human regular U-100 insulin and is indicated for the treatment of patients with diabetes mellitus who require more than 200 insulin units a day. The purpose of this study is to evaluate the economic impact of switching from U-500R 20-mL vials (10,000 units per vial) to U-500R 3-mL pens (1,500 units per pen) in acute-care hospitals in the United States (US) that currently have U-500R 20-mL vials but not U-500R 3-mL pens on their formulary

Methods: An economic model was developed to calculate the differences in insulin wastage and total cost after the switch from 20-mL vials to 3-mL pens. The model provides a US institution-focused perspective with a 12 month time horizon. Centers for Disease Control and American Hospital Association data were used for population estimates. Modeled scenarios include switching from individual patient supply (IPS) use of 20-mL vials to IPS use of 3-mL pens, and from central unit dose (CUD) use of 20-mL vials to IPS use of 3-mL pens. The model includes two types of insulin wastage: in-use wastage and inventory loss. In-use wastage occurs when unused insulin remaining in an opened vial or pen is disposed at the end of the in-use period or when the patient is discharged, and is automatically calculated by the model. Inventory loss represents wastage related to the loss of a pen or vial, breakage, or expiration of an unopened pen or vial, and is assumed to be 10 percent for vials and pens. For pen priming, 5 units are applied as a fixed dose added per injection from U-500R pens. Costs include U-500R 20-mL vials, 1-mL insulin syringes with safety shields, U-500R 3-mL pens, and pen needles. Insulin costs are based on current wholesale acquisition costs in RedBook: $1,283 per 20-mL vial and $495.50 per package of two 3-mL pens.

Results: In the base case analysis, patients eligible for U-500R are admitted to hospitals at an average rate of 0.68 patients per month (equivalent to 8.2 patients per year), with an average length of stay of 4.8 days, mean daily dose of 339 units, and average of 2.7 injections per day. Switching from IPS use of 20-mL vials to IPS use of 3-mL pens is estimated to result in an annual reduction of 63,995 units in total wastage (77,385 units versus 13,389 units) and a total annual savings of $7,203 ($11,945 versus $4,743). Total insulin wastage reduction per patient is 7,843 units (9,483 units versus 1,641 units) and total cost savings per patient is $883 ($1,464 versus $581). For the same population, switching from CUD use of 20-mL vials to IPS use of 3-mL pens yields a total annual reduction in wastage of 22,945 units (36,334 units versus 13,389 units) and a total annual savings of $1,936 ($6,679 versus $4,743). Total insulin wastage reduction per patient is 2,812 units (4,453 units versus 1,641 units) and total cost savings per patient is $237 ($818 versus $581).

Conclusion: Results from this economic model suggest that switching from 20-mL vials to 3-mL pens in a US hospital setting may reduce insulin wastage resulting in cost savings in both scenarios: switching from IPS of 20-mL vials to IPS of 3-mL pens and from CUD of 20-mL vials to IPS of 3-mL pens. These data further support the recent recommendation by the Institute for Safe Medication Practices where some hospitals may want to consider using U-500 pens for patients to not only eliminate dose conversion problems and but also eliminate potential wastage from a U-500 vial.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-143

Poster Title: Cost savings associated with utilization of donated medication program in a hospital outpatient pharmacy setting

Primary Author: Hillary Blackburn, Dispensary of Hope, LLC; **Email:** hcfreema@gmail.com

Additional Author (s):
Anita Stanford
David Neu
Jordan Holland
Austin Weaver

Purpose: The purpose of this study was to evaluate the impact of a donated medication program on preventable hospital utilization and costs of care for inpatient admissions and emergency department visits for the low income, uninsured population.

Methods: Saint Thomas Health Plaza Pharmacy in Nashville, TN, utilizes a combination of a subsidized formulary, patient assistance programs, and a donated medication program to provide a high level of care to their underserved population. The Advisory Board Company conducted a retrospective review of Saint Thomas Health patients enrolled in a donated medication program which demonstrated actual cost savings attributed to decreased hospital encounters for the patient cohort studied. Adult patients enrolled in the donated medication program, Dispensary of Hope, at Saint Thomas Health Plaza Pharmacy were included for a 2.5 year period. Patients were enrolled in the program if they met the eligibility criteria of being uninsured and at or below 200 percent of Federal Poverty Level. Approximately 1,000 patients could be connected to hospital data to analyze prescription utilization, hospital inpatient length of stay, emergency department utilization, hospital readmissions, condition-related preventable utilization, and total cost of care. Various methods of analysis were conducted to ensure the significance of results, including: 1) Analysis of approximately 400 patients with sufficient data pre- and post- enrollment; 2) Analysis of condition-specific utilization pre- and post- enrollment; 3) Analysis of patient cohorts by program enrollment year to compare utilization over time.

Results: A total of 400 patients were included in the pre- and post-enrollment review. After enrollment in the donated medication program, total inpatient encounters decreased 37

percent from 219 to 137 visits, while average length of stay decreased by 19 percent from 7 to 5.7 days. Overall cost per inpatient encounter was reduced 20 percent from 7,500 to 6,000 dollars. Total emergency department visit use decreased 3 percent from 212 to 205 visits with a 54 percent reduction in cost per encounter from 288 to 132 dollars. The implied savings for the hospital per 1000 lives totaled 2.08 million dollars. As measured by national standards for analyzing preventable utilization, enrollment in the donated medication program was a positive factor in improving patient outcomes associated with treated chronic conditions. Comparing utilization over time, patients enrolled in year 2013 and 2014 were followed through 2015 demonstrating an annual decrease of 1,400 dollars annually for inpatient visits and 82 dollars annually for emergency department visits post-enrollment. Despite healthcare costs' trend to increase 1.2 percent annually, costs decreased for inpatient visits 47 percent and 16 percent for those enrolled in 2013 and 2014, respectively.

Conclusion: The data suggests that enrollment in a donated medication program reduces costs to the hospital for this underserved population. As for limitations, there was no control group because this is a difficult to study population. Continued study of this population and analyses of program participants in other geographies/markets should be conducted to verify findings.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-144

Poster Title: Influence of cisplatin on DNA extraction for later genomic characterization

Primary Author: Verónica Casañas-Sánchez, Biologist; **Email:** vcasanas@funcanis.org

Additional Author (s):
Ruth Ramos-Díaz
Alejandra Rodríguez Capote
Gloria Julia Nazco Casariego
Fernando Gutiérrez Nicolás

Purpose: Cisplatin is an inhibitor of cell division in vivo widely used as cancer therapies. The drug enters the cell by passive diffusion and bind to deoxyribonucleic acid (DNA) and to proteins causing deleterious effects on the replication machinery, such as inhibiting DNA polymerase, and the cell status in general. Since the genetic test are increasing in cancer patients to know their sensitivity to certain drugs, would confirm that intravenous administration of cisplatin doesn´t constitute an impediment to DNA replication by polymerase chain reaction (PCR) in blood sample.

Methods: Blood samples were taken from 12 patients diagnosed with metastatic lung cancer adenocarcinoma and treated with antineoplastic scheme cisplatin-pemetrexed. Sampling was done just when these patients attended to Oncology Ambulatory Clinic for treatment administration.
Genomic DNA was extracted from dried blood on paper as described Ramos-Díaz et al. (2015). By each patient, 2 samples were obtained, one just before administration cisplatin (called pre-cis) and the other one 5 minutes after the cisplatin infusion was completed (post-cis), which was being administered for one hour.
One genetic variant, with relevance to cancer chemotherapy as it is ABCC2 gene (Rs717620), was amplified by PCR following the next profile: 30 seconds at 98 degree Celsius; 40 cycles of (10 seconds at 98 degree Celsius; 10 seconds at 55 degree Celsius; 10 seconds at 72 degree Celsius); 2 minutes at 72 degree Celsius. Subsequently, the amplicons, whose size was 442 bases pair, were analyzed on an electrophoretic gel and stained with ethidium bromide. This procedure was performed twice, the same day of DNA extraction and 21 days after such extraction.
All patients signed informed consent for genetic determination.

Results: A total of 48 determinations were carried out. In Figure 1 it can be seen the amplicons resulting from amplification of the ABCC2 gene polymorphism on the same day of DNA extraction and Figure 2 show the results 21 days after this. Every two consecutive bands correspond to the same patient before and after cisplatin administration. The intensities of pre-cis and post-cis bands were similar in each patient.

Conclusion: First, our results show the robustness of the method of dried blood on paper described by Ramos-Díaz et al. (2015). We can also confirm that the treatment with intercalating agents such as cisplatin does not affect in vitro DNA replication and, therefore, does not preclude application of subsequent analysis, allowing the use of PCR methodology for analyzing genetic variants with significance in pharmacogenetics in these patients.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-145

Poster Title: Utilization of just-in-time methodology to improve pharmacy operations

Primary Author: Melissa Diamond, Ascension Health - Sacred Heart Hospital; **Email:** melissa.diamond@shhpens.org

Additional Author (s):
Jerry Smith
Thanh Nguyen

Purpose: Minimization of waste is an important component in optimal pharmacy workflow. Dispensing through our central pharmacy, IV room and our automated dispensing machines (ADM) were identified as areas having excessive waste. The waste was in the form of inventory, overproduction, motion, time and redundancy. This project was designed to uncover and correct gaps in pharmacy operations to improve efficiency and patient care while decreasing workload and waste and improving associate and provider satisfaction.

Methods: Another Ascension Health facility, St. Thomas Midtown, in Nashville, Tennessee, implemented a change in workflow. This model was adapted by the pharmacy operational leadership team at SHHP through four full day focus group exercises. The objective of the focus group meetings was to agree upon goals and develop a workflow utilizing just-in-time and LEAN methodology. The focus group was comprised of the Director of Pharmacy, Operations Manager, Technician Supervisor, Purchasing Agent, Pyxis® Technician Specialist, IV Room Technician Specialist, Controlled Substance Technician Specialist, three Pharmacy Technicians and two Clinical Staff Pharmacists. In addition to the full day focus groups, the operational leadership team met to collate, analyze and refine the information derived from the group meetings.
One goal was to have each pick and delivery run take one hour and contain less than twenty medications per ADM. The number of ADM refills per day was determined by the size and nature of the unit to meet this goal. Another strategic goal was to decrease waste associated with returned IV medications. This was undertaken through increasing the number of batches and decreasing the interval between compounding and administration. A final broad goal was to increase nursing satisfaction, which included decreasing ADM stock outs, decreasing ADM overrides, decreasing phone calls to the central pharmacy, and increasing the number of medications dispensed via the ADMs.

Results: The percent improvement in compounded credits was 15.77 percent for the time period of August 2015 to May 2016 (95 percent CI, 10.46 percent to 8.24 percent, P equals 0.005), while ADM dispenses increased 13.92 percent (95 percent CI, 228,856 dispenses to 189,218 dispenses, P equals 0.012). For the same time period, stock-out and override percentages decreased 50.80 percent and 55.39 percent, respectively (stock-out 95 percent CI, 1.02 percent to 0.30 percent, P equals 0.006; override 95 percent CI, 7.16 percent to 2.65 percent, P equals 0.025). For the time period for January to May 2016, the average number of calls per day decreased by 36.36 percent.

Conclusion: Utilization of peer focus groups was helpful in identifying and planning goals and a workflow. Workflow implementation utilizing LEAN methodology and just-in-time principles produced clinically significant improvements in pharmacy and nursing workflow and satisfaction.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-146

Poster Title: Innovative residency readiness elective: student perceptions regarding usefulness and applicability of course

Primary Author: Kathy Eroschenko, Idaho State Univeristy; **Email:** keros@pharmacy.isu.edu

Additional Author (s):
Catherine Olipant
Tom Wadsworth
Glenda Carr

Purpose: In recent years, postgraduate residency training has gained more recognition as a vital necessity for pharmacy graduates. In order for students to compete for these sought after residency positions, additional training and education are recommended to better prepare students in the application and interviewing process. In addition, increasing student credentials with research may enhance competitiveness amongst their peers. The purpose of this study was to evaluate student perceptions/assessment (fall semester 2014 and 2015 and spring semester of 2016) of a residency readiness course with a focus on research for pharmacy students interested in postgraduate pharmacy residency.

Methods: This was a two credit residency readiness elective available to all pharmacy students at a satellite campus. Course instruction utilized lectures, forum discussions, mock interviews and guest lecturers. All students were required to complete a research project and present their results to a local, state and/or national research forum. Prior to conducting research projects, students had to show successful completion of CITI (Collaborative Institutional Training Initiative) and receive IRB (Institutional Review Board) approval. Students completed a pre and post survey to assess perceptions in their ability to apply for a residency position and conducting research. Statistical analysis was conducted through a 2-tailed paired students t-test.

Results: Twenty three students enrolled from 2014, 2015 and 2016. Twenty students completed the survey. Following the completion of the course, students reported that they felt more familiar with the residency application process (p less than 0.00001), more prepared to apply for a residency (p less than 0.00001), confident in competing for a residency (p equal to 0.00168), and navigating PhORCAS (Pharmacy Online Residency Centralized Application Service)

(p less than 0.00001). Students were also less apprehensive about interviewing for residency positions, preparing a curriculum vitae, choosing the right program and successfully matching with their chosen program, all of which were also statistically significant. With regards to conducting research, students were less apprehensive about the IRB approval process (p equal to 0.001481) and collecting data (p equal to 0.001929) however, disseminating or presenting final research data was not statistically significant (p equal to 0.086115).

Conclusion: These results show that students enrolled into a residency readiness course perceive more positive associations with applying for and obtaining a residency position. Students are also less apprehensive about the IRB approval process and collecting data. As postgraduate training continues to gain momentum, preparing students for these coveted positions is essential.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-147

Poster Title: Time to reach coverage gap and catastrophic coverage: a Medicare Part D claims analysis among beneficiaries with chronic obstructive pulmonary disease (COPD)

Primary Author: Vaidyanathan Ganapathy, Sunovion Pharmaceuticals Inc; **Email:** vaidyanathan.ganapathy@sunovion.com

Additional Author (s):
Lin Xie
Yuexi Wang
Qisu Zhang
Onur Baser

Purpose: Maintenance therapies (eg, inhaled anticholinergics and corticosteroids, inhaled/nebulized long-acting beta-2 agonists) are used in the treatment and management of COPD. For Medicare beneficiaries, these therapies are mainly reimbursed under Part D or, in some cases, Part B. Under Medicare Part D, beneficiaries often bear significant out-of-pocket expenses for covered drugs during a coverage gap (donut hole) period until paid prescription cost reaches the catastrophic coverage limit for that year. Given the variability in Part D plans, number/type of medications prescribed, and drug retail price, the time taken to reach the donut hole varies in a given year. This study evaluated the average time taken to enter and exit the donut hole among Medicare COPD beneficiaries who were prescribed maintenance therapies.

Methods: Medicare fee-for-service beneficiaries aged ≥65 years with at least one COPD diagnosis claim and continuous enrollment in Medicare Part A, B, and D in the calendar year were identified annually from 2010-2013. Beneficiaries eligible for analysis were required to be prescribed >1 COPD treatment during the last quarter of the previous year and were classified into the following mutually exclusive treatment cohorts based on index month prescription: arformoterol (ARF), tiotropium but no ARF (TIO), or inhaled beta-2 agonist/corticosteroid fixed-dose combination but no ARF or TIO (LABA/ICS). Beneficiaries with dual eligibility for Medicaid or a low-income subsidy for Part D were excluded from the analysis. Demographic characteristics, proportion of patient beneficiaries entering the donut hole, and the average time to reach the coverage gap and catastrophic coverage limits were compared across the three COPD treatment cohorts for each calendar year from 2010-2013. T-tests and Pearson chi-

squared tests were used to test statistically significant differences at the 5% level for continuous and categorical variables, respectively.

Results: From a total 214,496 eligible COPD beneficiaries in 2013, 11,169 were in ARF, 105,832 in TIO, and 97,495 in LABA/ICS cohorts, respectively. Approximately 57% were female, 96% white, and 38% resided in the Southern US (mean age of 77 years). Beneficiaries in the ARF group were prescribed more concomitant non-COPD medications (average: 10.5), versus those in the TIO (7.8) and LABA/ICS (8.9) groups ($p < 0.001$) before reaching the donut hole. The proportion of patients reaching the donut hole was 41.3% in the ARF group versus 83.2% and 68.4% in the TIO and LABA/ICS cohorts, respectively. The average time to reaching the donut hole was 219 days for ARF versus with 186 days for patients in TIO and 211 days for LABA/ICS cohorts ($p < 0.001$ vs. ARF). Of those reaching the donut hole, 21.9% in the ARF group also reached catastrophic coverage, versus 33.4% and 24.7% in the TIO and LABA/ICS cohorts, respectively. Beneficiaries in the ARF group spent an average 135 days in the donut hole before reaching the catastrophic coverage period versus those in the TIO (152 days) or LABA/ICS (146 days) groups ($p < 0.001$ vs. ARF). Similar trends and outcomes were observed in years 2010-2012.

Conclusion: This study suggests that a significant majority of COPD beneficiaries reached the donut hole within the first 6-7 months and only about 1 in 3 or 4 COPD beneficiaries among them reach the catastrophic coverage period in a given year. However, the proportion of beneficiaries and time taken to enter and exit the donut hole varies among beneficiaries receiving different maintenance treatments. Further analysis of treatment patterns among beneficiaries reaching the donut hole may provide insights about potential treatment modifications and/or clinical decision-making changes among COPD patients on these different maintenance treatments.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-148

Poster Title: Evaluation of hospital re-admission in smokers and non-smokers via Humedica real-world data

Primary Author: Scott Glosner, Pfizer Inc; **Email:** scott.glosner@pfizer.com

Additional Author (s):
Tim Mullenix
Kelly Zou
Christine Baker
Margaret McDonald

Purpose: Tobacco use is the leading cause of premature disease and death in the United States, responsible for almost half a million deaths and more than $100 billion in added healthcare costs each year. It is a primary driver of hospitalizations for various diseases like cancers, stroke, cardiovascular and respiratory diseases. Tobacco use also interferes with recovery post-hospitalization and contributes to delayed bone and wound healing, infection, and other post-operative complications. The purpose of this evaluation was to examine the association between smoking status and hospital admissions and readmissions using an anonymized Electronic Health Records (EHR) database.

Methods: This retrospective analysis was conducted using claims and clinical data from the Humedica de-identified EHR database from October 1, 2011 thru March 31, 2013. Patient smoking status and their admission and readmission rates were evaluated. Data sources included demographics (e.g. age, gender, race, smoking status), diagnoses (e.g. concomitant disease states), inpatient and outpatient visits (e.g. with dates to calculate admissions, readmission at 30, 90 and 365 days). Patients' smoking status was defined as continuous smoker (CS), requiring a code of smoking during all visits in pre and post index periods, and continuous non-smoker (CNS), requiring a code of not smoking during all visits in pre and post index periods. Records were linked through a unique patient identifier. Inclusion criteria included valid data during study period, age >/= 18 years old, documented smoking status (e.g. CS vs CNS), hospital admissions of greater than 1 day and re-admission within one year of index date. Patients were excluded if they met any of the following: data were outside study period, age

Results: There were 12,916,596 patients in the EHR database. 422,392 patients met inclusion criteria for index date, age, and discrete smoking status. 72,911 patients met above criteria with at least one hospitalization day, and of those patients, 19,359 had a re-admission date within 1 year of the primary admission date. In the overall population, 62% of subjects identified as being hospitalized were CS. Females accounted for 58.3% of hospitalized CS and 60.9% of hospitalized CNS. The average age for CS was 57.6+/- 16.4 years compared to 63.2 +/- 15.0 years for CNS at baseline. The overall percentage of patients with a documented readmission status at 365 days, 90 days and 30 days were 26.6%, 17.0% and 9.4%, respectively, whereas the percentage of readmissions among only CS was 36.3%, 34.9% and 34.4%. CS was associated with a significantly higher readmission rate compared to CNS at 365 days ($P < 0.001$). The top 5 primary diagnosis codes for the index hospitalization among patients were osteroarthrosis (72.9% (CS) vs 25.1% (CNS)), cardiac dysrhythmias (73.1% (CS) vs 25.0% (CNS)), pneumonia (76.1% (CS) vs 22.5% (CNS)), heart failure (70.1% (CS) vs 28.2% (CNS)), and acute myocardial infarction (64.8% (CS) vs 32.5% (CNS)).

Conclusion: CS subjects have higher hospitalization and readmission when compared to CNS subjects. It is important for healthcare providers (e.g. pharmacists, physicians, nurses etc.) to assess the impact that smoking has on the relationship between smoking and health care utilizations such as hospitalizations and re-admissions.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-149

Poster Title: Effect of pharmacist interventions on drug cost savings in a collaborative, unit-based practice model

Primary Author: Rebecca Greene, Rhode Island Hospital; **Email:** rgreene1@lifespan.org

Additional Author (s):
Andrew Zullo
Christine Berard-Collins

Purpose: Pharmacist participation in clinical rounds reduces preventable adverse drug events and medication errors while decreasing both drug-related and total healthcare costs. There is literature to describe the effect of pharmacist participation in rounds on health care costs in the intensive care setting. However, there are limitations on the generalizability of these estimates to current practice since the literature is largely decades old. The objective of our study was to quantify the drug cost savings associated with pharmacist participation on rounds in an intensive care unit in a unit-based, inpatient pharmacy practice model at a large academic medical center.

Methods: This study was an exploratory single-center retrospective observational cohort study conducted at a large, academic medical center. The study included patients in the trauma/burn intensive care unit, surgical intensive care unit, and surgical step down unit. Patients identified on a renal dosing report were also included if the unit-based pharmacist made a recommendation for them. Data was obtained through a detailed electronic medical record review for a 10-workday period from 3/7/2016 to 3/21/2016. Data on pharmacist interventions was obtained for the same period. Each intervention was categorized and independently reviewed to evaluate whether it resulted in drug cost savings. Only interventions accepted by the medical team that resulted in a measurable cost savings were included. Incidence rates were calculated with 95% Poisson confidence intervals. Cost savings were calculated as means with 95% exact confidence intervals.

Results: A total of 79 pharmacist interventions were made during the 10-workday period. This equates to a rate of 99 interventions (95%CI 78-123) per 100 hours worked by the pharmacist. Of the 79 interventions, 20 resulted in directly measurable drug cost savings. Estimated drug cost savings averaged $120.93 per day (95%CI 85.8-156.0), or $31,441.80 per year (95%CI

22,316-40,568) based on inpatient contracted group purchasing organization prices. Of these cost savings interventions, 35% (n=7) were made by direct participation in multidisciplinary rounds on the trauma/burn intensive care unit, 25% (n=5) were made through the renal dosing report and 40% (n=8) were made in the order verification process or by communicating with nurses or physician/mid-level staff while physically present on the floor. Intervention types that produced cost savings included intravenous to oral conversions (10%), recommended discontinuation of therapeutic duplicates (20%), eliminating unnecessary medications (25%), de-escalation of antibiotics (10%), decreasing doses or frequencies associated with renal dose adjustments (25%), and by provider-pharmacy communication regarding missing doses of medications (10%).

Conclusion: Decentralized, unit-based pharmacists and their participation on rounds is associated with substantial drug cost savings. Utilizing a pharmacist's knowledge of shifting drug product availability and pricing could result in greater cost savings for inpatient units.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-150

Poster Title: Involvement of clinical pharmacist at the migrant health clinic at Odense University Hospital

Primary Author: Mirza Gunic, Odense University Hospital, Clinical Pharmacy Unit (HEKLA);
Email: mirza.gunic2@rsyd.dk

Additional Author (s):

Purpose: The Danish health clinic for migrants was established in 2008 at Odense University Hospital when the problem of some migrants with language barriers and low health literacy along with complex chronical conditions was observed. The migrants with abovementioned problems experienced certain difficulties in meeting both the primary and secondary health care sector and vice versa. Difficulties included low degree of compliance, generic substitution at the community pharmacies, unwanted side effects and different understanding of medicine use. To cope with these medication difficulties the clinic involved the clinical pharmacist to develop the medication review model and to offer a consultation service.

Methods: The pharmacist was enrolled at the clinic and was in the same room with the physician during the consultation with the patient. The patients have multiple consultations at the migration clinic, and the clinical pharmacist was present sometimes at the initial conversation and sometimes at the follow up appointments. For patients with language deficiency in Danish or English the consultation was conducted using video conferenced language interpreter. When talking about medications with the patient, the clinical pharmacist was involved in the conversation with the physician and the patient. The potential changes in patient's medications as well as clinical pharmacist's recommendations were recorded by the physician in the electronic patient record. The time spent on each consultation was registered.

Results: The pharmacist took part in 7 consultations. Clinical pharmacist consultations took an average of 5 minutes per patient. The whole consultation with the physician and the time used for the interpretation took an average of 1 hour. Afterwards according to the clinical pharmacist's observations and previous experiences from the clinic presented by the head manager, the patients suitable for pharmaceutical intervention were defined as those patients taking more than 5 drugs (polypharmacy), chronic obstructive pulmonary disease and asthma patients, diabetic and metabolism patients, patients treated with antidepressants and/or

antipsychotics. For future collaboration it was decided that it would be most efficient if the physician screened the patients according to these criteria and referred them to the clinical pharmacist consultation as well as booked the time with the clinical pharmacist. The clinical pharmacist consultation should stand alone. It was further defined that the pharmacist consultation should be approximately 1 hour (10 minutes for anamnesis, 20 minutes for medication reconciliation together with the patient, 15 minutes for medication review and report in the patient's record, 5 minutes for registration of medication related problems in the electronic database, and 10 minutes for eventual questions and additional information).

Conclusion: Involvement of clinical pharmacist at the migrant health clinic had showed that clinical pharmacist consultation with the patients should stand alone. Physician consultation including the pharmacist showed unnecessary time consumption. Physicians should screen the patients for the in advance defined focus area to obtain the best use of pharmacist resources. Video conferenced interpretation at migrant health clinic has been identified as valuable tool in providing consultations to patients with language barriers.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 4-151

Poster Title: Impact of antimicrobial stewardship program implementation on antibiotic expenditures, bacterial resistance, and Clostridium difficile incidence at a suburban community hospital

Primary Author: Eugene Kolomiyets, St. Joseph Hospital; **Email:** eugene.kolomiyets@gmail.com

Additional Author (s):
Ihab Ibrahim
Tamar Berger
Howard Sussman

Purpose: Increasing antimicrobial resistance is a looming public health threat that has claimed tens of thousands of lives that costs the United States healthcare industry billions of dollars per year. Appropriate antibiotic use through implementation of interdisciplinary stewardship programs is recommended by the Centers for Disease Control's Core Elements and numerous other published guidelines. This study was designed to assess the impact of the implementation of a diverse set of antimicrobial stewardship interventions on antibiotic expenditures, bacterial resistance, and Clostridium difficile incidence at a 200-bed community hospital in suburban Long Island.

Methods: Implementation of an antimicrobial stewardship program consisted of a multimodal approach which included around-the-clock pharmacist-assisted dose optimization, clinical pharmacist participation in interdisciplinary rounds in the hospital's critical care unit, daily pharmacist-driven intravenous-to-oral conversions using automatic substitution protocols, prospective antibiotic review and restriction of a limited number of antibiotics to infectious disease-specialized physicians. Restricted antimicrobials included the carbapenems, daptomycin, linezolid, ceftaroline, and tigecycline, among others which constitute 30 percent of the institution's antimicrobial formulary. The hospital also implemented an electronic medical record, performs annual antibiogram analyses and created an antimicrobial stewardship committee, consisting of representatives from medicine, pharmacy, infection prevention and nursing, which meets twice weekly. The committee evaluates all patients on restricted antibiotics as well as those patients who have received greater than five days of antimicrobial therapy and makes interventions to prescribers. All interventions are documented in the hospital's electronic medical record. Implementation of the antimicrobial stewardship took

place over a period between June 2014 and February 2016. In addition to antimicrobial stewardship, the hospital also instituted policies to target Clostridium difficile by modifying cleaning policies and implementing changes to contact isolation procedures. Antimicrobial stewardship performance metrics assessed include changes in antibiotic expenses, Clostridium difficile rates, and susceptibility trends of common bacterial pathogens.

Results: During the period between January 2015 and March 2016, total antibiotic expenditures per 1000 patient days had decreased by 1.5 percent, which occurred after adding a clinical pharmacist in the critical care unit, establishing stricter pharmacist-driven antibiotic review policies, and the establishment of the antimicrobial stewardship committee. Total carbapenem expenses decreased by 34 percent, a trend driven by decreased ertapenem utilization. Ceftaroline expenses have been minimal and daptomycin expenses decreased by 95 percent. As alternatives to ceftaroline and daptomycin use, linezolid expenses increased by 160 percent and tigecycline expenses increased by 220 percent. Clostridium difficile rates also saw an approximately 50 percent decrease between 2012 and 2015, from 19.4 to 8.8 cases per 10,000 patients over the four-year period. Between 2012 and 2016, sensitivities of Staphylococcus aureus and Enterococcus faecalis have remained stable and highly susceptible to first-line therapies. Among gram-negative pathogens, there has been an increase in resistance for Acinetobacter baumanii with most antibiotics and an increase of resistance to cephalosporins and aztreonam with Klebsiella species and Escherichia coli. This trend is driven by an increase in extended-spectrum beta-lactamase and carbapanemase-producing strains. Resistance to piperacillin-tazobactam has remained relatively unchanged during the study period.

Conclusion: Antimicrobial stewardship is an essential and effective program in reducing and preventing unnecessary or inappropriate antimicrobial utilization, reducing Clostridium difficile infections and preventing antimicrobial resistance to antibiotics. An interdisciplinary approach that included a partnership between clinical and nonclinical departments had resulted in a successful implementation of this program that contributed to a decrease in antibiotic spending, decreased incidence of Clostridium difficile and maintained stable resistance patterns among common pathogens.

Submission Category: Preceptor Skills

Session-Board Number: 4-152

Poster Title: National survey of post-graduate year 2 (PGY2) critical care preceptor professional development engagement

Primary Author: Ann Biesboer, Concordia University Wisconsin School of Pharmacy; **Email:** annie.biesboer@cuw.edu

Additional Author (s):
Joel Feih

Purpose: The American Society of Health-System Pharmacists has specific standards preceptors must meet in order to be considered a clinical preceptor. Similarly, the American College of Clinical Pharmacy has also made recommendations regarding the qualifications of clinical preceptors, particular for those training specialty pharmacy resident (i.e. PGY2 residents). The purpose of this survey is threefold. First, the main objective is to identify the main types of professional development activities PGY2 critical care preceptors are most commonly engaging in. Second, this survey is intended to identify the main types of professional development activities PGY2 critical care preceptors are least likely to engage in. Lastly, it is designed to describe the motivators and barriers to professional development engagement amongst PGY2 critical care preceptors.

Methods: An electronic survey was distributed to PGY2 critical care program directors across the country. Program directors were asked to distribute the survey on to their designated critical care preceptors. Preceptors were given two weeks to complete the survey.

Results: A total of sixty critical care preceptors responded to the survey. Respondents have been practicing for an average of twelve years, ranging from two to forty-four years, and have been precepting PGY2 critical care residents for an average of seven years. Four specific professional development activities were identified as the most common activities for preceptors to engage in within the past 12 months. These include maintaining an updated curriculum vitae (98%), active participation on either a committee or taskforce that results in practice improvement (93%), development of new guidelines or protocols (89%), and maintenance on board certification as a pharmacotherapy specialist (73%). Preceptors were least likely to engage in the following professional development activities: maintenance of fellowship status within a professional organization (17%), maintenance of a written

professional development plan (36%), maintenance of a preceptor portfolio (46%), publication (57%), presentation at a professional meeting (63%), and acting as a peer-reviewer (61%). Preceptors unanimously identified self-motivation at the main reason for participating in professional development activities, followed by incorporation of the activity in to the annual review process. The greatest barriers to involvement in such activities are identified as time constraints, followed by perceived lack of opportunity and financial constraints.

Conclusion: This evaluation identifies key areas preceptor development that can be used by preceptors, residency program directors and system administrators to assist in the improvement of residency training experiences across the nation.

Submission Category: Preceptor Skills

Session-Board Number: 4-153

Poster Title: A longitudinal project designed to enhance student understanding of how a clinical skill set can be transferred to a real pharmaceutical industry activity

Primary Author: Colin Gillis, MCPHS University; **Email:** colin.gillis@biogen.com

Additional Author (s):
Katherine Carey
Aakash Dheri
Ekaterina Efimova
Bhumi Patel

Purpose: The pharmaceutical industry is considered a non-traditional career path for Doctor of Pharmacy graduates. The primary objective of this study was to assess the impact of a unique pharmacovigilance-related longitudinal project on student learning in a pharmaceutical industry elective course. The Mock Signal Evaluation (MSE) was conducted to educate students on assessing drug causality for a particular adverse event. The secondary objective of this study was to evaluate change in student perceptions of the pharmaceutical industry and student interest in pursuing opportunities in the pharmaceutical industry following completion of the course.

Methods: During an industry elective course offered in the second professional year, student groups conducted a MSE based on a drug safety communication issued by the FDA. Students attended lectures on functional areas within the pharmaceutical industry, utilized drug information resources, and manipulated and assessed fictitious safety signal data generated by the course coordinators. The course culminated with the groups submitting a written report and orally presenting their MSE findings. Following approval of the Institutional Review Board, pre- and post-surveys were developed and administered electronically at the beginning and end of the course for this descriptive study. The survey included 7 knowledge-based questions and 11 Likert-type questions related to student perceptions of the pharmaceutical industry and interest in pursuing careers in industry. Descriptive statistics (mean values) and student t-tests were applied to compare results of the pre- and post-course surveys. Informed consent was obtained from each student prior to data collection.

Results: The pre- and post-course surveys were completed by 19 of 20 students. Performance on the knowledge-based survey questions meant to assess comprehension of basic competencies and terminology was largely unchanged between assessments. The change in proportion of correct responses was greatest for questions concerning adverse event assessment knowledge (32 percent pre- versus 44 percent post-course) while a smaller change was seen for questions regarding regulatory reporting (47 percent pre- versus 56 percent post-course). There was a slight decline in the proportion of correct responses for questions regarding the use of Microsoft Excel (42 percent pre- versus 37 percent post-course) which was used for signal data manipulation.

There was no statistical difference in students' interest in pursuing a career in the pharmaceutical industry before and after the completion of the course ($p > 0.05$). Students expressed a consistent desire to pursue pharmaceutical industry advanced pharmacy practice experiences (APPEs) (68 percent pre- versus 60 percent post-course reporting "agree" or "strongly agree"). There was an increased awareness of career opportunities within pharmaceutical industry (52 percent pre- versus 70 percent post-course reporting "agree" or "strongly agree") and industry's patient-focus (68 percent pre- versus 75 percent post-course reporting "agree" or "strongly agree") following course completion.

Conclusion: There were no significant changes in either knowledge or perception on the part of the students. The lack of significant changes between pre- and post-course assessments could be attributed to several factors. One possibility is that student understanding of the material was better expressed through course grades and final projects, rather than the limited knowledge-based question set present in the survey. Constant interest in pursuing pharmaceutical industry APPEs in pre-course survey suggests that students in the elective course were already considering an industry career path. One limitation of the study was the inability to follow individual respondents from the pre- through their post-course assessment, which impeded the ability to track if certain students progressed. Another limitation was that the number of enrolled students was small. A potential area for further research would be to assess correlations between survey responses and final course grades.

Submission Category: Preceptor Skills

Session-Board Number: 4-154

Poster Title: Helping IPPE students become practice-ready pharmacists

Primary Author: Michael Kendrach, Samford University McWhorter School of Pharmacy; **Email:** mgkendra@samford.edu

Additional Author (s):
Peter Hughes

Purpose: All pharmacy schools are mandated by the Accreditation Council for Pharmacy Education (ACPE) standards to include Introductory Pharmacy Practice Experiences (IPPE) before the fourth-/last-year of the pharmacy curriculum. The intent of IPPEs is for students to be introduced to the profession, apply classroom learning, and learn the pharmacist roles first-hand. Pharmacy schools need practicing pharmacists for IPPE preceptors. The purpose of this project is to obtain feedback from students regarding their learning during IPPEs. These comments can assist IPPE preceptors in developing an effective teaching program so the students begin learning directly "what it takes to be a pharmacist".

Methods: Pharmacy student feedback was gathered from focus group sessions (FGSs) conducted over the past 3 years at a single US pharmacy school. First- through fourth-year (P1-P4) students were randomly invited to participate in a FGS for each P1-P4 class. The FGSs addressed various questions regarding the curriculum; six specific IPPE questions were in the P1-P3 FGSs. Students were asked to be honest and truthful with their responses. They also were informed that all responses were anonymous but the answers were compiled, summarized, and shared with the school faculty. The pharmacy school Associate Dean for Academic Affairs was the person who coordinated each FGS, asked the questions, took the answers, summarized the responses, and then communicated these to the faculty. This project received university IRB approval.

Results: A total of 108 P1-P3 students participated in the FGSs that had specific IPPE questions. Students do appreciate being involved with dispensing medications and learning the medication distribution process at the different IPPE sites (i.e., community, institution). However, common FGS responses from students regardless of year was “do not use me a free labor” and “do not expect me to know as much as P4s” but instead “allow me to shadow you and see what you do so I can learn first-hand from you”. Students seek real-life encounters

during IPPEs and they learned the best when they saw how IPPE preceptors: handle angry patients; counsel a patient regarding a sensitive nature; discuss a prescription error with a prescriber; manage technicians; advocate pharmacy; use technology; and handle stress and multiple priorities. Students also want to directly interact with other healthcare providers to learn their role. In addition, students are eager to see how and apply their classroom learning to real pharmacy practice to better comprehend and retain instructor teachings. Although students understand at times some manual labor and/or clerical activities (e.g., stock medication shelves, call third-party payers) need to be completed, these should not be primary IPPE activities.

Conclusion: IPPE students eventually become our professional colleagues. Pharmacy schools can teach students the practice of pharmacy in simulated environments, but students value authentic learning more. IPPE preceptors have the unique opportunity to assist in preparing pharmacy students to be a practice-ready pharmacist by serving as a mentor and role model plus providing students with real pharmacist encounters as learning experiences.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-155

Poster Title: Evaluating medication reconciliation in hospitals: the process of selecting, assessing, and applying assessment tool

Primary Author: Mohammed Aljamal, King Salman Military Hospital; **Email:** mmaljamal@hotmail.com

Additional Author (s):

Purpose: Evaluating quality of care is essential when redesigning or improving practice. Medicines reconciliation (MR) on hospital admission is now policy in the UK. It is the process of obtaining an up-to-date and accurate medication list and documenting any discrepancies. The overall aim of this work was to develop quality indicators to evaluate MR on admission to hospital and applying them in a hospital setting.

Methods: The study was designed in three parts, each consisting of three steps. In part I, ideas about potential indicators were obtained from two sources: a literature search and the nominal group technique. These ideas were converted to potential indicators using criteria for good indicators and then reviewed by nine reviewers. Part II was designed to achieve consensus on the appropriateness of the indicators to evaluate MR. It involved pre-piloting, piloting and conducting the main two-round online Delphi study. Several methods were used to approach predefined experts. Part III involved applying in hospital settings those MR indicators that had achieved consensus. It included developing operational definitions and directly observing the MR process as conducted by pharmacy staff in two hospitals. The indicators were further tested by collecting data about the MR process for all patients seen by pharmacy staff on one weekday in the two hospitals.

Results: A systematic approach was followed to develop MR indicators. The idea generation step produced over 90 ideas about potential indicators, which were converted to 85 MR indicators. The assessment by the nine practicing hospital pharmacists discarded 29 of them and the remaining 56 MR indicators were carried forward to the Delphi study, during which 41 indicators achieved consensus as appropriate for evaluating MR on admission to hospital. In the feasibility study, 5 MR indicators were found not to be feasible and three not adequately assessed, while 33 indicators were considered feasible to be used in a hospital setting.

Conclusion: This work provided a novel list of 33 indicators that achieved consensus and were found to be feasible to evaluate the MR process on admission to hospital. Further research should explore the use of these indicators, among others, to assess and improve the overall quality of care provided to patients on admission and throughout the hospitalization journey.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-156

Poster Title: Impact of computerized prescriber order entry on the reduction of occurrences associated with override medications at an academic teaching hospital

Primary Author: Varintorn Aramvareekul, MedStar Georgetown University Hospital; **Email:** varintorn.aramvareekul@gunet.georgetown.edu

Additional Author (s):
Geoffrey Cox
Haseena Hakeem

Purpose: Automated dispensing machines (ADMs) are widely used in healthcare institutions to streamline provider and nursing access to medications for administration in both regular and emergent care. Even though ADMs are designed to minimize chances for medication errors, the override function in ADMs contribute to the error rate by permitting drug dispensation prior to pharmacist order verification. The purpose of this study was to assess the impact of computerized prescriber order entry (CPOE) on the type and amount of override medication occurrences through the use of ADMs.

Methods: A two-year retrospective analysis was conducted, pre-implementation of CPOE (January 2014-December 2014) and post-implementation of CPOE (January 2015-December 2015), to determine whether there was a reduction of occurrences associated with overridden medications. With the use of CPOE, all medications should have corresponding orders and be verified in a timely manner by a pharmacist before a nurse has removed it from the ADM, except in emergency situations. The ADM override process was in accordance with guidelines set forth by the Institute for Safe Medication Practices and the American Society of Health-System Pharmacists, which recommend policies that minimize or prevent nursing staff from removing medications from the ADM without pharmacist verification and requires documentation of rationale for the override. A daily review of overridden medications by pharmacists was submitted to a data analyst for further review of the discrepancies. The two types of occurrences analyzed in this study were no prescriber order in the system and no documentation of medication given in the electronic medication administration record (eMAR).

Results: A total of 199 medication occurrences related to overrides through ADMs were identified for no order entered and no documentation on eMAR for the periods of pre-CPOE

and post-CPOE. During the pre-CPOE period, a total of 156 medication occurrences for no order entered and no documentation on eMAR ranged from 0 to 31 (mean 6.50, mode 4, SD 7.377). Of the 156 medications occurrences, 122 occurrences (78%) attributed to no order entered (mean 10.17, mode 3, SD 8.962) and 34 occurrences (22%) attributed to no documentation on eMAR (mean 2.83, mode 4, SD 1.946). During the post-CPOE period, a total of 43 medication occurrences for no order entered and no documentation on eMAR ranged from 0 to 14 (mean 1.79, mode 0, SD 3.256). Of the 43 medications occurrences, 40 (93%) occurrences attributed to no order entered (mean 3.33, mode 0, SD 4.097) and 3 (7%) occurrences attributed to no documentation on eMAR (mean 0.25, mode 0, SD 0.452). The implementation of CPOE showed that there was a statistical significance (t-test p-value of 0.003) reduction of 72% for overridden medication occurrences associated with no order entered and no documentation on eMAR.

Conclusion: The use of CPOE and ADMs in a healthcare facility setting is intended to increase workflow efficiency, improve patient care, minimize medication occurrences, and enhance patient safety. The results from this study showed a total of 72% reduction of medication occurrences associated with override function after the implementation of CPOE through the use of ADMs. Particularly, there was 67% reduction for no order entered and 91% reduction for no documentation on eMAR. Overall, the implementation of CPOE showed both clinically and statistically significant reduction of occurrences associated with override medications.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-157

Poster Title: In-house microbial air and surface sampling: lessons learned

Primary Author: Denise Arena, Beth Israel Medical Center; **Email:** darena@bidmc.harvard.edu

Additional Author (s):

Purpose: According to the current USP < 797> regulations, microbial air and surface sampling must be conducted every 6 months and the colonizing forming units (CFUs) must be identify to the genus level. Each of the six cleanrooms at Beth Israel Deaconess Medical Center (BIDMC) , a 672 bed Harvard Teaching Hospital, are compliant with these regulations. At BIDMC, we perform in-house air and surface sampling monthly in order to identify upward trends in counts as well as identify vulnerable areas in the cleanrooms which require heightened awareness.

Methods: Once a month, air and surface sampling is completed in each of our six cleanrooms. A volumetic air sampler is used for air sampling and TSB rodac plates are used for surface sampling. Every cleanroom has a map specific to that room which specifies the location of the air and surface sample as well as the ISO classification of the area and the amount of air that is being processed per liter through the air sampler. Only a selected group of trained technicians perform the task due to the concern of potential operator contamination.The samples are labeled according to the schematic. Plates are sent out to an outside independent microbial lab for testing and identification. When the samples are sent out , a Chain of Custody form is completed and samples are mailed overnight with a sleeve of control plates. Confirmation that plates were received in good condition with the controls is sent back via email. As preliminary results are identified, information is sent vial email so the process of remediation can start. All "actionable" CFUs are identified down to the specie level to determine the origin of the CFUs so remediation can be done appropriately. Each final report is placed on a spreadsheet to follow trends in each location from the previous months.

Results: USP < 797> came into effect in 2004. Starting in 2005, the BIDMC Pharmacy implemented air sampling on a monthly and weekly basis based on the standard requirements for low, medium and high risk compounding at that time. In 2008, when the Chapter was revamped, the standard was changed to every six months. Every six months is only a snapshot in time and it is very difficult to get a true picture of what is happening in the cleanrooms. Doing monthly air sampling has proven to be very effective in sorting out problems with

facilities, cleanroom air exchanges, free standing water, broken hood hepa filters and other issues. Identifying CFUs down to the specie level and trending CFUs is very helpful in remediation of the identified problems.

Conclusion: In conclusion, the current USP < 797> standard, as it stands, does not identify issues and trend results as rapidly or at all based on a every six month testing when compared to monthly testing. Identifying CFUs down to the specie level helps determine the source of contamination and aids with corrective remediation . Frequent air and surface sampling, the proper training of personnel, proper identification of colonizing forming units down to the specie level and the documentation of results and the remediation based on these results is the key to a happy and healthy cleanroom!

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-158

Poster Title: Assessment of usage and effectiveness of an updated health-system adult DKA (diabetic ketoacidosis) order set

Primary Author: Rosario Avelino, OSF Saint Francis Medical Center; **Email:** ruth.r.avelino@osfhealthcare.org

Additional Author (s):
Cara Phillips
Deepak Taneja
Bridget Mattson
Marjorie Oliver

Purpose: A multidisciplinary multisystem workgroup was charged with consolidating the existing adult DKA (diabetic ketoacidosis) order-sets, from 7 hospitals within our healthcare system. The goal was to improve safety and quality of care, by providing a standardized therapeutic approach utilizing existing and current guidelines but adapting them to meet our existing patient encounter workflow and practices. This project was designed to evaluate the effectiveness of the changes implemented across our healthcare system. It specifically compares the usage compliance, incidence of hypoglycemia , time needed to correct the metabolic abnormalities and hospital length of stay, before and after implementation.

Methods: Retrospective Chart review of all adult patients with an admission diagnosis of DKA in OSF Health-system hospitals over the course of 9 months before implementation and 9 months after implementation, with 4 months in between data abstraction to allow of education and implementation. Data were abstracted by our health-systems analysts and statistical analysis was done by our health-systems statistician to determine significance. Compliance of order set was measured as a percent of DKA patient encounters utilizing DKA order set out of total DKA patient encounters. Safety was measured using the Incidence of hypoglycemia (Blood Glucose less than 70) measured as a percent of patient encounters that had a hypoglycemic event over total patient encounter per group. Efficacy was measured as time from initiation of insulin drip to metabolic abnormality correction (Anion GAP less than or equal to 12 AND Bicarb greater than or equal 15 OR pH greater than 7.3) and time from hospital admission to discharge (LOS). Demographics and patient location at time of initiation of insulin infusion were included in the study. Basic Statistical analysis was done as appropriate to determine significance. For patients

with multiple admissions, each admission is counted as a separate set of data points for analysis.

Results: 297 patient encounters (138 pre-intervention and 159 post-intervention) from 231 individual patients (110 in pre- intervention and 121 post-intervention) were included in the audit. There was no statistically significant difference between the two groups based on demographic factors, order set compliance (87 percent pre-intervention versus 90 percent post-intervention), duration it takes to correct the metabolic abnormalities (average 13.8 hours pre-intervention versus 15.3 hrs post-intervention), and hospital length of stay (73.7 hours pre-intervention versus 67 hours post-intervention). The incidence of hypoglycemia was significantly lower in the post-intervention group (8.2 percent of patient encounters) compared to the pre-intervention (18.1 percent of patient encounters) , with a relative risk reduction of 56 percent.

Conclusion: Use of the single updated adult DKA order set available for use across our healthcare system, lowered our incidence of hypoglycemia with a relative risk reduction of 56 percent. The updated changes did not adversely impact compliance, as well as duration of time to correct the metabolic abnormalities and hospital length of stay.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-159

Poster Title: Design and implementation of a system to maintain stock of critical medications

Primary Author: Michael Barberio, Children's Hospital Colorado; **Email:** michael.barberio@childrenscolorado.org

Additional Author (s):

Purpose: Certain disease states and conditions, such as hereditary angioedema and severe bleeds in patients with hemophilia, require initiation of pharmacotherapy in a timely manner in order to prevent adverse outcomes. If the medications necessary for treatment are not stocked or are inadequately stocked, patient harm could occur due to delays in care. The responsibility for maintaining adequate stock of these critical medications falls on the institution's pharmacy department. The design and implementation of a standardized system to manage and maintain critical medications at Children's Hospital Colorado (CHCO) is described.

Methods: A list of critical medications was developed with consultation and input from pharmacy clinical specialists, departmental medical directors, and published guidelines for antidote and emergency management stocking. To delineate from stocking pars, minimum pars were established to alert pharmacy team member of how much medication must be stocked at all times and to intervene if stock falls below that par. These pars were set based on three factors: 1) known patient populations, highest doses, and lowest dosing intervals (e.g., the largest patient known to the hematology department needing a specific amount of an antihemophiliac factor), 2) availability for borrowing from local facilities, and 3) timeframe needed for restocking from suppliers and manufacturers. Checklists were developed for each stocking area as well as using a color-coded bin and labeling system to provide visual reference for all pharmacy personnel. A departmental policy was developed, implemented, and revised in order maintain minimum pars.

Results: A list of 59 medications and respective minimum pars was developed. The initial policy placed stock verification responsibility as a shift responsibility, rather than assignment to a specific staff position. Initially, stock verification took place on Mondays and Thursdays. Following implementation, three stock-outs occurred consisting of two medications on the original list of critical medications and one that was not initially listed. A failure analysis was performed, which established the need for daily inspections by specific staff members rather

than assigning the responsibility to a shift, as well a method for communication between shifts to identify higher-than-normal use, to prevent stock-outs, especially on weekends or evenings. Communication was also identified as a failure point. The original policy relied on passive communication, having the buyers review the inspection lists. Inspectors or staff members identifying inadequate stock would verbally communicate this to the buyer or supervising pharmacist who could then decide the appropriate course of action. Following implementation in January of 2015, 3 stock outs occurred in the first 10 months. Once the revised policy was implemented, no stock-outs have been reported in 8 months.

Conclusion: Medical facilities, particularly those that provide service to high-risk or unique disease states, are entrusted by the community that they serve to maintain stock of certain critical medications. If not readily available for immediate or near-immediate administration, patients can experience adverse outcomes ranging from temporary injury to death. After recognizing shortcomings in our normal stocking systems, the CHCO Pharmacy Department established a stocking policy and verification system to prevent stock-outs of these important medications. Implementation of a system to maintain the stock of critical medications can effectively prevent stock-outs, though pre-implementation reporting bias prevented quantitative data from being reported.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-160

Poster Title: Combating the opioid abuse epidemic: what can a hospital pharmacy do to help?

Primary Author: Lisa Block, St Rita's Medical Center - Mercy Health; **Email:** lisa_block@mercy.com

Additional Author (s):
Nancy Rampe
Brian Latham
Brenda Hoang
Margaret Sant

Purpose: St. Rita's Medical Center (SRMC) is a 450 bed community hospital located in Lima, OH. The opioid abuse epidemic has taken a toll on the state of Ohio with an increase in drug overdose deaths of 18.3% from 2013 to 2014. Opioids have been found to be the main cause of these deaths and nationwide opioid overdoses have quadrupled since 2000. SRMC pharmacy department decided to take an active role in attempting to curb the opioid abuse epidemic by participating in novel strategies to educate the public and provide a means to remove opioids from public circulation.

Methods: It was determined that there was a need for a medication collection bin to remove expired and unused medications from local homes more frequently than the medication take-back days being offered once or twice a year in the area. Medication collection companies were vetted and one was selected based on price, ease of use, and the manner of destroying medication. SRMC pharmacy department modified their DEA license to become an authorized collector. A secure medication collection bin was installed in the ER lobby and hospital staff were trained on processes involved in collection and removal of the drug waste. Marketing of the bin's use was promoted with local TV news coverage and in local newspapers. SRMC pharmacy department also participated in a citywide medication take-back day as another means to remove expired and unused medication from local homes. In addition, SRMC pharmacy department implemented a local program to educate youth about proper use of prescription opioids. A SRMC pharmacist developed an interactive opioid abuse prevention presentation adapted from APhA's GenerationRx program. Presentations to local middle school students throughout the SRMC area have been given with the help of pharmacy interns and students from a local college of pharmacy.

Results: Secure medication collection bin use has been overwhelming. It was estimated that bin would need to be emptied every other month and in actuality the bin has needed to be emptied every week since put into use. In a 7 week period, 300 lbs of medication have been collected from the public and removed from circulation. A city wide medication take-back day in coordination with local hospitals and local law enforcement agencies collected 750 lbs of medication (packaging removed) from local homes. To date, one local school district has benefitted from the opioid abuse presentation with multiple other schools scheduled for the fall of 2016.

Conclusion: The need for opioid abuse education and prevention is ongoing. SRMC pharmacy department has helped fill a void with the astounding amount of medications that have already been removed from circulation. With ongoing focus on these programs and further education of the area's youth, we plan to continue to combat Ohio's opioid epidemic while providing a useful service to our community.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-161

Poster Title: Assessing the public's understanding of the regulation of dietary supplements

Primary Author: Brittany Carroll, University of Findlay; **Email:** carrollb@findlay.edu

Additional Author (s):
Jessica Morrison
Taylor Boyer
Laura Perry

Purpose: The Dietary Supplement Health and Education Act of 1994 (DSHEA) requires dietary supplement manufacturers to provide a limited amount of safety data, but does not require efficacy data prior to marketing a new product. This study aimed to determine how well patients understand dietary supplement regulations. Primary endpoints assessed patient understanding of the FDA regulations regarding the safety and efficacy of dietary supplements. Secondary endpoints were the reasoning and influence behind the decision to use dietary supplements, disclosure of use with healthcare providers, and danger of using dietary supplements with prescription medications.

Methods: Data was collected using a validated survey at three pharmacy locations in Northern Ohio. A total of 109 surveys were collected, approximately 30-40 surveys per pharmacy location. Upon agreement to participate in the study, patients gave informed consent by completing the survey. Any patient 18 years of age, picking up a prescription from one of the pharmacies, and able to independently complete the survey was eligible for inclusion. Patients were instructed to fill out the survey independently and were not required to answer questions that did not apply to them or that they did not feel comfortable answering. After completion of the survey, a patient friendly handout reviewing regulations of dietary supplements was provided.

Results: Overall, 62 percent of patients surveyed believe that dietary supplements must be proven safe by the FDA prior to being sold on the market. Patients were nearly equally divided on whether these products must be proven effective prior to being sold on the market. The majority of patients were influenced to use dietary supplements by their doctors (36 percent)

followed by family members (23 percent), friends (14 percent), the media (12 percent), pharmacists (9 percent), and other (2 percent). Most patients reported using dietary supplements to prevent getting sick (32 percent), followed by supplementing diet (26 percent), enhance performance (16 percent), treat a health condition (15 percent), and other (11 percent). 75 percent of patients said their doctors are aware of their use of dietary supplements and 92 percent believe they should be aware. 47 percent of patients said their pharmacists are aware, while 81percent agreed that they should be aware. 90 percent of patients said they believe it can be dangerous to take dietary supplements with prescription medications. Study limitations included low health literacy among the patient population, incomplete surveys, non-diverse demographics, and a small sample size.

Conclusion: Overall, the majority of patients believe that dietary supplements are required to be proven safe and half believe they also need to be proven effective. Although most patients believed that it can be dangerous to take dietary supplements with prescription medications (90 percent), only 47 percent of patients reported that their pharmacist was aware of their use. These results suggest that pharmacists should collect a history of dietary supplement use when filling prescriptions in the community pharmacy setting.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-162

Poster Title: Aligning education and research with service delivery providing real-time CPD

Primary Author: Mairead Casserly, Mater Hospital; **Email:** mcasserly@mater.ie

Additional Author (s):
Ciaran Meegan
Jennifer Brown
Laura McCabe
Mariosa Kieran

Purpose: Continuing Professional Development (CPD) is a key responsibility of individual pharmacists and is mandatory in Ireland for continued registration. It involves the continuous upgrading of clinical skills, development of the necessary skills for appraising evidence, clinical audit, application of standards and the monitoring of performance against standards. CPD in healthcare has been associated with positive effects such as participant satisfaction and attitude changes at organisational level. The MMUH Pharmacy Department has a strong education ethos. It was identified that education processes needed to be an integral part of Pharmacy services to meet strategic goals and all facets of professional development.

Methods: Aims & objectives. To review Pharmacy Department education and research processes & to incorporate education, training and research into Pharmacy Department service goals
A SWOT (Strengths, Weaknesses, Opportunities, Threats) strategic review of the Pharmacy educational services was undertaken. The review included:
A review of lecturing provision at undergraduate & post graduate level
Research opportunities
Education and training requirements at staff induction
Continuing professional development of staff
Following the Education SWOT review
All Pharmacy service reviews, team meetings and service SWOT analyses now include continuing education and research targets and goals.
The inclusion of research and education into pharmacy staff's core roles.

Expansion of mentor and tutor provision by staff from all service areas for undergraduate & postgraduate students.
Implementation of a mentor peer review system for educational presentations.

Results: Education and Research Strategy
A strategic vision for pharmacy education and research was developed. The strategy enables greater oversight and target setting for educational services.
Generation of research ideas consider strategic priorities.
Increased opportunities for all pharmacy staff to participate in education as part of their pharmacy role.
Teaching Methodologies
Modification of educational formats to provide practice/problem based learning and collaborative work. Training for clinical pharmacists has evolved from a ward-based tutor-led model to additional self-directed learning based on case scenarios.
A review of practical implications of large scale research.
Blended learning methodologies increase the flexibility of the learning arena within the Pharmacy, in recognition of the diverse and complex cohorts of students and teachers.
The use of alternative teaching methods has reduced the time commitment on trainers and transferred additional responsibility for learning to the student.
Standardisation and Mentor Review
Education presentation structure and content was formalised.
Pharmacists communication and presentation skills, have improved and the quality of presentations has been enhanced.
The establishment of a clinical mentor system to provide feedback has encouraged reflective practice and helps ensure delivery of appropriate quality educational material appropriate for the target audience.

Conclusion: Health professionals need a wide range of skills which are changing at a rapid pace due to technological progress and changes to service delivery. Continued investment in learning is central to professional and organisational development. Cost effective, systematic and organisational support for CPD, is a important for staff development.
A review of education and research in the Pharmacy Department has led to the development of multifaceted education and training processes. The aim is to be inclusive of all service areas, improve the capacity to gain knowledge, integration into practice, and continuously expand advanced skills in accordance with MMUH strategic goals.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-163

Poster Title: Adult crash carts: process changes improve staff productivity

Primary Author: Gayle Cotchen, Magee-Womens Hospital of UPMC; **Email:** cotcgx@upmc.edu

Additional Author (s):
Rosella Hoffmann

Purpose: Both Respiratory and Pharmacy Departments had been involved in every cart rotation, because medications and medical supplies were both accessible when the cart was unlocked during the code. Magee's Respiratory Team identified an opportunity to reduce unnecessary restocking by one or both of these departments.

Methods: A plan was developed by Respiratory and Pharmacy to separate crash cart medications from supplies using 1 lock for drawers 1 and 2 (medications) and adding a second lock for drawers 3 through 6 (supplies). The plan was communicated to Nursing, Pharmacy and Respiratory staff members; feedback was incorporated. Medication security, patient safety, and cart availability during conversion were key considerations of facility carpenters, Pharmacy and Respiratory teams during lock installation. After installation, each crash cart was restocked with medications and supplies and the cart locked before being placed back into service. Related policies and procedures were updated and posted.

Results: There was a positive impact on the Respiratory Department as evidenced by reduced percent of post-code supply reviews from 100 percent to 48 percent, reduced percent of post-code calls to Pharmacy for medication review from 100 percent to 34 percent, and reduced percent of calls to Pharmacy regarding expiration checks from 100 percent to 0 percent. There was a positive impact on the Pharmacy Department as evidenced by a reduction in post-code calls received by Pharmacy, post-code medication tray replacements, medication trays restocked by technicians, and medication trays verified by pharmacists. All of these Pharmacy activities were reduced from 100 percent to 34 percent.

Conclusion: The crash cart rotation process was successfully streamlined by locking medical supplies separately from medications.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-164

Poster Title: Development of a neonatal IV dilution chart to increase standardization and ensure consistent preparation of neonatal sterile products

Primary Author: Holly Creveling, Beth Israel Deaconess Medical Center; **Email:** hcreveli@bidmc.harvard.edu

Additional Author (s):
Denise Arena
Rena Lithotomos
Margaret Stephan

Purpose: A comprehensive neonatal IV dilution chart was created to assist pharmacists and technicians in the preparation of neonatal IV medications. The chart was created to provide a standard method to compound neonatal medications as well as assist with beyond-use dating based on stability and sterility information in accordance to USP < 797>. The pharmacy department has an adult IV dilution chart and, based on staff feedback, a neonatal IV dilution chart was developed to enhance safety and offer information and guidance when processing NICU formulary medications in this high risk specialty population.

Methods: A working group consisting of 3 sterile products supervisors and 1 lead clinical pharmacist was formed. The working group identified a list of 75 formulary injectable medications used in the compounding of neonatal sterile products. The working group used current references to list the following information for each injectable neonatal medication: package sizes available in the pharmacy, reconstitution instructions, reconstituted vial concentration, vial beyond-use date, vehicle compatibility, standard administration information, product beyond-use date, special comments (including auxiliary labels to place on final compounded product), and references. USP < 797> sterility considerations were used to determine beyond-use dating for both the needle-punctured vial and the compounded sterile product. Because of compounding complexity, limited commercial availability, and serial dilution factors often involved in compounding neonatal medications, certain injectable medications were identified as needing comprehensive compounding procedures. These medications were bookmarked in the neonatal IV dilution chart and referenced to a separate neonatal compounding binder for further detailed instructions.

Results: The chart contains useful information for neonatal preparations which help to ensure standardization in the neonatal population. The chart is reviewed and updated quarterly. It is available on-line and is posted in the main cleanroom which services the NICU population. The pharmacy staff rely greatly on the neonatal IV dilution chart as a quick and reliable reference. The chart is in compliance with USP < 797> beyond-use dating and it clearly identifies all injectable medications requiring a more complex compounding procedure.

Conclusion: The neonatal IV dilution chart is a welcome addition to the already existing adult IV dilution charts and helps to build consistency, safety and quality into the sterile compounding areas. The neonatal IV dilution chart serves as a readily available reference to pharmacists and technicians working in this area. It combines USP < 797> sterility considerations with current stability information to provide beyond-use dating which is USP < 797> compliant. The pharmacy staff rely heavily on this helpful resource tool.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-165

Poster Title: A retrospective evaluation of the use of continuous insulin infusion in a community hospital

Primary Author: Martha Espinoza-Friedman, Cleveland Clinic Florida; **Email:** espinom@ccf.org

Additional Author (s):
Megan Zaleski
Carmen Villabona

Purpose: The optimal strategy for achieving glycemic control in critically ill patients remains a priority among practicing physicians as the association of both hyperglycemia and hypoglycemia with worse patient outcomes has been well described. The standard of care for treating hyperglycemia in this population is intravenous insulin infusion however, the optimal protocol and glycemic target remains unknown. The purpose of this study was to evaluate the safety and effectiveness of our current standardized, nurse- driven intravenous insulin infusion protocol and adherence to our transition to subcutaneous insulin protocol.

Methods: All patients treated with intravenous insulin infusion non- diabetes ketoacidosis (Non-DKA) protocol admitted to intensive care units during the 2015 calendar year were included in this retrospective, Institutional Review Board approved study. Three hundred ninety four patients were reviewed and for each patient, hourly glucose measurements were analyzed to assess frequency of hypoglycemic events, maximal blood glucose and the median time to achieve glycemic goal (glucose less than 180) in each medical unit. From this group of patients, 154 were randomly selected to evaluate the appropriateness of transition from intravenous to subcutaneous insulin.

Results: Of the 394 insulin orders, 42 were from the medical intensive care unit (MICU), 227 from the surgical intensive care unit (SICU), 107 from intermediate medical care unit (IMCU), and 18 from emergency room (ER). The median time (hours) to achieve goal blood glucose was 5, 3.38, and less than 1 hour in the MICU, IMCU and SICU, respectively. The incidence of moderate hypoglycemia (glucose less than 70) was (4/42) 9.5 percent in the MICU, (21/227) 9.2 percent in the SICU and (10/107) 9.34 percent in the IMCU. Incidence of severe hypoglycemia (glucose less than 50) was (0/42) 0 percent in MICU, (1/227) 0.44 percent in the SICU and (1/107) 0.93 percent in the IMCU. Inappropriate transition from intravenous to subcutaneous

insulin occurred in 47 percent of the cases. There was an unadjusted 5.5 times risk of death in the inappropriate group (p-value is 0.01). Median length of stay was 7 days in the appropriate group versus10 days in the inappropriate group (p-value is 0.06).

Conclusion: Our study demonstrated that our current intravenous insulin infusion protocol appears to be safe with an overall rate of 0.5 percent severe hypoglycemia. Rates of moderate hypoglycemia were nearly identical across the intensive care units. This evaluation study helped identify opportunities for pharmacists to collaborate in improving the underutilization of our intravenous insulin infusion, the time to blood glucose goal and improve transition from intravenous to subcutaneous insulin.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-166

Poster Title: Tracking and trending anesthesia controlled substance discrepancies using an electronic database

Primary Author: Rebeca Gansari, University of Ilinois Hospital & Health Sciences System; **Email:** rebeca.gansari@gmail.com

Additional Author (s):
Julie Golembiewski
Adam Bursua
Richard Banchs

Purpose: Monitoring controlled substance (CS) discrepancies and their resolution within a timely manner are of paramount importance due to regulatory requirements and patient safety. The Controlled Substance Act (CSA) requires "…a complete and accurate record of each such substance manufactured, imported, received, sold, delivered, exported, or otherwise disposed of…". An accurate, concise and reliable monitoring and tracking system for anesthesia CS discrepancies was identified as a need at our institution.

Methods: The Research Electronic Data Capture (REDCap) system was employed as a method for data collection, communication and analyzing platform of anesthesia controlled substance discrepancies at our institution. Narcotic reconciliation is performed daily by the operating room (OR) pharmacist and technician as close to real time as possible (with the exception of weekends and holidays). Upon discovery of a discrepancy, the pertinent data is entered into the REDCap database, which includes: name and medical record number (MRN) of patient, name of anesthesia provider and supervisor, dates of procedure and of discovery of discrepancy, location, discrepant medication, medication amount and person identifying discrepancy. An automated e-mail is generated and sent to the provider for five consecutive days containing a link with a survey where the provider explains the reason for the discrepancy (incorrect documentation, medication not returned to pharmacy, medication not returned to dropbox, medication wasted in room, lost controlled substance or other explanation) and how they plan to have it resolved (documentation amended, returned medication to pharmacy, returned medication to dropbox, documented waste on patient record, discrepancy unaccounted for, or other method). In addition, a Google text page is sent to the provider's cell phone to alert them of the discrepancy and to respond to the e-mail survey within 24 hours.

Results: Reports are generated from the REDCap database by the OR pharmacist for each anesthesia residents' four week block schedule. The data is stratified by provider and includes time frame for answering the electronic survey, medication and amount discrepant and method of resolution. The data is reported to anesthesia, pharmacy and hospital leadership for review and analysis. The data includes: the total number of discrepancies, percentage of unresolved discrepancies (%), and percentage of provider response (%). Additional details (provider name, number of discrepancies per provider, reason for discrepancy and resolution) are provided to anesthesia and pharmacy leadership.

Conclusion: To meet regulatory requirements, it is imperative that controlled substance discrepancies are closely monitored and reported when not resolved. Our institution's immediate goal is to define best practice for tracking, trending and reporting of anesthesia CS discrepancies. Our long-term vision is to establish a robust drug diversion surveillance system for a high risk setting that includes monitoring usage patterns and analyzing waste.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-167

Poster Title: Impact of pharmacy-driven metabolic monitoring of patients on antipsychotics

Primary Author: Emily Gray, Saint Francis Health System; **Email:** engray@saintfrancis.com

Additional Author (s):
Teresa Cooper

Purpose: Antipsychotics are associated with metabolic effects including increases in body weight, cholesterol, and glucose. Patients with mental illness have a decreased life expectancy with the majority of premature deaths contributed to cardiovascular events. In 2004, the American Diabetes Association, American Psychiatric Association, American Association of Clinical Endocrinologists, and North American Association for the Study of Obesity released consensus guidelines (ADA/APA guidelines) for monitoring with second generation antipsychotics. While more than ten years old, adherence to guidelines has been found to be low.. Our goal was to investigate if a pharmacy driven metabolic monitoring protocol could improve adherence to guidelines.

Methods: The Pharmacy and Therapeutics (P&T) committee approved a medication use evaluation (MUE) to assess adherence to monitoring guidelines at a 91-bed acute care psychiatric hospital. The results from the MUE were presented to the P&T committee, and a pharmacy driven metabolic monitoring protocol was developed to help further meet clinical practice guidelines and associated Centers for Medicare and Medicaid Services (CMS) standards. The protocol authorizes the pharmacist to order a hemoglobin A1c and fasting lipid panel if not resulted in the past 12 months. These laboratory results are then referenced in a progress note with recommendations for treating any abnormal values.

Results: At baseline, adherence was measured in regard to personal/family history, body mass index (BMI), and blood pressure, and guidelines were followed 100% of the time in the patients evaluated (N=50). Waist circumference was not documented on any of the patients. Fasting blood glucose and/or hemoglobin A1c was measured for 80% of the patients, and lipid panels were obtained for only 22% of the patients. Approximately 150 patients are monitored monthly, and thirty patients are audited monthly for adherence to clinical guidelines. During follow-up evaluation, an improvement was seen in adherence to guidelines, 95% of patients

had a fasting lipid panel and 98% had a fasting blood glucose or hemoglobin A1c measured (N=240).

Conclusion: The metabolic monitoring protocol is a successful approach to raise awareness of metabolic syndrome in patients on antipsychotics and promote initiation of medications to manage associated symptoms. At least once weekly, based on protocol interventions, the pharmacist identifies a patient in need of further evaluation for elevated hemoglobin A1c or fasting blood glucose. Additionally, triglyceride levels greater than 800 mg/dL have been identified in several protocol patients. Pharmacist interventions are usually effective and result in initiation of appropriate medication therapy. Overall, the protocol has made a positive effect on monitoring for adverse metabolic effects of antipsychotic medications.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 4-168

Poster Title: Evaluating medication use in the operating room

Primary Author: Courtney Hebert, UAB Hospital; **Email:** chebert@uabmc.edu

Additional Author (s):
Cindy Holcombe

Purpose: The perioperative setting is a high-risk, complex area where pharmacists are not present for the traditional order verification and dispensing role. Although the literature is sparse on perioperative medication errors, common causes of these medication errors reported include inappropriate labeled syringes. In addition, waste from medications used by anesthesia services can lead to major financial loss for a healthcare institution. The purpose of this prospective, observational study is to analyze current anesthesia syringe preparation practices and to assess and determine financial implications to the institution if medication waste exists in the cardiovascular operating room.

Methods: The institutional review board approved this single-center, prospective observational study of syringe label compliance and medication waste in the cardiovascular operating room at the University of Alabama at Birmingham. For the primary objective, the most common non-controlled medication syringes prepared by anesthesia in the cardiovascular room were evaluated for the accuracy of syringe preparation by analyzing labels placed on unused syringes collected after cardiovascular surgical procedures over the course of three months. The collected syringes contained the following injectable medications: vasopressin, phenylephrine, norepinephrine, epinephrine, ephedrine, lidocaine, succinylcholine, and rocuronium. Unused syringes of these select medications were collected after each case by an independent anesthesiologist not involved in case management and labeling components assessed for compliance included drug name, drug strength, initials of preparer, date of preparation, and time of preparation. Any syringes returned for analysis were considered expired if returned over 24 hours after the date of preparation indicated on the label. The second primary measure was an analysis of drug wastage collected from opened vials returned and unused syringes at the conclusion of cardiovascular cases. The amount of drug remaining unutilized in glycopyrrolate, dexamethasone, esmolol, and neostigmine vials, ampules, and unused syringes were measured and a cost estimate based on the amount of drug waste was performed.

Results: A total of 108 medication syringes prepared by cardiovascular anesthesiologists were assessed for appropriate labeling of syringes both on and off the anesthesia surgical field. Syringe labels containing the drug name and strength/concentration yielded greater than 90 percent compliance, followed by 75 percent compliance in drug preparation date. Maximal wastage was associated with glycopyrrolate and neostigmine vials which accounted for 32 percent and 28.2 percent of the measured overall waste volume respectively. The maximum wastage due to drugs not being used after preparing and loading into a syringe were epinephrine and vasopressin at 30.1 percent and 18.2 percent respectively. Based on these results, several improvements were suggested such as implementing premixed ready-to-use syringes which would have tamper-evident seals meeting label requirement standards and decrease waste. Also, continued education to all anesthesia providers regarding beyond use dating and the potential for patient harm if unused syringes are kept in the room or anesthesia cart. Although the initial cost may be neutral or slightly more expensive to outsource; however if limited to the most commonly wasted medications, the saving associated with preventing adverse drug events justifies the cost.

Conclusion: This project evaluated and defined the current practices of anesthesia in the cardiovascular perioperative setting. The results illustrate that contributing factors that could lead to medication errors and thus patient harm include labeling errors such as illegibility and incomplete label contents, and unlabeled syringes, and cardiovascular anesthesia drug trays with look-alike drugs close in positioning. Overall, this study showed that standardization in aesthesia medication procedures such as uniform syringe labeling and implementing ready-to-use syringes along with enhanced communication can improve waste and safe medication practices which is pivotal for patient safety in the perioperative setting.

Submission Category: Small and Rural Pharmacy Practice

Session-Board Number: 4-169

Poster Title: Impact of the implementation of computerized prescriber order entry and automated dispensing cabinets on a medication-error analysis program

Primary Author: James Williamson, Comprehensive Pharmacy Services; **Email:**

Additional Author (s):
Ginger Bain

Purpose: Beginning in June 2012, a computerized prescriber order entry (CPOE) system was implemented, followed by the installation of automated dispensing cabinets (ADCs) in June 2014 in a 25-bed critical access hospital (CAH) with the intention of improving the quality of care, including the reduction of medication occurrences. The purpose of this study is to determine the impact of both health care technologies on the rates and types of medication occurrences reported at the institution.

Methods: Each reported medication occurrence is currently recorded on a quality care review (QCR) form and reviewed jointly by a pharmacist and at least one nursing supervisor within 24 hours of the event. The QCR form requires documentation of factors associated with the medication occurrence including the type of error, event severity, medications(s) involved, potential breakdown point(s), and clinical staff involved in the reported occurrence. On a monthly basis, trending of reported medication occurrences is presented at the institution's pharmacy and therapeutics (P&T) committee meeting to identify opportunities for process improvement. The monthly trend reports highlight the total number of events, event types, event types by medication class, events by breakdown point, and severity of occurrences. To determine the impact of the technology on overall trends in medication occurrences using data collected for monthly P&T meetings, data from a nine month baseline period from December 2009 through August 2010 (pre- CPOE/ pre- ADCs) was compared with data from a similar nine month study period from December 2014 through August 2015 (post-CPOE/post-ADCs).

Results: There was a 127 percent increase in the number of medication errors reported from 184 during the baseline assessment to 223 during the study. Medication administration and communication errors accounted for 33.6 percent (N=62) and 23.4 percent (N=43) of errors, respectively, at baseline compared to 36.9 percent (N=86) and 0.8 percent (N=2) of errors, respectively, in the study period. During the baseline period, the top most common types of

errors included 58.6 percent (N=108) due to omissions and 17.3 percent (N=32) due to the wrong drug. In the study period after the implementation of CPOE and ADCs, the top percentage of errors were due to omission at 50.6 percent (N=118) and wrong medication at 6 percent (N=6). Antibiotic medication errors accounted for 25.5 percent (N=47) and 25.7 percent (N=60) in the baseline and study periods, respectively. A no harm rating in the severity category was reported at a rate of 66.8 percent (N=123) during the baseline period and 53.6 percent (N=125) in the study period.

Conclusion: The remarkable 127 percent increase in total number of medication errors from baseline to the study period was largely due to the greater visibility pharmacy has to audit charts, and check for documentation. Automation and bar code scanning helped decrease omissions in the study period, because orders were captured electronically and were more visible to ensure timely processing. ADCs helped decrease omission errors by increasing accountability. Omission rate improvement allowed greater focus on timely administration of high alert medications. Implementation of CPOE and ADCs did not decrease the overall number of medication errors, but it changed the types of errors.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 4-170

Poster Title: Surge capacity: design and implementation of a scalable response plan for crisis situations

Primary Author: Michael Barberio, Children's Hospital Colorado; **Email:** michael.barberio@childrenscolorado.org

Additional Author (s):
Angela McIntosh

Purpose: The unpredictability of world events mandates that healthcare facilities prepare for mass casualty incidents (MCIs) or other situations in which patient or workload surges, such as technology failures, stress available resources. Children's Hospital Colorado (CHCO) experienced such an event during the Aurora Theatre Shooting. Review of emergency preparedness plans revealed the need to effectively mobilize resources and adapt to a dynamic situation. Maintaining care of the current patient population had to be considered while prioritizing care for incoming patients. Presented is the design and implementation of the Surge Capacity Plan implemented by the pharmacy department at CHCO.

Methods: Pharmacists within the emergency department (ED) and intensive care unit (ICU) worked with department level, institutional level, and hospital-specific emergency management personnel to develop a plan aligned with organizational terminology and structure. A clear chain-of-command was established by identifying an incident-commander designated as a pharmacist-in-charge (PIC). These PICs are ED/ICU trained clinical pharmacists with operational knowledge and additional incident command systems (ICS-100) training. Major operational and clinical areas requiring uninterrupted coverage were identified and delineated based on training requirements. Both pharmacists and technicians were instructed to volunteer for each role based on training, competence and personal comfort with the area. To accommodate the lack of on-call system, a phone list was developed to 1) identify clinical and operational capability of pharmacists and technicians, 2) staff member's ability to volunteer for response regardless of the time of day, and 3) employee's estimated time of arrival (ETA) to hospital. So that in-house staffing resources could be utilized for patient care, phone call responsibility was shifted from on-site personnel to off-site managers. Needs would be communicated to the manager-on-call who could activate responders based on number needed, ETA, and response area. Areas of responsibility were defined so that pharmacy

department resources could shift as patients move from initial triage/stabilization in the ED through the system to their eventual final area of care (inpatient bed, ICU level bed, discharge).

Results: When alerted of a patient influx, the ED pharmacist calls the central dispensing pharmacist describing the incident and required resources. The ED pharmacist assumes the role of PIC, managing on-site resources and establishing initial command and control. The central pharmacist calls the manager-on-call who then utilizes the call list to bring in appropriate resources. If the current ED pharmacist is not a PIC, a PIC is called in to assume that role with the ED pharmacist returning to clinical duties upon their arrival. If they are a designated PIC, the ED pharmacist will relinquish clinical duties to oncoming responders and assume command and control duties solely. Upon arriving, responders will identify themselves to the PIC who will then allocate resources to appropriate areas. Until the event resolves, the PIC will act as a liaison with pharmacy leadership and direct pharmacy resources appropriately.

Conclusion: While MCIs are the normal impetus for discussion of such plans, more commonplace issues including computer failures could be enough to compromise the ability for a pharmacy department to meet patient care duties. All pharmacy departments should have a plan based on their staffing structures to respond to eventualities that could compromise patient care. The solution presented here could aid other institutions in development of their own plans by serving as a model. Though never fully activated, in July 2015 the command-and-control aspects were successfully implemented following computer server failures; shutting down all electronic systems including the robotic dispensing units.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 4-171

Poster Title: Impact of emergency department pharmacist on appropriate antimicrobial therapy for community-acquired and healthcare-associated pneumonia

Primary Author: Brett Faine, University of Iowa Hospitals and Clinics; **Email:** brett-faine@uiowa.edu

Additional Author (s):
Jenna Dietrich
Laura Meadow
Karisa Harland
Nicholas Mohr

Purpose: Pneumonia is one of the most common infections encountered in the emergency department (ED), and it remains one of the leading causes of hospital readmission and mortality. Appropriate antibiotic selection and timely administration of therapy has been shown to significantly decrease morbidity and hospital length of stay for patients with pneumonia. Clinical pharmacists in the ED serve as a strategy to improve both appropriate antibiotic prescribing and stewardship. We hypothesized that the presence of an ED clinical pharmacist will improve antibiotic appropriateness for community-acquired (CAP) and healthcare-associated pneumonia (HCAP).

Methods: Retrospective cohort study of CAP and HCAP patients presenting to a 65,000-visit academic emergency department between July 2008 – December 2013. The study included all patients who received empiric antibiotics for the treatment of pneumonia in the ED and were subsequently admitted to the hospital. The intervention group included patients who presented to the ED when a clinical pharmacist was present (0900-1800), and the control group included patients who presented to the ED when a clinical pharmacist was not present (1800-0900). Antibiotic appropriateness was determined using recommendations from the Infectious Diseases Society of America (IDSA) CAP and HCAP guidelines.

Results: Four hundred and six patients were included, 103 in the intervention group and 303 in the control group. Baseline demographics were similar in both groups, and there was no difference in the proportion of patients in the intervention and control group who were admitted for CAP (35% vs. 39%, p=0.44) and HCAP (65% vs. 61%, p=0.61). Patients were

significantly more likely to receive appropriate antibiotic therapy when the clinical pharmacist was present compared to when the clinical pharmacist was not present (58% vs. 38%, $p < 0.001$). When a clinical pharmacist was present in the ED, patients were more likely to receive appropriate antibiotic therapy for CAP (77% vs. 53%, $p=0.008$) and HCAP (48% vs. 29%, $p=0.005$). For patients with CAP, 49% received therapy consistent with HCAP guideline recommendations (broad-spectrum) and 52% of patients admitted with HCAP received antibiotic therapy consistent with CAP guideline recommendations. After controlling for type of pneumonia, patients who received appropriate antibiotic therapy when the pharmacist was present were significantly less likely (aOR=0.39 [0.17-0.92]) to have a repeat hospitalization within 30 days compared to patients who received inappropriate antibiotics. There were no significant differences in hospital length of stay or in-hospital mortality.

Conclusion: The presence of an ED clinical pharmacist significantly increases the likelihood of appropriate empiric antibiotic therapy for patients presenting to the ED with CAP and HCAP pneumonia. Future studies should continue to evaluate the impact of clinical pharmacist interventions on clinical outcomes in patients presenting to the ED with pneumonia.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 4-172

Poster Title: Factors associated with availability of anticoagulation reversal agents in rural and community emergency departments: a mixed methods study

Primary Author: Brett Faine, University of Iowa Hospitals and Clinics; **Email:** brett-faine@uiowa.edu

Additional Author (s):
Julie Amendola
Jordan Homan
Azeemuddin Ahmed
Nicholas Mohr

Purpose: Anticoagulation reversal is challenging especially in rural and community hospitals where pharmacy resources may be limited. These drugs are rarely used, so they may be difficult to stock in low-volume emergency departments (EDs). We hypothesized that anticoagulation reversal agents and reversal protocols would be uncommon in low-volume EDs, and we sought to identify barriers to increased availability of reversal agents in rural America.

Methods: We conducted a cross-sectional telephone survey of all EDs in a rural state. A structured telephone questionnaire was administered to a nurse manager, pharmacist, or ED physician in each hospital. Additional data on ED volume, monthly ICHs, neurology coverage, contrast tomography (CT) and magnetic resonance imaging (MRI) availability, referral patterns, and geographic considerations were collected from each hospital. Follow-up qualitative interviews were conducted with hospital pharmacists selected by purposive sampling until theme saturation was achieved to identify barriers to availability of reversal agents. Categorical data were analyzed with the chi-squared test, and continuous variables were analyzed with the Student's t-test or Wilcoxon rank sum test, as appropriate.

Results: One hundred and three (84%) of the EDs responded to the survey request. Almost 45% of respondent EDs experienced fewer than five thousand (5,000) annual visits while only 10% of EDs had greater than thirty thousand (30,000) visits. Sixty-six percent (66%) of respondents care for 1 or fewer intracranial hemorrhage patients per month, regardless of type or associated anticoagulation. Neurology service was available any time for 11 (10.6%) EDs, 12 (11.6%) had partial neurology coverage and 88 (85.4%) had no neurology available. Two (1.9%) EDs had

activated prothrombin complex concentrates (aPCC), 15 (14.5%) had 4-factor prothrombin complex concentrates (PCC) and only 2 (1.9%) had recombinant factor VIIa. Most EDs (84%) had FFP available, however 18 (17.4%) EDs noted it would take longer than one hour to begin administration. ED volume and neurology coverage were associated with the availability of anticoagulation reversal agents and having a protocol for warfarin or direct oral anticoagulant (DOAC) reversal ($p=0.014$ and $p < 0.001$ respectively). Factors identified that contribute to anticoagulation reversal medication non-availability were cost, knowledge of drug availability, and shelf- life. Factors identified to overcome identified barriers included additional financial resources, a physician champion, and increased drug utilization.

Conclusion: Most low-volume EDs have FFP available for warfarin reversal, but a minority have 4-factor PCCs or reversal agents for DOACs available. Few low-volume EDs have protocols for anticoagulation reversal, and availability of advanced reversal agents is associated with ED volume. Cost and knowledge about anticoagulation reversal agents were commonly cited reasons for not stocking reversal agents. Future studies should determine if anticoagulation reversal availability is associated with significant delays to reversal and adverse patient outcomes

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 4-173

Poster Title: Assessment of vapour containment performance for closed system drug transfer devices (CSTDs) that either employ a mechanically closed physical barrier or air filtration technology – a harmonised approach to NIOSH.

Primary Author: Alan-Shaun Wilkinson, University of Derby and BSTL; **Email:** alan@biopharmatesting.co.uk

Additional Author (s):
Ian Pengelly
Colin Morris
Rebecca Finnis
Michael Hemingway

Purpose: The purpose of this study was to develop a Universal test protocol that builds upon the draft NIOSH protocol and that is capable of evaluating the performance of both mechanical barrier and air filtration based CSTD systems for their ability to contain hazardous drug (HD) vapours. The original protocol used a 70% Isopropyl alcohol (IPA) mixture as surrogate but IPA has an extremely high vapour pressure ~ 4400 atmosphere at 20oC, much higher than any hazardous drug. This new study investigates the performance of both CSTD systems using a replacement surrogate of a 2.5% w/w aqueous solution containing 2-Phenoxyethanol (POE), which has a vapour pressure of 1 atmosphere at 20oC and therefore better represents a hazardous drug (HD) solution.

Methods: Building upon the NIOSH draft protocol an environmental test chamber was fabricated and used under static conditions to assess vapour release from the CSTD systems tested. Three commercially available CSTDs were evaluated, two employing a physical barrier: PhaSeal (Becton Dickinson) and ChemoClave (ICU Medical) and a third employing air filtration (ToxiGuard) technology – OnGuard marketed by B. Braun in the US (Teva Medical, Tevadaptor). Test vials contained a 2.5% w/w 2-Phenoxyethanol (50 mL) solution in water. Tenax tubes with 100ng of internal standard were prepared for the study by Health and Safety Laboratory (HSL) in the UK. The chamber was purged with “clean air” at 15 Litresminute-1 for 20 minutes prior to test. Blank tubes were collected by sampling air from the empty chamber for 30 minutes at a flow rate of 100mLminute-1 using a GilAir pump connected to a Tenax tube. All manipulations of CSTD’s were according to instructions for use (IFU) and dual sampling pumps collected

chamber air on to Tenax (100ml/minute for 30 minutes). Once completed, Tenax tubes were sealed and placed in Ziploc bags for analysis. Analysis of Tenax tubes was made by Thermal Desorption Gas Chromatography with Mass Spectrometry detection (TD-GC-MS). Negative tests were performed using water only and positive controls performed using a needle and syringe. All data expressed in parts per billion (ppb) for the released vapour concentration.

Results: The HSL validated the TD-GC-MS method and calibrated for 2-Phenoxyethanol using five standards in the range 6 to 185 ng. Data was fitted to a quadratic curve with an R^2 of 0.9996. The limit of detection (LOD) and lower limit of quantitation (LLOQ) were determined at 0.21 and 0.71 ppb respectively. The robustness of the method was tested including checking for breakthrough of 2-Phenoxyethanol on Tenax. No breakthrough was detected even when sampling for up to 12 Litres. Recovery rates for POE release from Tenax was performed and shown to be >99%. Sampled background laboratory air from CSTD testing (n=10) by TD-GC-MS gave values for POE which were <LOD.
Positive control values obtained using a standard needle and syringe were 4.15±1.14 ppb and 5.13±0.87 ppb for task 1 and task 2 respectively (n=2). Blanks (n=74) gave 0.16±0.07 ppb and were used to set the LOD and LLOQ for the method.
Vapour containment values for PhaSeal and OnGuard (Tevadaptor) were <LLOQ for both tasks (n=5). ChemoClave however produced higher release values of between 5 and 25 x LOD and one release of 120 x LOD. The latter release was associated with a physical liquid droplet release observed in use.

Conclusion: The Universal CSTD test protocol developed with the Health and Safety Laboratory UK and discussed here, allows the pharmacist to evaluate the vapour containment performance of both types of CSTD system. 2-Phenoxyethanol at 2.5% w/w is proposed for all future testing of CSTD's, due to its reduced vapour pressure making it a better surrogate than Isopropyl alcohol used in previous NIOSH testing. We report increased sensitivity of detection with an LOD and LLOQ of 0.21 and 0.71 ppb respectively using an in house HSL TD-GS-MS analytical method. PhaSeal and OnGuard (Tevadaptor) systems produced results <LLOQ in all testing. ChemoClave produced the highest (1 to 5 xLLOQ) vapour release values for POE. Finally, during testing a droplet of drug solution was released using the ChemoClave CSTD system. Values of POE vapour associated with this type of release were very similar to those obtained using the standard needle and syringe approach.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-001

Poster Title: Development and implementation of system-wide staff education modules for medications with risk evaluation and mitigation strategy (REMS) programs

Primary Author: Stephanie Gregg, The Mount Sinai Hospital; **Email:** stephanie.gregg@mountsinai.org

Additional Author (s):
Gina Caliendo

Purpose: The recent formation of the seven-hospital Mount Sinai Health System (MSHS) has prompted the need for uniform system-wide staff education modules. There was a focus on REMS medications due to: significant FDA regulatory requirements, high-risk nature, system-wide usage, and impaired ability to obtain drug if there is noncompliance with the program. The objective of this descriptive study was to develop and evaluate the effectiveness of shared system-wide pharmacist education modules for bosentan and ambrisentan, transmucosal immediate-release fentanyl, erythropoietin stimulating agents, and dofetilide.

Methods: Baseline written policies and procedures were collected and compared throughout MSHS. Findings were communicated to pharmacy directors at each of the sites. Education material on the various REMS programs was created. A 16-question baseline survey was administered to all pharmacists within the health system over a two-week period. Utilizing a learning management system, education modules were distributed, and pharmacists were given a post-assessment. The pre- and post-tests results were analyzed to view effectiveness of the education modules.

Results: After reviewing the modules, MSHS pharmacists scored 31.3% higher (67% vs 88%). The number of pharmacists who scored ≥80 increased by 212% after the post-test (26.3% vs 82.0%).

Conclusion: System-wide pharmacist staff education modules utilizing an electronic learning management system appear to effectively educate MSHS pharmacists.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-002

Poster Title: Evaluation of student knowledge following an elective in preparation for pursuing postgraduate residency training

Primary Author: Drayton Hammond, University of Arkansas for Medical Sciences; **Email:** dhammond@uams.edu

Additional Author (s):
Jordan Rowe
Tessa Wiley
Jacob Painter

Purpose: ASHP proposes that all new graduates from colleges of pharmacy who desire to provide direct patient care should complete an ASHP-accredited postgraduate year-1 pharmacy residency. However, the growth in residency applicants has exceeded that of ASHP-accredited programs since 2007. To help alleviate these concerns, the American Association of Colleges of Pharmacy advocates that colleges of pharmacy be proactive and develop and enhance residency programs. Our purpose was to evaluate if deficits in students' knowledge regarding the pursuit of postgraduate residency training (PGRT) can be resolved following completion of an elective in preparation for pursuing PGRT.

Methods: A 40-question, institutional review board-approved knowledge assessment was provided to students in two consecutive classes enrolled in a preparation for pursuing PGRT elective at a single institution. Each question belonged to one out of ten essential aspects of the process for pursuing PGRT. The mean number of questions answered correctly in each of the ten sections was compared prior to and after completion of the elective with Wilcoxon sign rank test. Student demographics were assessed using descriptive statistics.

Results: Twenty-seven students completed the knowledge assessment before and after the elective in preparation for pursuing PGRT. Students' knowledge, as measured by the mean number of questions answered correctly, increased in five of the ten sections: basic PGRT concepts (3.96 vs. 4.67 questions, p=0.005), interview preparation (4 vs. 4.41 questions, p=0.016), teaching and precepting (1.93 vs. 2.37 questions, p=0.002), and research and medical writing (5.26 vs. 6.41 questions, p=0.024). Students' knowledge decreased for desirable applicant qualities (2.93 vs. 2.67 questions, p=0.008). Areas where student knowledge was

unchanged were curriculum vitae and letter of intent preparation, how to be successful as a resident, selecting programs for application, and professional development.

Conclusion: Students who completed an elective in preparation for pursuing PGRT were more knowledgeable in areas that are important for their success in understanding, matching with, and performing well in a PGRT program. The methods by which students learn information in the other five areas of the course should be evaluated to improve students' understanding of concepts.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-003

Poster Title: Development, progression, and successes of a comprehensive pharmacy technician career ladder

Primary Author: Julie Lanza, Beth Israel Deaconess Medical Center; **Email:** jlanza@bidmc.harvard.edu

Additional Author (s):
Jean Beach

Purpose: The Pharmacy technician career ladder was implemented to increase technician growth and development within the department and medical center. One of the primary goals with career ladder development was to reduce the turnover rate of technicians, retain the current technicians on staff by giving them new opportunities and creating a desirable place of employment for current and future staff. This career ladder provides an avenue for increased exposure of pharmacy technicians throughout the medical center, educational experiences as the pharmacy technician career expands and personal growth for the technicians in these positions.

Methods: Due to the increased complexity and demands on technicians including licensure/certification, MA board regulations, and USP < 797> guidelines, we recognized that the previous two level career ladder were insufficient based on the expansion of the technician duties & requirements. The methods used to develop a new career ladder included: a market analysis to potentially increase rate for technicians, review of medical centers mission statement future goals, communication with other institutions who have implemented successful career ladders, and research into the predicted expansion of the role of the hospital pharmacy technician in the future. Working with pharmacy administration and educators, the development of a multi-level technician career ladder was drafted to show the increased benefit this would create for our department. After building a proposal to address the need for a more comprehensive career ladder so employees can have the opportunity for career growth, the next step was to present our need to Human Resources, Compensation & Workforce Development. Once the career ladder was approved and implemented, the progression and successes are monitored with general communication such as: bi-weekly and follow up meetings to ensure all requirements implemented were being met and new and pending requirements have an action based plan.

Results: The new five level pharmacy technician career ladder takes into account leadership, role model behavior, training, education, and clinical skills. Once the criteria is met for applicant, the detailed interview process includes collaboration with pharmacy administration, lead pharmacists and peer technicians. Currently, of the 38 pharmacy technicians at BIDMC, 55% have advanced due to an opportunity that was given to them through this career ladder BIDMC has 21 certified pharmacy technicians that have moved a total of 29 steps on the career ladder. With each step, the employee receives and incremental pay raise along with an additional list of requirements/responsibility that must be maintained. Involvement and completion of tasks must be demonstrated annually at performance review. Failure to comply with the requirements of the level on the ladder will result in re-assignment into one level below with a commensurate in pay. Since the implementation of the career ladder, the turnover rate of pharmacy technicians has decreased resulting in a higher rate of retention of highly skilled technicians. Based on the successes so far, the career ladder continues to expand in growth with countless opportunities for technicians throughout our pharmacy department as well as medical center wide.

Conclusion: Career ladder incentives have created an increase of retention with technicians at Beth Israel Deaconess Medical Center. With a 9% projected increase of need for pharmacy technicians by 2024, the responsibilities and requirements of pharmacy technicians will expand with growth. The progression & success of the career ladder has brought pharmacy technicians to another level within the department and throughout the medical center. With a comprehensive career ladder in place, BIDMC technicians can grow as the pharmacy technician career path thrives and grows throughout the country.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-005

Poster Title: Distribution and inventory management of high-cost medications at a large academic medical center

Primary Author: Robyn Pisacane, Yale-New Haven Hospital; **Email:** robyn.pisacane@ynhh.org

Additional Author (s):
Adrienne Donaldson
Marjorie Lazarre
Christine Hong
Molly Leber

Purpose: Yale-New Haven Hospital (YNHH) is a 1,541 bed dual-campus acute care hospital, specializing in more than one hundred medical specialties and subspecialties. The YNHH-York Street Campus is served by a pharmacy department situated two city blocks from the hospital's patient care units. As a result, the medication distribution model centers around two hundred forty-eight automated dispensing machines (ADMs) as the primary means of dispensing. The pharmaceutical inventory within the ADMs serves as a robust source for cost containment initiatives, from which, an opportunity to maximize the inventory turnover of high cost medications was identified.

Methods: The implementation of the medication redistribution process began by identifying medications to target using the following criteria; pharmacologic agents non-urgent or emergent in nature and a cost per dose of greater than fifteen dollars. Following the development of the targeted medication list, all ADMs carrying the medications were reviewed. The review of ADMs was intended to assess medication utilization. Medications demonstrating a high order volume per individual ADM signified that the operational effort to redistribute that inventory outweighed the proposed cost avoidance. These items were coded as "standard stock," which serves as a mechanism to exclude a medication at a particular location from redistribution.
After optimizing the ADM standard stock designation across the institution, the redistribution process was drafted into a standard operating procedure utilizing a resource-neutral, decentralized pharmacy technician workflow. The procedure for the redistribution process starts with a customized daily ADM report that detects the targeted medications without an active patient order. The report is reviewed by the pharmacy technicians and all medications

not pre-defined as standard stock are unloaded from the ADMs. The unloaded medications are subsequently restocked into the pharmacy's central inventory thereby preventing additional wholesaler purchases otherwise generated by the par-based replenishment system.
Financial monitoring of this initiative was observed post-implementation through ADM and wholesaler reporting systems.

Results: The high cost medication redistribution program was piloted with six targeted medications in October 2014. Based on a successful pilot, the program was expanded to include a total of forty-five targeted medications [$15 - $313 per dose] and fully implemented into daily operations in July 2015.
The dollars spent on the targeted medications was $1,822,385 for the twelve months preceding implementation. In the eleven months following implementation, the dollars spent decreased to $1,038,952, resulting in an annualized cost avoidance of $688,983 [38%]. The process also demonstrated an impressive 41% decrease in purchase volume, and an improved ADS inventory turnover ratio from 10.5 to 20.2 turns across the affected product lines.
In addition to the cost avoidance garnered by the new workflow, the favorable results were augmented by a decrease in price for three of the medications, related to the national release of generic equivalents.
Notably, this initiative was largely based on medications used to treat a highly acute and specialized patient population, in conjunction with an ADM medication distribution model. The targeted medications can be tailored to any institution's formulary and patient population. Applicability may vary at organizations with just-in-time delivery as the primary distribution model.

Conclusion: This initiative reduced the annual spend on targeted high cost medications by 38%. Additionally, a decrease in purchase volume and increase in inventory turnover due to the increased rotation and utilization of available inventory was realized. Expansion of the program across the Yale-New Haven Health System (YNHHS) delivery network is in progress. Hospitals with similar medication distribution models should consider the addition of a high cost medication redistribution program as a cost avoidance initiative.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-006

Poster Title: Pharmacy residency program director maternity leave impact on current residents

Primary Author: Lisa Richter, Sanford Medical Center Fargo; **Email:** lisa.richter@sanfordhealth.org

Additional Author (s):
Lisa Nagel

Purpose: According to the Department of Professional Employees 56% of pharmacists were women as of 2013. The ASHP Connect Women in Pharmacy Leadership group recently had a posting asking for tips about pharmacist maternity leave planning: before, during and after. With the growing number of pharmacy residency programs, maternity leave of directors during a residency program may be increasingly encountered by residents. The purpose of this study was to describe the steps taken prior to leave and examine the effects of a maternity leave by the residency program director (RPD) on current pharmacy residents.

Methods: Prior to a 12 week maternity leave the RPD used a monthly to-do list that was repeated yearly due to the cyclical nature of many of the tasks of an RPD. This list was the basis for meetings and scheduled items that needed to be addressed during the projected maternity leave. Using this list the RPD scheduled all presentations and meetings that would need to take place in her absence and appointed a contact person for the meeting if necessary. The RPD scheduled all quarterly evaluations for three weeks prior to the due date to allow one-on-one discussion of any items that needed to be addressed before or during leave with each resident. The RPD met with the interim director and detailed tasks that would need to be completed while she was gone. Additionally several items such as preceptor development meetings and coordinating a report back from a regional residency conference were delegated to specific residents. Following maternity leave an anonymous nine question Likert scale and one question free -text response SurveyMonkey survey was emailed to all four PGY1 residents (three traditional and one nontraditional).

Results: All four surveys were completed for a 100% response rate. Respondents all (4 of 4) strongly agreed or agreed they knew who to contact with questions while the RPD was gone, understood the expectations of them, knew their schedules for rotations and presentations, and if personal issues or issues with other residents arose felt they could handle it on their own

or with the help of another preceptor. Feeling supported by other staff while the RPD was gone resulted in a 75% strongly agree or agree response, however only 50% of residents surveyed felt if issues with preceptors arose they would be able to deal with them with another preceptor or on their own in the RPD's absence. All residents reported they strongly agreed or agreed that they could contact the RPD while on maternity leave if needed, however free-text comments indicated residents were unclear with what circumstances would be appropriate to contact the RPD.

Conclusion: The use of a monthly task list was very successful in planning ahead and allowing the residents to be clear about expectations during a maternity leave absence. It also allowed the RPD to delegate several tasks to the residents which was done successfully and will likely continue in the future even while not on leave. This survey highlighted the need for the RPD to have a more detailed plan in place if issues with preceptors arose. This survey also describes the need for the RPD to discuss examples of times it would and would not be appropriate for the residents to contact her. One limitation is this maternity leave took place from February to May and may not be applicable to residents earlier in their residency year.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-007

Poster Title: Implementation of dedicated pharmacy education and research managers in a large integrated health-system

Primary Author: Elizabeth Sebranek Evans, Intermountain Healthcare; **Email:** elizabeth.evans@imail.org

Additional Author (s):
Richard Ensign
Sabrina Cole

Purpose: While the role of a nurse educator is well defined, there are limited published data regarding the role of pharmacy educators in health systems. These systems have complex needs, with diverse practice sites, such as: hospitals, homecare, community, specialty, supply chain, and managed care settings. Educational areas with a need for consistency include onboarding, competencies, continuing professional development, college of pharmacy coordination, preceptor development, and research. This report outlines the process for implementing the role of a pharmacy education manager in a large integrated health system.

Methods: This health system has over 1000 employees in pharmacy services, with a similar number of pharmacists and technicians and about 70% practicing in acute care settings. During a restructuring of central pharmacy services, 1.5 pharmacist FTEs were approved for the role of central pharmacy education and research managers, with the positions starting in September 2014. The initial responsibility of these managers was to: standardize competency education and documentation; implement a system-wide professional development program utilizing ACPE when appropriate; coordinate learners from local colleges of pharmacy; and promote research among the pharmacy staff. Development of competencies focused on regulatory areas such as controlled substances management, compounding, pharmaceutical waste, and collaborative practice agreements. These were designed to integrate training and demonstration of competency through computer-based trainings, exams, case studies, and skills pass-offs. Professional development efforts included developing a system-wide program to meet the needs of diverse audiences, utilizing remote conference technology to make programming available anywhere in the system. During the first year, contract ACPE providers were used, and in 2016, the health system became an ACPE-accredited provider. Coordination of learners, including standardizing computer access and improved communication with local

colleges of pharmacy was also established. These positions also provide support for the health system's Institutional Review Boards (IRBs) as well as supporting residency and pharmacy research projects.

Results: During the initial 20 months of these positions, the following results were seen. For competency training, 5 computer-based trainings (CBTs) in regulatory areas and 7 CBTs to support collaborative practice agreements were developed. In addition, over 20 other educational projects were implemented to support various pharmacy services initiatives. Objectively, improvements were seen in audits of the controlled substances management process. During the first full year, a combination of previously planned local facility programs and system-developed programming was utilized, resulting in 106 unique ACPE-accredited activities that were broadcast system-wide. During that time, a detailed needs assessment was done to form the basis for programming in 2016. During the first 5 months of 2016, 46 unique ACPE activities were delivered, which included weekly system-wide broadcasts, a PGY1 resident CE series, management journal clubs, and one multidisciplinary conference on thrombosis. For these 46 activities, a total of 2850 certificates of credit (79% pharmacists, 21% technicians) were uploaded to CPE monitor, with approximately 410 unique pharmacist attendees and 150 unique technician attendees. The overall experience for these programs was rated as 4.2 (scale of 1-5), with 57% of attendees reporting that the activities would result in a change in practice.

Conclusion: After the approval and implementation of system-wide pharmacy education and research managers, significant progress was made to develop and implement standardized education for pharmacy staff. Over 30 educational initiatives were implemented, with several being modified for use by nursing. An initial focus on controlled substances management resulted in improved audit findings; however, the need for additional compounding education was identified. The professional development program was well attended with positive feedback. Ongoing efforts include plans for a compounding education summit in September 2016, improvement in technician-focused educational offerings, and a plan for standardization of the pharmacy onboarding process.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6--008

Poster Title: Maintaining formulary standardization across multiple technological systems in a multi-site healthcare network

Primary Author: Shannon Smallwood, Community Health Network; **Email:** ssmallwood@ecommunity.com

Additional Author (s):

Purpose: A network of community-based hospital, cancer center, surgery center, and infusion center sites recently implemented several technological systems that must align to coordinate safe use of medications from ordering through administration. The pharmacy committee responsible for formulary standardization needed to identify methods for coordinating formulary additions and changes across all systems and sites.

Methods: All electronic databases and systems interfacing with pharmacy services at each healthcare site were identified. These included but were not limited to: Epic electronic medical record, Cerner electronic medical record, Pyxis MedStation ES automated medication dispensing system, BD Alaris infusion pumps, Talyst AutoPharm Enterprise inventory software, DoseEdge Pharmacy Workflow Manager, and internal intranet database informational resources. All data fields that require entry or updating with the addition or change of a formulary medication were compiled and grouped by database or system. Predetermined wording and selectable options within each data field were established, where applicable. Additionally, standard days for regular monthly updates, and the staff members responsible for performing each action, were identified.

Results: Two dynamic checklists were created to 1) implement a new medication record or 2) update an existing medication record uniformly across the network. The checklists are completed by a team of clinical pharmacists and pharmacy administrators to determine the appropriate timing of a complete update.

Conclusion: New technologies continue to be implemented across the continuum of patient care. Standardized processes for synchronous updates to all systems are required to maintain safe and effective medication practices.

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-009

Poster Title: Establishing pharmacist workflow metrics to guide staffing patterns in an outpatient oncology pharmacy satellite

Primary Author: Andrew Szkiladz, Baystate Health; **Email:** andrew.szkiladz@baystatehealth.org

Additional Author (s):
Jonathan Angus
Mark Heelon
Erin Taylor

Purpose: Volumes at our outpatient oncology center have grown 94 percent since 2009 with a 40 percent increase in the last 2 years alone. Despite this growing volume, pharmacist staffing patterns have not been changed to meet the growing volume and demand. Pharmacy literature lacks national benchmarking data to support a "safe" oncology product preparation rate. We sought to measure the time it takes a pharmacist to safely review and prepare chemotherapy orders in an effort to establish an appropriate pharmacist staffing ratio for our outpatient oncology pharmacy satellite.

Methods: A prospective, observational study employing lean principles was conducted to evaluate the time necessary for a pharmacist to safely review and prepare a chemotherapy order. Takt time, which represents the required pace of production to meet demand, was established using current oncology volumes and current pharmacist staffing plans. Cycle time, which represents the observed time to complete a task, was established by observing and measuring the average overall time required to review and prepare chemotherapy orders of varying complexities. In order to calculate a full time employee (FTE) ratio, which determines the necessary number of FTEs needed to safely review and prepare chemotherapy orders and meet current workflow demands, cycle time was divided by takt time.

Results: Based on current pharmacist staffing patterns, our takt time is 16 minutes per patient. Under ideal conditions, pharmacists require 25.9 minutes per patient (cycle time). The calculated FTE ratio is 1.62, meaning that in order to appropriately meet the demand, we would need an additional 9.9 hours per day, or 49.6 hours per week, of pharmacist staffing time.

Conclusion: These calculations objectively demonstrate appropriate pharmacist staffing needs at our outpatient oncology pharmacy satellite and can be reproduced as needed. These observations can be repeated on an ad hoc basis as policies, procedures, and patient volumes change in order to develop new takt and cycle times, FTE ratios and adjust pharmacist staffing patterns as necessary.

Submission Category: Ambulatory Care

Session-Board Number: 6-010

Poster Title: Implementation of a new multidisciplinary clozapine clinic with finger capillary blood sampling capabilities

Primary Author: Jonathan Leung, Mayo Clinic, Rochester, MN; **Email:** leung.jonathan@mayo.edu

Additional Author (s):
Emily Johnson
Brian Palmer

Purpose: Clozapine is the medication of choice for treatment resistant schizophrenia. In addition to evidence demonstrating reduction of suicidality; clozapine has been shown to decrease mortality. However, evidence also suggests that clozapine is under-prescribed. Several clinician response survey studies have assessed the barriers to the successful initiation and continuation of clozapine treatment. These include blood monitoring, fear of adverse events, and unfamiliarity with clozapine. At Mayo Clinic, a multidisciplinary clozapine clinic was created to centralize laboratory and side-effect monitoring to enhance the care of patients receiving this medication as well to function as clinical support to providers for complex clozapine-related issues.

Methods: A psychiatrist, nurse practitioner, and pharmacist collaborated to develop a clozapine-specific clinic that aimed to enhance the care of patients prescribed this medication. Patients are referred to the clinic by other Mayo Clinic providers. One goal of the clinic was to eliminate the need for patients to make separate visits to a laboratory to provide the venous blood that is mandated by the Food and Drug Administration. This was accomplished by establishing the capability to draw a finger capillary blood sample at the clinic office that could be analyzed within 20 minutes by the Mayo Clinic Laboratory. Based on preference, patient can still request venous blood draws. Another goal of the clinic is to ensure the safety and tolerability of clozapine and in addition to assessing the absolute neutrophil count, the Glasgow Antipsychotic Side-effect Scale for Clozapine score is assessed at visits. This scale encompasses questions related to other significant side effects of clozapine including sialorrhea, hypotension, and gastrointestinal hypomotility. During an appointment the pharmacist is able to conduct a Medication Therapy Management visit and bill for services. The pharmacist is able to function within the clozapine clinic using a Collaborative Practice Agreement. The Collaborative Practice

Agreement allows the pharmacist to issue clozapine prescriptions as well as order pertinent related monitoring (e.g. complete blood count with differential, lipid panel, serum clozapine level, chest radiography, etc).

Results: The clozapine clinic in its infancy has had 2 patient referrals that were scheduled for reoccurring venous blood draws due to 1) patient preference and 2) the patient was already being issued other venous laboratory orders for management of a hematologic cancer. These patients significantly benefited from the availability of the clozapine clinic. The first patient had been recently discharged from the hospital and was unable to have psychiatry follow-up for 2 months which would have impacted her ability to continue clozapine. The second patient was undergoing chemotherapy for follicular non-Hodgkin's lymphoma. Her primary psychiatry provider was uncomfortable continuing clozapine in the setting of chemotherapy and follow-up with another provider was not available until several months later. In each case both these patients had been prescribed clozapine for many years and continuation was crucial continuing optimal mental health. Patients enrolled in the clozapine clinic did not required interventions for the management of clozapine-related side effects as assessed by the Glasgow Antipsychotic Side-effect Scale for Clozapine.

Conclusion: To date the clozapine clinic has been able to provide medication monitoring and follow-up for patients prescribed clozapine. In each situation because of limited psychiatric resources the clinic allowed for continuation of this life saving medication. With the referral of additional patients to the clozapine clinic, use of finger capillary blood sampling will be trialed. Following the continued success of the clinic we aim to evaluate clinical outcomes associated with implementation of the clinic.

Submission Category: Ambulatory Care

Session-Board Number: 6-011

Poster Title: Design and implementation of comprehensive, team-based care in a federally qualified health center to improve diabetes and depression outcomes

Primary Author: Brody Maack, North Dakota State University; **Email:** brody.maack@ndsu.edu

Additional Author (s):
Mykell Barnacle
Amy Werremeyer
Mark Strand
Sarah Schmidt

Purpose: Patients with diabetes commonly present with symptoms of depression. Depression can worsen glycemic control, complications, cost and quality of life. Primary care providers (PCPs) are often unable to address each medical condition during a clinical visit, resulting in inadequate comprehensive care. Team-based care has been shown to improve care of medically complex patients, including those with diabetes and depression. This project, designed to provide more intensive diabetes and depression management, implements a team-based care model utilizing a clinical pharmacist and a certified diabetes educator (CDE). The 9-item Patient Health Questionnaire (PHQ-9) is utilized more frequently to help guide depression management.

Methods: A prospective cohort study was designed and presented to staff at a federally qualified health center (FQHC). Electronic medical record (EMR) and quality indicator enhancements were proposed, and focused training sessions for clinical staff were developed. Institutional review board approval was obtained and the study was recently implemented with adult patients aged 45 to 75 with a type 2 diabetes diagnosis and a PHQ-9 score of at least 10 identified at a primary care visit. Upon patient identification, referral to the clinical pharmacist (CP) and CDE is placed by the PCP or nursing staff. Informed consent is obtained and patients are scheduled for initial visits with the CP, and subsequently the CDE, with ongoing follow up visits scheduled as needed while maintaining regular follow up with PCPs. PHQ-9 assessments are repeated at every encounter if not done in the previous month. The CP employs a collaborative drug therapy management protocol for treatment of several chronic diseases. Recommendations regarding antidepressants are provided by the CP to the PCP. The CDE provides diabetes education with focus on lifestyle and dietary factors. Clinical data are

extracted from the EMR at baseline and after 12 months. Patient Activation Measure (PAM) survey is administered at baseline, 6 months and 12 months. Pharmacist intervention-specific data are also collected throughout the study, which will continue until 50 patients are enrolled.

Results: Support and feedback was received from all FQHC staff, including commitment from information technology staff for ongoing data and quality assessment. Training of clinical staff was designed to sustain the study protocol beyond the study period, and was received favorably with no objection to added workload induced by the study protocol. Transition of participants from identification to referral and scheduling has been challenging, with ongoing Plan-Do-Study-Act method used to improve study protocol adherence. After 3 months, 12 patients have been referred, and five of those enrolled in the program. Preliminary results from baseline mean data have been collected, and show glycated hemoglobin of 7.9 percent and PHQ-9 score of 12.8. At the initial visit, the pharmacist identified a mean of 3.75 medication list errors upon reconciliation, and a mean of 2.5 drug therapy problems. A total of 7 recommendations were made by the pharmacist at the initial visit, all of which were accepted by the primary provider.

Conclusion: This hypothesis generating, single-site study has been successfully implemented, and will add to the existing literature of team-based primary care while exploring the novel component of frequent PHQ-9 assessment to provide focus and guidance for treatment of depression in patients with diabetes. Preliminary data show five patients enrolled with high medication complexity and strong provider support as evident by pharmacist recommendations and subsequent acceptance. Completion of this study will describe the feasibility and outcomes of implementing a team-based care model with meaningful use of the PHQ-9.

Submission Category: Ambulatory Care

Session-Board Number: 6-012

Poster Title: Adherence, quality of life and patient satisfaction with dalfampridine in clinical practice

Primary Author: María Belén Marzal-Alfaro, Hospital General Universitario Gregorio Marañon; **Email:** belen.marzal@salud.madrid.org

Additional Author (s):
María Luisa Martin Barbero
Ana de Lorenzo-Pinto
Ana Herranz-Alonso
María Sanjurjo-Saez

Purpose: Mobility impairment is a major concern for patients with multiple sclerosis (MS). Dalfampridine improves walking speed. Nevertheless, it entails self-administration and there is little data on adherence rate, patient satisfaction and quality of life (QOL) in clinical practice. The objective of our study was to assess adherence, QOL and degree of patient satisfaction with dalfampridine in patients treated in our hospital.

Methods: We included MS patients on dalfampridine treatment for at least 6 months from May 2014 to March 2015. Clinical data was collected from the patient's charts: demographic information, duration and type of MS, Expanded Disability Status Scale (EDSS).
On the pharmaceutical care office, adherence was measured by Morisky-Green questionnaire, patient satisfaction with a visual analogue scale (VAS) and patients QOL with the improvement in the following items: mobility, self-care, daily activities, pain/discomfort or anxiety/depression.
The Institutional review board approved this study and patients signed an informed consent.

Results: 30 patients (46.7% female, mean age 39 years, mean duration of MS 13.7 years, mean EDSS 5.8) were included. Regarding the type of MS: 17 patients (57%) had relapsing-remitting MS, 9 (30%) secondary-progressive MS, 3 (10%) primary-progressive MS and 1 (3.3%) progressive-relapsing MS. Twenty-four patients (80%) needed walking aids before treatment initiation. According to Morisky-Green test, 21 (70%) patients were adherent to treatment. Regarding the motives of non-adherence, 7 (23.3%) patients had sometimes forgotten to take the drug, 1 (3.3%) patient did not administer the drug at the scheduled hours and did not

respect the fasting period, and 2 (6.7%) patients decided not to take the drug because of side-effects.
Median of general satisfaction VAS was 8 (IQR: 7-9). Patients reported an improvement in mobility (70%), anxiety/depression (33.3%), self-care (23.3%), daily activities (23.3%) and pain/discomfort (3.3%). 20% of patients reported that dalfampridine improved their fatigue.

Conclusion: Other studies have reported high level of adherence (97.5%) whereas in our experience it was suboptimal. It should be reinforced by hospital pharmacist in the follow-up. Patients reported high patient satisfaction and improvement in different scales of QOL.

Submission Category: Ambulatory Care

Session-Board Number: 6-013

Poster Title: Impact of a pharmacist-run telemedicine clinic on medication adherence rates in the incarcerated hepatitis C population

Primary Author: Diana Mei, UIC COP Pharmacy Student; **Email:** dmei6@uic.edu

Additional Author (s):
Alisha Patel
Leo Pratt
Lillian Bellfi
Juliana Chan

Purpose: Viral hepatitis C (HCV) is the leading cause of chronic liver disease with over 170 million people infected worldwide, and an estimated 2.7-3.9 million infected in the United States. Reported rates of HCV in the U.S. incarcerated population are 10.1%-29.7%. Pegylated interferon (Peg-IFN) and ribavirin therapy is one of several HCV treatment options. The Centers for Disease Control and Prevention (CDC) report sustained virologic response (SVR) rates in the non-incarcerated population to be 50%-80% with higher rates in genotypes 2/3 patients and lower rates in genotype 1. The purpose of this study is to determine if a pharmacist run telemedicine clinic leads to similar SVR rates between patients receiving HCV treatment in the general population versus the Illinois' incarcerated population.

Methods: A retrospective review was conducted for all incarcerated patients at the Illinois Department of Corrections (IDOC) Hepatitis C Telemedicine Clinic. This study was approved by the Institutional Review Board (IRB) for IDOC patients treated with Peg-INF and ribavirin between 7/5/2010 – 6/10/2014. Patient adherence data and treatment outcomes were evaluated. IDOC patients treated for HCV were required to take their medications under close supervision of a nurse. Thus, the number of reduced or missed doses by patients was consistently documented in the medical records by the clinical pharmacist. Missed doses of ribavirin were defined as complete doses, typically ranging from 800-1400 mg, of medication missed unintentionally for reasons including: patient refusal, facility transfers, or lack of administration by a nurse. Reduced doses were defined as unintentional receipt of only partial quantities of ribavirin tablets (1 tablet of ribavirin is 200 mg) resulting in a subtherapeutic ribavirin dose. The initial ribavirin dose was 1200 mg unless otherwise adjusted due to baseline

hemoglobin or weight and treatment duration was determined using patient genotypes. The data was evaluated and descriptive analysis was conducted.

Results: There were 150 male patients (n=104 Caucasian, n=28 African American, n=16 Hispanic, n=1 Asian, n=1 Other) with an average age of 43.8 (SD=10.7 years) included in this study. The overall SVR rate was 65.3% (N=150). SVR rates were 37.7% (n=53) for genotype 1 and 80.4% (n=97) for genotypes 2 and/or 3, which is consistent with published literature. Furthermore, adherence to Peg-INF and ribavirin showed that 34 (22.7%) patients had at least one missed or reduced dose of ribavirin, 4 (2.7%) patients missed at least one dose of Peg-INF, and 4 (2.7%) patients missed/reduced at least one dose of both the ribavirin and Peg-INF (n=42). On average, the patients missed solely 1.1% (SD=1.3%, n=38) and 5.09% (SD=3.9%, n=8) of the theoretical total ribavirin and Peg-INF doses they should have received, respectively. Furthermore, a chi-square test indicated that there was no statistically significant difference in SVR rates between patients in this population who missed or received reduced doses of ribavirin and/or Peg-INF and patients who did not miss any doses of their HCV medications (57.1%, n=42; 67.6%, n=108; p=0.23).

Conclusion: In summary, the data shows that SVR rates in this incarcerated population are similar or superior to the SVR rates in the general population. Furthermore, there was no difference in SVR rates in patients who missed doses compared to patients that did not miss doses. This correlates with the notion that even for patients who missed doses, the proportion of doses they missed was very low and insignificant in determining their treatment outcomes. The high rates of medication adherence in the prison population is likely to be attributed to the nature of timely medication distribution in the incarcerated setting, the take-watch approach of nurses observing the patients ingesting medications, and the close monitoring and care provided by a telemedicine-based pharmacist. All these factors are valuable contributors to the high SVR rates seen in the incarcerated population.

Submission Category: Ambulatory Care

Session-Board Number: 6-014

Poster Title: Applying lean methodology to improve hepatitis C care within the Veterans Health Administration

Primary Author: Jenny Mullakary, MCPHS University - Boston; **Email:** jmull1@stu.mcphs.edu

Additional Author (s):
Ashley Smith
Whitney Rockefeller
William Lukesh

Purpose: There is a surge in patient demand and provider initiative to treat Veterans affected by Hepatitis C Viremia (HCV). However, the current system is not designed to meet the growing needs of HCV care. A three-day rapid process improvement event was conducted with HCV practitioners from six Veterans Affairs Medical Centers within the Veterans Integrated Service Network (VISN) 9. Lean methodology was applied throughout the improvement event to better understand the systematic gaps and to design a system to meet the demand of our nation's veterans affected by HCV.

Methods: Two lean practitioners, an industrial engineer and improvement specialist from the New England Veterans Engineering Resource Center, planned and facilitated the improvement event. One to two HCV practitioners from each medical center in VISN 9 participated in the improvement event including physicians, nurse practitioners, case managers, and pharmacists. A 9-box A3 problem solving method guided the planning and progression of the lean event evaluating the reason for improvement, current state, target state, gap analysis, solution approaches, rapid experiments, completion plan, confirmed state, and insights for each medical center. To prepare for the event, the current state process for each medical center's pre-treatment, treatment, and post-treatment of HCV were gathered and illustrated in flow maps. The HCV practitioners analyzed their current processes by identifying the steps that added value to the process and those steps that did not add value. The results of the analysis facilitated the practitioners to design their future state with only value-added steps.

Results: HCV practitioners from six Veterans Affairs Medical Centers within VISN 9 participated in the lean improvement event. The HCV practitioners had impactful discussions around strong practices and barriers to delivering care to veterans by analyzing their respective current state

processes. As they progressed through the 9-box A3, they designed their target state process of delivering HCV care, identified the gaps between the current state and target state, and then plausible solutions to reach their target state. Lastly, the HCV practitioners developed and designed measurable rapid experiments to test out their solutions within their medical centers.

Conclusion: Ultimately, the rapid process improvement event provided the HCV providers in VISN 9 a structured and systematic approach to apply lean methodology to better understand the gaps within their processes and to develop a system to meet the growing needs of Hepatitis C care to our nation's veterans.

Submission Category: Ambulatory Care

Session-Board Number: 6-015

Poster Title: Impact of an interprofessional diabetes specialty clinic for uninsured patients

Primary Author: Kathleen Packard, Creighton University; **Email:** kpackard@creighton.edu

Additional Author (s):
Kathleen Packard
Kathy Hoebelheinrich
Emily Mannschreck
Kris Saunders

Purpose: From 1980-2011, the number of diabetic patients in the US has more than tripled. Costs have risen from $174 to $245 billion from 2007-2012. Approximately 13,790 individuals in Lancaster County, Nebraska have diabetes and 15% are living in poverty.
Uninsured diabetic patients require high levels of care. Collaborative care may improve outcomes. An interprofessional diabetes clinic was integrated into the Clinic with a Heart infrastructure, in partnership with stakeholders. The clinic operates once monthly and serves uninsured patients with diabetes. It is staffed by a nurse practitioner, certified diabetes educator, pharmacist, public health nurse/referral coordinator, and ancillary support.

Methods: Data were collected on 45 patients seen between June 2014 and November 2015. Baseline demographics collected include medications, hemoglobin A1c (A1c), and blood pressure (BP). Establishment in a medical home and the first A1c and BP in the new medical home (3-6 months later) were captured. Likewise, the number of hospitalizations and ED visits was compared six months pre-and post-clinic intervention.
Student's paired t test was used to determine the change in A1c and BP while McNemar's test was used to compare the proportion of patients with controlled outcomes pre and post intervention. A p value less than 0.05 was considered statistically significant.

Results: In the 45 patients seen, the mean age was 50.0+11.3 years, 58% (26) were women, and 89% (40) had type II diabetes. All patients were provided a free glucometer, test strips and free medications. All were referred to a medical home. After 6 months, 75% (34) of patients established a medical home. A1c was reduced from 10.6+2.6 to 8.1+1.9 (p=0.002) and SBP was

reduced from 133.3+20.1 to 126.2+13.0 (p=0.047). The proportion of patients at goal BP increased from 61% to 83% (p=NS). For patients that established a medical home, the mean number of hospitalizations and ED visits combined trended towards a decrease in utilization (0.13+0.43 pre-intervention and 0.06+0.25 post-intervention, p=0.49).

Conclusion: A city-wide interprofessional diabetes clinic was effective in significantly reducing A1c, BP, and establishing a medical home for uninsured patients. Larger studies need to be conducted to confirm that this intervention reduces healthcare utilization and costs.

Submission Category: Ambulatory Care

Session-Board Number: 6-016

Poster Title: Management of adverse effects from pegylated interferon plus ribavirin in incarcerated patients infected with hepatitis C in a pharmacist-run telemedicine clinic

Primary Author: Alisha Patel, UIC; **Email:** alishap90@gmail.com

Additional Author (s):
Diana Mei
Leo Pratt
Lillian Bellfi
Juliana Chan

Purpose: Although newer hepatitis C virus (HCV) therapies have emerged, pegylated interferon (PegINF) and ribavirin are still commonly prescribed. PegINF and ribavirin are known to cause neutropenia and anemia, respectively, which may result in increased discontinuation and, consequently, lower sustained virologic response (SVR) rates. Clinicians at the Illinois Department of Corrections (IDOC) Hepatitis C Telemedicine Clinic have a more aggressive approach in treating side effects in hopes of increasing SVR rates. The purpose of this retrospective study is to determine if pharmacist-led aggressive management of PegINF-induced neutropenia and ribavirin-induced anemia in incarcerated patients leads to equivalent SVR rates as patients who do not experience the adverse drug effects.

Methods: Patients were included in this retrospective, Institutional Review Board (IRB) approved study if they were treated with PegIFN and ribavirin for HCV between 7/5/2010 and 6/10/2014. Clinicians at this telemedicine clinic initiated granulocyte colony-stimulating factor (GCSF) and erythropoietin-stimulating agent (ESA) when the absolute neutrophil count (ANC) was less than 0.5x10^9 L or hemoglobin (Hgb) was less than 10 g/dL, respectively, in place of treatment discontinuation. They may have also, subsequently, reduced the doses of PegINF or ribavirin in cases where adjunct therapy was insufficient in managing these side effects. Patients were categorized by therapeutic management for neutropenia and/or anemia versus no neutropenia or anemia. Therapeutic management of neutropenia was defined as patients given one or more doses of GCSF, filgrastim, and/or a PegINF dose reduction. Therapeutic management of anemia was defined as patients given one or more doses of ESA, darbepoetin, dose reduction of ribavirin, and/or held dose(s) of ribavirin. Descriptive data analysis was conducted and evaluated using a chi-square test.

Results: Twenty-eight out of the 150 patients received therapeutic management of neutropenia. The ANC at which therapeutic management of neutropenia was initiated was 0.50x10^9 L with a standard deviation (SD) of 0.16x10^9 L (n=28). Thirteen (46%) of these patients were genotype 1 and 15 (54%) were genotypes 2 and/or 3. Twenty-five out of the 150 patients received therapeutic management for anemia with an average Hgb of 9.43 g/dL (SD=0.32 g/dL, n=25) at initiation of ESA. Fourteen (56%) of these patients were genotype 1 and 11 (44%) were genotypes 2 and/or 3 . Ten of these patients required management of both neutropenia and anemia. The SVR rate for patients who were managed for neutropenia and/or anemia was 59.6% (n=52) compared to 68.4% (n=98) for patients who did not require management for neutropenia or anemia (p=0.28). A total of 7 patients discontinued HCV treatment prematurely (2 due to psychological issues, 2 due to self discontinuation by patient, 1 due to jaundice, 1 due to joint pain, 1 due to rash; N=150). No patients discontinued treatment due to complications of neutropenia or anemia.

Conclusion: Patients who experienced PegINF-induced neutropenia or ribavirin-induced anemia were properly managed by the clinical pharmacist as no patients discontinued treatment due to these particular adverse drug reactions. Patients who required management for neutropenia and/or anemia achieved similar SVR rates to patients who did not experience these adverse drug reactions in this study. Furthermore, the SVR rates achieved in this population were similar to or better than the the rates seen in the literature (54-56%). This supports the claim that pharmacist-led interventions play a crucial role in HCV treatment outcomes in the telemedicine setting and that incarcerated patients are treated as well as, or better than, the non-incarcerated patients documented in the literature. Furthermore, these findings indicate that aggressive management of neutropenia and anemia in HCV therapy may have benefits of use in other health care settings.

Submission Category: Ambulatory Care

Session-Board Number: 6-017

Poster Title: Impact of supporting pharmacists in the primary care network

Primary Author: Jarred Prudencio, University of Hawaii at Hilo - The Daniel K. Inouye College of Pharmacy; **Email:** jpjarred@gmail.com

Additional Author (s):
Stephanie Roberts
Stephanie Marin

Purpose: The UC Davis Health System (UCDHS) began offering clinical pharmacy services at seven clinics within its primary care network (PCN) in August 2014. The pilot program was implemented to target ambulatory patients with uncontrolled chronic conditions and medication management issues such as polypharmacy concerns, medication access issues, or poor disease state or medication understanding. This study will evaluate the impact of the pharmacist on chronic disease state outcomes, in comparison to standard care without a pharmacist.

Methods: Patients with diabetes that were seen by the PCN pharmacists from October 1st, 2014 to October 31st, 2015 were retrospectively evaluated. The primary endpoint was to assess a composite of therapeutic goal attainment in the areas of diabetes, hypertension, and dyslipidemia, prior to and following pharmacist intervention, and compare that to a matched usual care cohort without a supporting pharmacist. The impact of the pharmacist was assessed by evaluating if patients had achieved therapeutic goals, based on standard clinical practice guideline recommendations. The three clinical goals were set as followed: hemoglobin A1c ≤ 8%, blood pressure ≤ 140/90 mmHg, and prescription of a moderate- to high-intensity statin dose. Total goal attainment for defined glycemic, blood pressure, and lipid parameters were combined to represent a chronic disease state (CDS) bundle score. This CDS bundle entails a score from zero to three, representing how many disease states are controlled, with a higher number representing an improved level of disease state control. The number of medications utilized for each disease state will also be assessed.

Results: 40% of patients in the pharmacist group achieved all three clinical goals after intervention, compared to only 12% of patients in the standard care group. There were no significant differences in number of antihypertensive and anti-diabetic medications utilized

between groups. The pharmacist group had statistically significantly higher improvements in each of the three areas of A1c, blood pressure, and statin goal attainment.

Conclusion: The addition of a supporting pharmacist to standard care in primary care clinics has a positive impact on clinical outcomes of patients with diabetes in the areas of glycemic, blood pressure, and lipid control.

Submission Category: Ambulatory Care

Session-Board Number: 6-018

Poster Title: Pharmacological and nonpharmacological therapy among bariatric surgery patients

Primary Author: Jihan Safwan, Lebanese International University; **Email:** jihan.safwan@liu.edu.lb

Additional Author (s):
Faraj Saade
Marwan Akel
Michelle Cherfan
Katia Iskandar

Purpose: In the Lebanese community, the number of patients undergoing bariatric surgeries is increasing tremendously following the worldwide trend. The four most common types of surgeries are: adjustable gastric banding (AGB), sleeve gastrectomy (SG), roux-en-Y gastric bypass (RYGB), and bilio-pancreatic diversion (BPD). The objective of this study is to evaluate the pharmacological and nonpharmacological therapy among patients who have undergone a bariatric surgery.

Methods: This study was conducted in Lebanese community pharmacies for a period of 4 months from February 2013 till May 2013. A survey of thirty multiple choice questions was developed and validated. It required an average of fifteen minutes to be filled. The study was approved by the institutional review board of the university. Survey data was analyzed based on 300 responses after signing a written informed consent from the patients. Inclusion criteria were patients that have underwent any type of bariatric surgeries from 2000 till 2014 who were at least fifteen years old. The collected data incorporated detailed demographics, medical history, medication and supplements history, lifestyle and dietary habits. Data was analyzed using the Statistical Package for the Social Sciences.

Results: Among 300 participants, 65.7 percent were females and 66 percent were 21 to 39 years old. Beirut was the residence of 49.7 percent. The socioeconomic status was average for 57.7 percent. Smokers were 56 percent, and 14 percent drank alcohol. Pre-surgery, 69 percent didn't exercise and 63.7 percent adopted a high calorie diet. Post surgery, the percentages changed by only 10 percent to the better. Most surgeries (79 percent) were performed

between 2010 and 2014, with types including: AGB 15.3 percent, SG 57.7 percent, and RYGB 27 percent. Around 27 percent admitted losing 31 to 40 kg. Counseling was mainly performed by physicians (46.7 percent) and least by pharmacists (2 percent). Concerning pharmacological therapy, the disease and treatment were as follows: hypertension by beta blockers (4 percent), dyslipidemia by statins (7 percent), diabetes mellitus by metformin (7.7 percent), hypothyroidism by levothyroxine (1.3 percent), and anemia by iron (42.7 percent). The patients consumed calcium (27 percent), vitamin B12 (27 percent), vitamin B9 (13 percent), vitamin B complex (17.7 percent). For reflux, proton pump inhibitors were consumed by 42.3 percent and histamine 2 receptor blockers by 2.3 percent. Nonsteroidal anti-inflammatory drugs were used by 7.3 percent and oral contraceptives by 1.7 percent.

Conclusion: Medical management and follow up of patients who have undergone bariatric surgery is a challenge. Based on the questionnaire results, most patients needed counseling about the appropriate practices after surgeries, from lifestyle management to medications and nutrients adjustments. While very few specific recommendations on optimizing medication regimens exist for such individuals, some general guidelines have been formulated. Awareness campaigns about the use and misuse of the drugs after these surgeries are crucial, because many have special consideration after bariatric procedures. Moreover, healthcare providers need to be cognizant of the effect these procedures will have on our therapeutic prescribing practices.

Submission Category: Ambulatory Care

Session-Board Number: 6-019

Poster Title: Two-year retrospective review of outpatient clinical pharmacy interventions in patients with hypertension at an academic medical center

Primary Author: Maria Thurston, Mercer University College of Pharmacy; **Email:** thurston_mm@mercer.edu

Additional Author (s):
Caitlin Jenkins

Purpose: Current literature demonstrates that clinical pharmacist involvement in direct patient care and management of chronic conditions not only results in better patient outcomes, but also reduces healthcare costs by decreasing morbidity and adverse events. Based on this literature, it is postulated that pharmacist collaboration on a healthcare team will also improve patient outcomes by providing the necessary pharmacy interventions to achieve blood pressure (BP) control in ambulatory patients with hypertension. This study describes the pharmacy interventions performed within an academic outpatient internal medicine clinic and offers evidence of whether such interventions are effective in contributing to BP lowering.

Methods: This study was IRB approved. Patients were evaluated using a single-center, retrospective design. Eligible patients for the intervention group were those with a clinic visit between April 2013-March 2015, 18 years of age or older, with a past medical history of hypertension and/or uncontrolled BP as defined by either JNC 7 or JNC 8 and a baseline BP measure on record, naïve to clinical pharmacy interventions, and who received at least one pharmacist intervention for hypertension during the study period. Patients eligible for the control group were those as mentioned in the intervention group with no history of receiving a pharmacy intervention. Patients were excluded if they did not have a follow-up visit or were lacking a baseline or follow-up BP measurement. Demographics were extracted from the medical record: age, race, gender, weight, systolic blood pressure (SBP), diastolic blood pressure (DBP), smoking status, relevant comorbidities, number of overall medications, number and classes of antihypertensive medications, number of follow-up appointments attended, insurance status, and numbers and types of pharmacy interventions performed. Means and standard deviations and frequency distributions and percentages were calculated for the data. Between-group comparisons were made using Chi-square analysis and ANOVA or student t-test as appropriate.

Results: 201 patients were included in the intervention arm. They were approximately 55 (plus or minus 12.5) years, 87.6 percent African-American, and 58.7% female. Over one-third of patients were also diagnosed with diabetes and prescribed approximately 5 medications (2 for hypertension). Patients had average initial BP of 146/89 (plus or minus 23/15) mmHg. 37.8 percent were initially classified as having controlled BP. Patients received approximately 7 pharmacy interventions over 3 clinic visits with the most common interventions of the 18 different types performed being medication history (19 percent) and medication counseling (14 percent). The average BP at final follow-up was 145/87 (plus or minus 23/14) mmHg with 43.8% being classified as having controlled BP. The total number of patients in the intervention arm with controlled BP increased overall from 76 to 88 during the study period; this was statistically significant (p equals 0.0005). Additionally, there was a statistically significant difference between the average initial and final SBP (p equals 0.0018) as well as DBP (p less than 0.0001). The control group consisted of 314 patients with similar demographics. Control group patients experienced a 2.04/2.61 mmHg reduction in BP with 21.3 percent controlled initially and 42.4 controlled at final follow-up.

Conclusion: Although statistically significant BP reductions and improvement in BP control were noted in the pharmacy intervention arm, their clinical relevance is not compelling, especially when compared to the control group. However, the greater change in BP in the control group may be related to pharmacy interventions intentionally targeting patients with a more complex clinical status and at a higher risk for nonadherence, both of which may affect BP control. Finally, a shift in the focus of the types of pharmacy interventions most frequently performed may lead to more effective changes in BP in our patients.

Submission Category: Ambulatory Care

Session-Board Number: 6-021

Poster Title: Time in therapeutic range for a rural pharmacist-run anticoagulation clinic

Primary Author: Dominique Werge, Yuma Regional Medical Center; **Email:** dawerge@utexas.edu

Additional Author (s):
DeAnna Manarang
Jacob Schwarz
Michael Nguyen

Purpose: Oral anticoagulation therapy with warfarin is used in the prevention of cardioembolic events in atrial fibrillation (AF) and venous thromboembolism (VTE). Warfarin therapy requires the monitoring of a patient's international normalized ratio (INR) in order to reach and maintain a goal of 2.0–3.0 for both indications. The proportion of time that an INR is within therapeutic range is said to be the time in therapeutic range. Previous studies have demonstrated average time in therapeutic range in warfarin patients to be around 64 percent. This project was designed to determine the time in therapeutic range of a pharmacist-run anticoagulation clinic.

Methods: This study was a retrospective review of patient electronic medical records which were monitored at a pharmacist-run anticoagulation clinic within a six month period. Baseline demographics (age, gender, ethnicity, indication for warfarin therapy, INR goal range, number of concomitant medications and comorbid conditions, and CHADS-VASc scores) were obtained. Patients were evaluated if they met inclusion criteria (age of 18 years or older; diagnosis of AF, DVT, PE, or stroke; anticoagulated with warfarin during the study period; and exclusively received INR management at the YRMC pharmacist-run anticoagulation clinic). Patients were excluded from this evaluation if they met any of the exclusion criteria (other indications for warfarin therapy; INR goal ranges other than 2.0 – 3.0; hospitalized at any point during the study period; having less than two INR measurements during the study period). Point-of-care INR measurements were extracted for each subject to determine the time in therapeutic range for the anticoagulation clinic using the Rosendaal method. Other analyses conducted were time in therapeutic range by indication, time in therapeutic range by warfarin initiation period, and reasons for non-therapeutic INR values.

Results: The overall time in therapeutic range for the YRMC pharmacist-run anticoagulation clinic was 69.7 percent based on a total population of 201 patients. When looking at the time in therapeutic range solely by indication, the time in therapeutic range for AF and VTE were 67.9 percent and 78.1 percent, respectively. The time in therapeutic range based on inception period versus experienced period patient groups was 70.5 percent versus 69.6 percent. Taking into account patients' time in therapeutic range by indication and then further breaking down to inception period versus experienced period, the time in therapeutic range for AF was 68.3 percent versus 67.8 percent, respectively, while the patients in VTE group had a time in therapeutic range of 79 percent and 78 percent, respectively. Amongst all patients, the most common reason for both sub-therapeutic and supra-therapeutic INR values was dietary changes.

Conclusion: Patients with AF or VTE on warfarin being managed by a pharmacist-run anticoagulation clinic, had a time in therapeutic range of about 69.7 percent, which is similar to, if not better than the national average of 64-65 percent based on previous studies. Patients had a similar time in therapeutic range regardless of whether they were in the inception group versus the experienced group. With dietary changes being the most common cause of a sub/supra-therapeutic INR, emphasis may need to be placed on the standardization of patient education in order to potentially maintain patients within the therapeutic INR goal range.

Submission Category: Ambulatory Care

Session-Board Number: 6-022

Poster Title: Impact of clinical pharmacists' interventions on the management of mineral and bone disorder in chronic hemodialysis patients

Primary Author: Mohammad Zaitoun, Armed Forces Hospitals Southern Region; **Email:** mzaitoun84@gmail.com

Additional Author (s):
Sara Hazem
Khaled Al Al-Sheikh
Adel Abou Ali

Purpose: To evaluate the impact of clinical pharmacists' intervention on the management of mineral and bone disorder (MBD) in chronic hemodialysis patients regularly attending the dialysis unit of the Armed forces hospitals southern region (AFHSR), Khamis Mushait, Saudi Arabia.

Methods: A quasi-experimental nonrandomized, pre-post intervention study was conducted from February 2015 till February 2016. All the AFHSR chronic hemodialysis patients' monthly prescriptions were reviewed by two clinical pharmacists taking into consideration changes in patients' labs (Average number of patients reviewed per month = 296).
Blood levels of corrected calcium, Phosphorus and intact parathyroid hormone (PTH) were reviewed according to the latest edition of the KDIGO guidelines. The outcomes measured in the study were the treating physicians' acceptance of clinical pharmacists' recommendations, post-intervention improvement of relevant patients' labs and cost saving due to reductions in medications dosing or unnecessary medications discontinuation. The study protocol was reviewed and approved by the research and ethics committee of the AFHSR.

Results: During the study period, 86 interventions were recommended by clinical pharmacists, 75 interventions were accepted by physicians (87.2%). The most common interventions categories were medication discontinuation (42.7%), dose change (23.3%), added medication (15.5%) and administration route/time change (5.8%). Alfacalcidol was the most frequent drug

with clinical Pharmacy interventions (37.6% of cases) followed by Paricalcitol (18.2%), Calcium Carbonate (16.1%), Cinacalcet (15.1%) and Sevelamer (12.9 %).
The accepted interventions were associated with post-intervention improvement in patient labs in 93.4% of the cases. While the remaining cases showed no clinically significant changes in their labs with reduced medication costs. Dose reductions and medications discontinuation resulted in a total average saving cost of $4431 USD per month. The majority of the cost reduction was due to dose reductions or discontinuation of Cinacalcet (70.85%) and Paricalcitol (21.83%).
For the non-accepted interventions, 63.6% of the cases were associated with post-intervention improvement, 18.2% showed improvement with significantly higher cost (Paricalcitol instead of sub-maximal dose of Alfacalcidol) and 18.2% showed no improvement.

Conclusion: The study findings suggests clinical Pharmacists' interventions in the management of MBD in hemodialysis patients were associated with improved clinical and economic outcomes.

Submission Category: Automation/ Informatics

Session-Board Number: 6-023

Poster Title: Implementation of clinical decision support (CDS) within computerized prescriber order entry (CPOE) system guiding intravenous immunoglobulin (IVIG) orders and product selection at a large health system

Primary Author: Joseph Moss, University Hospitals Case Medical Center; **Email:** joseph.moss@uhhospitals.org

Additional Author (s):
Bridget Gegorski

Purpose: Develop enhanced workflow for prescribers and pharmacists in CPOE system for IVIG products utilizing patient screening questions and CDS. The CPOE system listed IVIG as a generic order without a brand name and had a default base volume of 0.1 milliliters. During the verification process, the pharmacist needed to contact the prescriber to clarify the IVIG brand product for the patient and to change the base volume to match the quantity of grams ordered based on concentration. CDS logic development was needed to aid the prescriber in selecting an IVIG product and to resolve the base volume for the pharmacist.

Methods: The clinical informatics pharmacist and the medication safety officer identified the need to enhance clinical workflow for IVIG products. Three clinical IVIG order sets were impacted in CPOE: immunology, non-oncology, and oncology. The first change was to develop CDS using a concentration field and the number of grams ordered to calculate the base volume. Secondly, new IVIG orders were made to support brand products. Lastly, new patient screening questions were added to each order set. The questions assessed if a patient was a new start, had risk factors, was intolerant to ten percent solution, and whether a patient was stable on a specific IVIG brand product. CDS was developed to use the prescriber responses to the screening questions on the updated order sets to select the appropriate IVIG product. If no specific IVIG product was selected, the CDS chose the preferred agent based on the health system's IVIG product contract.

Results: The revised order sets with CDS provided the guidance for prescribers to select the appropriate IVIG brand product. Oncology physicians requested the removal of one IVIG ten percent solution due to infusion reactions and subsequent chart audit. This request required a

language modification in the patient screening question; however, the CDS programming logic did not require a change.

Conclusion: IVIG brand product selection was achieved using CDS with patient screening questions. During order entry, patient screening questions guided the prescriber to select the appropriate IVIG brand product. Additionally, pharmacist workflow was enhanced using the CDS to calculate base solution volume and identification of the IVIG brand product.

Submission Category: Automation/ Informatics

Session-Board Number: 6-024

Poster Title: Royal Victoria Regional Health Centre pharmacy evaluation of plastic vials in a robotic intravenous admixture machine

Primary Author: Paul Moyer, Royal Victoria Regional Health Centre; **Email:** moyerp@rvh.on.ca

Additional Author (s):
Sean Hopkins
Dawn Hallyburton

Purpose: Physical characteristics of medications used in IV automation must be measured and trained for use in a production environment. Training includes measuring and entering the width, height, crimp width, etc. into the device's database. Plastic, flexible vials are intended for use with hazardous products due to their safer handling. However, robotic machinery may have difficulty grasping a flexible vial because the dimensions are variable. Vials may be rejected as their physical characteristics fall outside of parameters. This project was designed to assess the machinery's ability to handle the plastic vials with modified parameters accounting for the variability of the vials.

Methods: The physical characteristics of the plastic vials were measured and the vial properties were programmed into the automation software. The vial sizes range from 2 mL to 100 mL, however the 2 mL vials cannot be used in the machine so this study only looked at 5, 10, 20, 25 and 100 mL vials. The vials are used for cytarabine, doxorubicin, epirubicin, idarubicin or irinotecan; however for testing the vials were filled with sterile water for injection. Sample doses were calculated based on common regimens using these agents. The corresponding volumes were calculated and syringes were prepared from the various vials to ensure a meaningful range of doses were evaluated. Doses were programmed such that vials would be used, returned to the holding area and re-used to ensure repeated gripping by the machine. Vials were also refrigerated to simulate the effect of changing temperature on the plastic. Physical data was extracted from the automation machine's database which contains vial height, diameter, weight, etc as well as dose information and any rejection rationale. This data was then reviewed to determine whether or not the programmed physical dimensions allowed for proper use and handling of the plastic vials by the machine.

Results: The 100 mL vials had an average diameter of 45.7 mm and 14 of the 292 measurements failed for low diameter. The average height was 89.6 mm and 3 of 95 measurements failed for low height. The 25 mL vials averaged 30.5 mm in diameter and 55.2 mm in height. 5 of 370 measurements failed for low diameter, 10 of 130 measurements failed for low height and 1 failed for low label placement. The 20 mL vials averaged 29.8 mm in diameter and 50.3 mm high. None of these vials failed for any reason. The 10 mL vials had an average diameter of 25 mm and an average height of 47.3 mm. 1 of 152 measurements failed for low diameter while 9 of 54 failed for low height. Another vial failed for low weight. The 5 mL vials averaged 20.3 mm in diameter and 40.7 mm in height. 7 of 224 measurements failed for low diameter while 1 of 77 failed for low height. Of the 244 syringes prepared, 41 failed for low weight and 1 failed for high weight. The syringes that failed for weight were on average 14.23 percent different from the expected value.

Conclusion: The diameter and height at which 95 percent of the vials would pass were determined to establish settings for training the vials in the automation software. The diameters for the 100 mL, 25 mL, 20 mL, 10 mL and 5 mL vials were 43.94 mm, 29.9 mm, 29.335 mm, 29.5 mm and 19.733 mm respectively. The heights for the 100 mL, 25 mL, 20 mL, 10 mL and 5 mL vials were 88.98 mm, 54.63 mm, 49.895 mm, 46.836 mm and 40.18 mm respectively. These parameters should lead to fewer vial rejections and a smoother use of the plastic vials.

Submission Category: Automation/ Informatics

Session-Board Number: 6-025

Poster Title: Optimizing efficiency with automated dispensing cabinets (ADCs)

Primary Author: Gavin O'Brien, St. Peter's Hospital; **Email:** gavin.obrien@acphs.edu

Additional Author (s):
Brendan Kuchenbecker
Nicholas Nobles
Laura Caracci
Thomas Lombardi

Purpose: The purpose of this report is to describe a process, POP, developed and utilized at our organization to optimize medication delivery through the use of automated dispensing cabinets (ADC). The primary outcome of this process is to increase the percentage of doses removed from ADCs with an ultimate goal of removing all medications from ADCs. Secondary outcomes include reducing unload, refill and vend times and also improving ergonomics for technicians and nurses.

Methods: Our organization is a 442 bed acute care community hospital, utilizing 41 ADCs with auxiliary cabinets and towers, with approximately 2.5 million doses administered annually. The POP process involves three phases. Phase one involves dedicating a single compartment (drawer) of the ADC tower to patient specific medications with infrequent use. Par levels are set to allow refills approximately every 72 hours. Unloading occurs weekly and the ADC skips any medications with active orders. Phase two reorganizes the three remaining tower drawers. The top and bottom drawers are loaded with medications that are frequently dispensed. Using the tower, as opposed to cubies in the cabinet, allows maximal utilization of space and ability to load larger quantities of medications. At waist height, the final drawer contains IV's and larger medications, maximizing ergonomic principles. In phase three, controlled substances have been relocated to top drawers of the medstation to facilitate efficient inventories. The remaining drawers are loaded with medications based on usage patterns with the most frequently used medications near the top. Par levels are set to allow once weekly refills for non-patient specific medications. In order to evaluate the process from a nursing perspective, a satisfaction survey was developed.

Results: Phase one of POP was implemented on all patient care units starting March 2015. To date, phase two has been fully implemented on four patient care units. Phase three is in the process of being implemented. Since implementation, through May 2016, the percentage of medications removed from ADCs increased from 91.95 to as much as 95.5 percent. This has led to an estimated reduction of 240 medications per 24 hour cart fill. Units that have undergone phase 1 and 2 changes have decreased refill time by an average of 8 percent per cabinet per day (maximum of 30.8 percent). There was an estimated 15 minute reduction in unload time per unit per week. Nursing vend time decreased from 401 to 394 minutes per day. Nursing satisfaction survey results, on average, demonstrate recognition of this change in vend time.

Conclusion: Overall, the POP process was found to be effective in improving the percentage of medications removed from ADCs, as well as unload and refill times. This intervention has affected nurses by decreasing vend time. Nurses were generally satisfied with the POP process. An added benefit is this process reduces physical fatigue due to more convenient medication placement. Continual optimization is important to further improve medication delivery and safety. More research is needed to further optimize ADC use.

Submission Category: Automation/ Informatics

Session-Board Number: 6-026

Poster Title: Environmental contamination of 5-fluorouracil during mixing by the robot

Primary Author: Yoshiyuki Sano, National Cancer Center Hospital East; **Email:** yosano@east.ncc.go.jp

Additional Author (s):
Tomoko Morita
Yasuhiko Ichida
Shinichiro Saito
Masakazu Yamaguchi

Purpose: Antineoplastic drugs have often been shown to be mutagenic, teratogenic and carcinogenic, and these agents are often associated with environmental contamination and exposure of pharmacists during preparation. In recent years, awareness of healthcare workers to minimize occupational exposure to antineoplastic drugs has been emphasized, and consequently, robots have been developed to mix these hazardous drugs. However, there are only a few reports on environmental contamination during mixing by the robots.
We investigated the level of 5-fluorouracil (5-FU) contamination during mixing antineoplastic drugs by the robot and pharmacists.

Methods: Inside biosafety cabinet (BSC), 2 stainless steel plates (10 × 10 cm) were placed under the workspace where syringes were filled with 5-FU. These plates were collected at the end of the preparation, and 5-FU contamination on the plates was analyzed by a validated liquid chromatography coupled to tandem mass spectrometry method (LC-MS/MS). The robot (YASKAWA Electric Co. Ltd, Kitakyushu, Japan) had a pair of arms that allowed mixing of 5-FU in the BSC.

Results: We collected the plates placed under the robot for each day during five consecutive days, and we analyzed the plates individually used by 24 pharmacists from 12 hospitals. On average, 42 vials containing 5-FU per day were prepared by the robot, 12 vials were prepared by the pharmacists. 5-FU contamination level by the robot was less than limit of quantitation, and the pharmacists was 2153 ng/200 cm2 on average.

Conclusion: We herein demonstrate that environmental contamination by the robot was less than the pharmacists. The programming of precise syringe technique allows plungers to be held at the constant position, and consequently, stable negative pressure in the syringe. These features lead to reduction of environmental contamination during mixing of antineoplastic drugs. Currently, major challenges include the speed of the robot to mix the drugs, and the limited number of preparation the robot can perform. In future, we anticipate contribution of mixing robots to reduce occupational exposure of healthcare workers to antineoplastic drugs.

Submission Category: Automation/ Informatics

Session-Board Number: 6-027

Poster Title: Creation and implementation of an electronic pharmacy processing system for research medications

Primary Author: Margaret Stephan, Beth Israel Deaconess Medical Center; **Email:** mstephan@bidmc.harvard.edu

Additional Author (s):
David Mangan
Stephen Maynard
David Grosso
Lois Hurst

Purpose: Beth Israel Deaconess Medical Center is a 672 bed academic teaching hospital with renown clinical research programs. The Medical Center has a robust home-grown electronic provider order entry system, but clinical research medications are still largely paper-based. BIDMC has two Research Pharmacies which service approximately 350 clinical drug trials. A series of internal Research Pharmacy audits identified the lack of a fully integrated technology system for processing research medications and drove the creation of a high level solution design for Research Pharmacy systems & process integration spanning inpatient and outpatient non-oncology and oncology clinical trials.

Methods: A work team was organized to complete a resolution plan inclusive of the following: clear definition and agreement on project governance structure including executive sponsors and work teams, high-level solution design for Research Pharmacy systems and process integration, and immediate and long term resource requests. A resolution plan and timeline was developed which focused on pharmacy system functionality needed to support electronic processing of research medications, including reviewing medication profiles of research patients for safety, drug-drug interactions, contraindications or duplications, consistent and automated drug label management, display notifications in hospital systems indicating that a patient was receiving a research medication, and automating research medication inventory management. A formal project manager was assigned to lead the work and met weekly with members of the Pharmacy Department and Information Systems to design, program, build and test the core Research Pharmacy functionality. The project work was reported out on a monthly basis to a Steering Committee consisting of executive sponsors from Patient Care Services,

Information Systems, and Research and Academic Affairs. In addition, the medication reconciliation policy was updated to include research subjects so that drug interaction checking could interface with commercially available research medications. Numerous inservices and hospital-wide email announcements were conducted to disseminate the new electronic research functionality. This work spanned over the course of approximately 18 months.

Results: The Research Pharmacy integration project began in October, 2014 and was completed in June, 2016. Completed enhancements include the following: an upgraded, in-house pharmacy processing system for the intake of paper research medication orders, tools for drug/drug interaction checking for commercially available research medications, an enhanced system to create standardized research medication labels, research protocol tools to validate authorized prescribers and track informed consent for inpatient electronic research medication orders, a system display in the Emergency Department and WebOMR (On-line Medication Record) indicating that a patient received a research medication and displayed as part of the patient's comprehensive WebOMR medication list, the purchase/configuration/deployment of a new system to electronically manage research medication product inventory, a comprehensive electronic research pharmacy profile, as well as email notification to a Research Pharmacy mailing list when inpatients are enrolled in clinical drug trials. An extra 0.4 Pharmacist FTE and 1.0 Technician FTE was added to implement and maintain the pharmacy protocol/drug dictionary. The roll-out of the new electronic pharmacy processing system went live in two phases: from September - October, 2015 for the West Campus Research Pharmacy and from February - April, 2016 for the East Campus Research Pharmacy.

Conclusion: This work created a core system architecture to process all variations of medications related to research studies. Enhanced safety features include drug/drug interaction checking for commercially available research medications as well as a system display in the Emergency Department, Provider Order Entry, and the on-line medication record (WebOMR) indicating that a patient received a research medication. Now that this project work is complete, the next plan is to expand the electronic order entry of research medications to support both oncology and non-oncology in the inpatient and outpatient settings and have the orders interface with the newly created core pharmacy system architecture.

Submission Category: Automation/ Informatics

Session-Board Number: 6-029

Poster Title: Adaptation of a hybrid computer prescriber order entry (CPOE) system in an oncology centre of a multi-site tertiary care teaching hospital

Primary Author: Anjie Yang, University Health Network; **Email:** anjie.yang@uhn.ca

Additional Author (s):
Karen Ong
Wallace Lam
Celina Dara
Jin Huh

Purpose: In 2001, University Health Network (UHN) consisted of three hospitals: Toronto General Hospital (TGH) specializing in General Internal Medicine (GIM), cardiology and Multi-Organ Transplant (MOT); Toronto Western Hospital (TWH) specializing in neurology and orthopedic surgery; and Princess Margaret Hospital (PMH) specializing in oncology. CPOE was implemented at TGH and TWH but not at PMH due to system constraints regarding oncology; this caused workflow and patient safety challenges during information transfers between sites. Fifteen years later, UHN now comprises of five hospitals and strives to become a High Reliability Organization (HRO). As such CPOE implementation at PMH is revisited.

Methods: Adaptation of the current CPOE and electronic Medication Administration Record (eMAR) system interfaced to an independent pharmacy system and a shared medication database with other affiliated hospital sites is described. Medication related project scoping with regards to oncology prescribing and administration workflow in light of system limitations is discussed focusing particularly on chemotherapy protocols, Pre-printed Order Sets (PPOS) and medications with both oncology related and non-oncology related indications. Medication related processes and activities such as medication analysis, database building, quality assurance, functionality testing, and order design are highlighted. Impact on new downstream applications built since the original CPOE implementation in 2001 and collaboration with other sites are also addressed.

Results: In response to system constraints and unique oncology needs, a hybrid system with specific criteria for medications on paper vs. CPOE and eMAR is developed and tested, which in turn will interface with a pharmacy system automatically or manually. Challenges for

consideration include standardization of some longstanding practice differences between sites with specialized patient populations, updating organizational policies and procedures, reconciling inventory product discrepancies between sites, designing complex oncology product builds to withstand technical system limitations, and addressing previously existing system issues and workarounds. Opportunities include an improved, unified patient information system and updated, standardized policies and procedures, which allow for more seamless patient information transfer processes that in turn improve patient safety.

Conclusion: Converting a paper-based oncology hospital site to CPOE in order to align with existing CPOE hospital sites caring for different patient populations within one organization has its unique challenges and opportunities, not only in system design but also in many other aspects including clinical practice and operations. We hope our experience will serve as a valuable resource for any considering CPOE implementation within large complex centers under similar circumstances.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-030

Poster Title: Pharmacist-managed glycemic control after cardiothoracic surgery

Primary Author: Brad Hein, The Christ Hospital; **Email:** brad.hein@thechristhospital.com

Additional Author (s):
Tyler Dickerson

Purpose: Stress hyperglycemia after cardiothoracic surgery has been shown to prolong length of stay and increase readmissions secondary to sternal wound infections and other complications. The stress response typically begins during surgery, peaks within 6 hours and can last up to 72 hours. The Society of Thoracic Surgery has recommendations to maintain blood glucose levels less than 180 mg/dL for patients in the intensive care and step down units after cardiothoracic surgery. Since 2008, the institution has utilized a pharmacist-managed glycemic control program. The pharmacist transitions the patient from the intravenous insulin infusion to a subcutaneous insulin regimen and manages the patient until discharge. The purpose of this study was to evaluate the safety and effectiveness of the program.

Methods: This institutional review board-approved retrospective chart review evaluated patients who had cardiothoracic surgery and subsequent hyperglycemia managed by a pharmacist between July 1, 2014 and June 30, 2015. Patients were excluded if not initiated on an intravenous insulin infusion, emergent surgery was required after initial surgery or if endocrinology was involved in the glycemic management of the patient. Data was collected on: demographics, baseline diabetes status, blood glucose control, hospital length of stay, use of long-acting insulin and 30-day readmission for sternal wound infections. Blood glucose data was compared to data from similar populations who did not have pharmacist involvement in glycemic control (cardiovascular step-down and surgical intensive care unit) as well as the institution as a whole. A subgroup analysis of just patients with diabetes was performed. The primary outcome was blood glucose control in the target range, defined as 100-180 mg/dL, relative to comparator groups. Incidence of hypoglycemia (glucose less than 70 mg/dL) and significant hyperglycemia (glucose greater than 250 mg/dL) was also evaluated. Chi-square analysis was utilized to test for statistical significance.

Results: 413 patients met the inclusion criteria. The majority of patients were Caucasian (92.5 percent) males (68 percent). Approximately 30 percent of patients in the pharmacist-managed

cohort had diabetes, as compared to 25 percent in the comparator groups. The average hemoglobin A1C was 5.8 percent and average length of stay was 5.5 days. In the study group, 77 percent of blood glucose values were between 100-180 mg/dL, compared to 60 percent in surgical intensive care unit (SICU) (p value less than 0.01), 60 percent in the cardiovascular step down unit (CVSU) (p value less than 0.01) and 55 percent for the institution overall (p less than 0.01). Hypoglycemia rates were reduced in the pharmacist study group at 0.8 percent vs 1.3 percent in the SICU, 1.3 percent in the CVSU and 3.4 percent institution overall (p values less than 0.01 for all comparisons, respectively). Significant hyperglycemia was significantly reduced for all comparator groups. There was no difference in 30-day readmissions between the groups. For the diabetes subgroup, the pharmacist-managed cohort had more values in the goal range and fewer episodes of hyperglycemia versus all comparator groups (p value less than 0.01) with similar rates of hypoglycemia versus the CVSU and SICU.

Conclusion: The results of this study revealed that pharmacists can safely and effectively manage hyperglycemia in cardiothoracic surgery patients. The pharmacist cohort had more patients at goal, fewer patients with significant hyperglycemia and fewer patients with hypoglycemia when compared to a similar surgical population, a similar cardiovascular population and the hospital as a whole. Institutions should consider implementing a pharmacy-managed glucose control program in cardiovascular surgery patients if baseline analysis deems the population in need of tighter control.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-031

Poster Title: How clinical pharmacists improve outcomes in heart failure patients being treated with intravenous (IV) loop diuretic therapy

Primary Author: Ashley Hinton, Sentara Obici Hospital, Sentara Health System; **Email:** ajallmon@sentara.com

Additional Author (s):
Kathleen Duke

Purpose: The efficacy of diuretics in improving symptoms of heart failure (HF) such as dyspnea and edema has long been documented. In a wide range of studies, adverse effects of diuretics on clinical outcomes in HF patients show a direct correlation with diuretic dose. Electrolyte abnormalities, renal dysfunction, hospital length of stay, and overall mortality are among the problems encountered. Based upon information from the Heart Failure Society of America, a HF multidisciplinary team suggested Clinical Pharmacists order and monitor labs as well as weights in these patients.

Methods: A protocol was approved by the Medical Staff allowing clinical pharmacists to order a daily basic metabolic panel (BMP) and weights for three days in patients receiving IV loop diuretics that have a diagnosis of HF. Clinical Pharmacists were educated through in-services and one-on-one sessions to review the charts of HF patients prescribed an IV loop diuretic for daily BMP and weight orders. Protocol allows ordering of daily BMP and weights when not previously ordered. Patients were identified on the computerized consult list. Clinical Pharmacists would monitor lab values and weights for trends and contact physicians with any findings they consider significant via text page, face-to-face conversations, or during multidisclipinary rounds. Implementation began with a pilot program on the Telemetry Unit and quickly followed with hospital wide execution a month later.

Results: Compared to 2015, the hospital's average length of stay (LOS) for HF patients decreased from 4.38 days to 4.19 days, a 13 percent decrease. The LOS Ratio (Actual LOS/Expected LOS) decreased from 0.98 to 0.90. Prior to implementation, 64 percent of telemetry HF patients on IV loop diuretics had daily BMPs ordered and 100 percent had daily weights accessible in the computer. It was discovered that all patients on this unit had daily

weights documented by a nursing champion, regardless of orders. Since implementation, 100 percent of HF patients on IV loop diuretics have daily BMPs and weights ordered.

Conclusion: Clinical Pharmacists have acclimated to the additional work load. Their additional efforts have resulted in a variety of interventions related to elevated creatinine and electrolyte abnormalities. Anecdotal observations are trending towards a reduction of adverse drug events. The Medical Staff has been receptive, supportive, and appreciates to the new program. A future goal of this program is for Clinical Pharmacists to order serum magnesium levels and automatically enroll qualifying patients in the nursing driven electrolyte replacement protocols. We believe our hospital's innovative and collaborative approach to monitoring heart failure patients has improved patient outcomes

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-032

Poster Title: Assessment of an intravenous chlorothiazide restriction protocol on prescribing practices and outcomes in acute decompensated heart failure

Primary Author: Alexander Kantorovich, Chicago State University College of Pharmacy/Advocate Christ Medical Center; **Email:** akantoro@csu.edu

Additional Author (s):
Michaela Smith
Brittni Botchway-Bradley
George Gavrilos
Rolla Sweis

Purpose: Heart failure (HF) is a common syndrome of structural or functional impairments which leads to the inability of the heart to meet the metabolic demands of the body. Diuretic therapy is recommended in most HF patients with clinical evidence of fluid retention, however, diuretic resistance is common in this patient population. Therefore, the addition of thiazide-type diuretics is warranted to combat these occurrences and overcome renal adaptations. The aim of this study is to compare the effectiveness of oral metolazone versus IV chlorothiazide in critically ill HF patients after institution of a restriction protocol.

Methods: The institutional review board approved this single-center, retrospective, historical control cohort study in patients hospitalized with acute decompensated heart failure after implementation of a chlorothiazide restriction protocol created by the primary author with input from multiple physician specialists. Patients in the historical control group all received IV chlorothiazide and the post-protocol group could have received either IV chlorothiazide or metolazone per the protocol. The primary efficacy endpoints in the study were the attainment of at least 600 mL of urine output (UOP) in 6 hours and 3000 mL in 24 hours after thiazide dose administration. The primary safety endpoint was worsening renal function defined as an increase in serum creatinine greater than 0.5mg/dL from the patient's baseline within 48 hours from the day of thiazide administration. Other secondary safety endpoints included worsening electrolyte imbalances such as hypokalemia, hypomagnesemia and hyponatremia. Two pair-wise comparisons for the historical group versus the metolazone-only group and the historical group versus the post-protocol group were performed, respectively, thus an alpha of less than 0.025 was deemed significant. The two treatment group differences for the normally

distributed continuous variables were compared using the Student's t test. Non-normally continuously distributed variables utilized the Mann-Whitney U test. Chi-squared and Fisher's exact test compared the categorical variables, as appropriate.

Results: 78 patients were included in the study, 45 patients in the historical control group and 33 patients in the post-protocol group. Within the post-protocol group 12 patients were administered metolazone. The cohorts were fairly well matched, but poorer health status was evident in the post-protocol group demonstrated by a lower mean ejection fraction and higher home furosemide doses. No difference was noted between groups in reaching 6 hour UOP goals (77.8 percent vs. 96.2 percent, P equals 0.03). A significant increase was seen post-protocol implementation in UOP greater than 3000 mL in 24 hours after thiazide administration (62.2 percent vs 92.3 percent, P equals 0.006). The rates of hypokalemia (8.9 percent vs 36.6 percent, P equals 0.004) and hypotension (6.7 percent vs 42.2 percent, P equals 0.0002) were significantly increased in the post-protocol group. There was significantly higher rates of renal replacement in the control group likely due to inefficient diuresis with IV chlorothiazide. Median ICU length of stay was prolonged in the post-protocol cohort compared to the control group. Financially, there was a 75 percent reduction in IV chlorothiazide pharmacy spend 3 months post-protocol implementation compared to 3 months pre-protocol implementation which has continued for the past 12 months.

Conclusion: A Statistical difference was seen in 24 hour UOP goal attainment post-protocol implementation compared to historical control. No differences were noted in UOP achievement at 6 hours and 24 hours between the metolazone and historical control group. The restriction protocol was deemed safe and effective along with being cost beneficial based on financial analysis. Future support of large, randomized-controlled prospective trials examining this comparison would provide a wide array of information yielding more observations along with other additional clinical outcomes

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-033

Poster Title: Impact of direct oral anticoagulants on anti-factor Xa levels utilized for monitoring heparin: an unanticipated drug-laboratory interaction

Primary Author: Kelly Macedo, St. Luke's Hospital; **Email:** macedoka@southcoast.org

Additional Author (s):
Peter Tatarian
Kenneth Eugenio

Purpose: Due to an increased use of direct oral anticoagulants (DOACs) and a conversion to anti-factor Xa (AXA) levels to monitor parenteral heparin therapy, our institution has begun to notice unintentional drug-laboratory interactions between DOACs and AXA levels. While DOACs are typically regarded as “unmonitored” medications, the AXA laboratory assay is a potentially sensitive indicator, though no exact correlation to specific levels is known. Given that determination of the presence or absence of residual DOAC may be necessary prior to transition to parenteral heparin, this retrospective review was undertaken to assess the impact of apixaban, rivaroxaban, and edoxaban on AXA levels.

Methods: An institutional review board waiver was obtained for completion of this retrospective review. While commercially available DOACs include both factor-Xa inhibitors (apixaban, rivaroxaban, and edoxaban) and direct thrombin inhibitors (dabigatran), only factor-Xa inhibitors influence AXA. Due to this, patients with one or more documented laboratory AXAs between 10/1/2015 to 6/1/2016 that received apixaban, rivaroxaban, or edoxaban immediately prior to admission or during their inpatient stay were selected for pharmacist review. Selected charts were then assessed for temporal relationship between last administered dose of DOAC and timing of AXA draw. If the timing suggested a potential effect from DOAC on AXA, the patient was considered to have met study inclusion criteria. Confounding factors potentially expected to influence AXA or DOAC levels were noted. These included recent prior administration of unfractionated heparin (UFH) or low molecular weight heparin (LMWH) products, development of acute renal failure, concomitant use of interacting drugs, or suspected outpatient nonadherence with DOAC therapy. Anticoagulant regimens were also reviewed for dose appropriateness based on indication and patient specific variables including age, weight, and renal function. Total time elapsed and number of AXA draws required until AXA reached desired therapeutic range was also recorded.

Results: Fifty patients met inclusion criteria with baseline demographics evenly distributed by gender (52 percent male versus 48 percent female) and with an average age of 70 years (range 39-95). Sixty percent of selected patients were on rivaroxaban, 40 percent apixaban and 0 percent edoxaban. In patients (n=7) who had an AXA drawn less than 12 hours after last dose of apixaban (i.e., within dosing interval) and not exposed to alternate anticoagulation, 71 percent had an initial AXA greater than 1 international units/milliliter, while 29 percent had AXAs below suggested published "trough" levels (i.e., 0.7-1.1). For AXAs drawn within the dosing window of rivaroxaban (n=11), without concurrent parenteral anticoagulation, 55 percent had an initial AXA greater than 1 while 36 percent had AXAs below expected "trough" values (0.6-1). In patients (n=29) who were initiated on heparin prior to AXA monitoring, recent administration of apixaban or rivaroxaban resulted in supratherapeutic initial AXAs for our institution's adjustment protocol (goal AXA 0.3-0.7) 69 percent of the time. A maximum of eight AXA draws were necessary before AXA fell within therapeutic range in patients previously on apixaban (average of 2.5 draws per patient) whereas up to five draws (average of 1.5) were noted post rivaroxaban.

Conclusion: Our findings indicate that laboratory AXAs are influenced by recent administration of DOACs, even at time points considerably beyond recommended dosing intervals. Accordingly, AXA levels have limited utility as a heparin monitoring parameter for patients recently treated with DOACs. Staff education about this phenomenon is essential. Consideration should be given to delay heparin therapy until AXA levels are appropriate; sequential monitoring of AXAs may be necessary. Hospitals utilizing AXA levels to monitor heparin therapy must plan for this DOAC induced drug-laboratory interaction and give further thought to alternative methods of UFH monitoring or use of subcutaneous LMWH in these patients.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-034

Poster Title: Dosing heparin utilizing adjusted body weight in obese patients for the treatment of venous thromboembolism

Primary Author: Derek Nadeau, Comprehensive Pharmacy Services; **Email:** nadeaude@cmhc.org

Additional Author (s):
Sarah Green
Emily Dornblaser

Purpose: There is limited data on dosing in regards to utilizing unfractionated heparin (UFH) infusion therapy in venous thromboembolism in obesity. For the treatment of deep vein thrombosis (DVT) and pulmonary embolism (PE), UFH is often administered using a weight-based dosing strategy. Concerns for bleeding in obese patients have raised the question of whether dose adjustments or dose capping is necessary. The purpose of this study was to determine if using an adjusted body weight for dosing UFH in obese patients avoids supra-therapeutic activated partial thromboplastin times (aPTTs) and thereby avoiding potential bleeding events.

Methods: Data were retrospectively collected from January 1, 2014 through December 31, 2015, via pharmacy-maintained paper charts. Patients with orders for heparin according to hospital protocol and a body mass index (BMI) greater than 30 were included in the evaluation. The following information was collected on all patients: age, actual body weight, ideal body weight (IBW), adjusted body weight (ABW) when applicable, body mass index (BMI), obesity class, heparin dose adjustments, indication for the use of heparin, the initial infusion dose of heparin in units per hour and units/kilogram (kg)/hour, the duration of heparin therapy, the baseline aPTT, first aPTT after heparinarization, time to first therapeutic aPTT, number supra-therapeutic aPTT's, number of sub-therapeutic aPTT's in the first 24 hours, and the total number of aPTT's within the therapeutic window.

Results: A total of 57 patients were enrolled (38 patients in the dose-adjusted group and 19 in the non-adjusted group). The dose-adjusted group's mean time to first therapeutic aPTT was 12 hours versus 16 hours in the non-adjusted group (p=0.05). The mean number of supra-

therapeutic aPTTs within the first 24 hours in the dose-adjusted group was 0.72 versus 1.4 in the non-adjusted group (p=0.01). The percent of time within the therapeutic window for the dose-adjusted group was 63 percent versus 48 in the non-adjusted group (p=0.07). The number of first aPTTs within range in the dose-adjusted group was 18 versus 4 in the non-adjusted group (p=0.09). The total mean number of supra-therapeutic aPTTs was 1.74 in the dose-adjusted group versus 2.07 in the non-adjusted group (p=0.33). There was a10 percent incidence of sub-therapeutic aPTTs in the dose-adjusted group versus a 12 in the non-adjusted group (p=0.29). Relative risk was calculated at 0.62 with 95 percent confidence interval (CI) (0.43-0.90), as defined by avoidance of supra-therapeutic aPTTs, thus suggesting a protective value to using ABW to dose heparin in obese patients. An odds ratio was calculated at 0.20 with 95 percent CI (0.05-0.84) (p=0.02), further suggesting a protective role to using ABW.

Conclusion: Dose adjusting heparin infusions for the treatment of PE or DVT in obese individuals leads to more time within the therapeutic window, and avoids supra-therapeutic aPTTs without a higher incidence of sub-therapeutic aPTTs. These results suggest that it is prudent to dose adjust heparin infusions in obese patients when treating PE or DVT.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-035

Poster Title: Impact of health literacy level on time in therapeutic range in patients on chronic anticoagulation managed through a telephone-based service

Primary Author: Anne Ottney, Ferris State University/Sparrow/Michigan State University Family Medicine Residency Clinic; **Email:** anneottney@ferris.edu

Additional Author (s):
Emma Holmi

Purpose: Health literacy, or the degree to which an individual is able to obtain, process, and understand basic health information, is an important aspect of medication management. The importance of health literacy is highlighted in patients taking warfarin therapy. Although literature exists regarding how literacy level affects time in therapeutic range (TTR) for patients on warfarin being managed through face-to-face encounters, limited evidence is available for patient populations that are managed primarily through telephone-based services. The purpose of this project was to determine how patient health literacy level affects TTR for patients on chronic warfarin therapy managed through a telephone-based service.

Methods: Patients were recruited at two family medicine clinics using an anticoagulation registry between January 2016 and March 2016. English speaking patients who were at least 18 years of age and had been on warfarin for at least 6 months were included in the study. Patients who were mentally disabled or had home laboratory draws were excluded from the study. Upon enrollment, patients were scheduled to meet with a pharmacist, pharmacy resident, or pharmacy student. A 15 dollar gift card was offered as an incentive to attend the visit. After a medication review, participants were asked to complete a demographic survey, followed by four validated warfarin numeracy questions. Health literacy level was assessed using the Rapid Estimate of Adult Literacy in Medicine-Short Form (REALM-SF). Individuals with a score of 0 to 6 were categorized as having limited literacy, while individuals with a score of 7 were considered to have adequate literacy. TTR was calculated using the Rosendaal method. Based on available literature, a TTR greater than or equal to 65 percent was considered to be adequate anticoagulation control and less than 65 percent as poor control. Statistical analysis was completed using SPSS version 20.

Results: A total of 25 patients were enrolled in the study. Mean patient age was 69 years and 92 percent of participants were Caucasian. All participants had at least a high school diploma or GED. Most patients (72 percent) reported having two or more tablet strengths of warfarin at home. The majority of participants (68 percent) were identified as having adequate health literacy. The median warfarin numeracy test score was 3.5 in the adequate literacy group and 4 in the limited literacy group (p equals 0.67). The most commonly missed question in both groups asked about calculating tablet quantity.
Overall, 50 percent of those in the limited literacy group had adequate anticoagulation control compared to 53 percent in the adequate literacy group. Linear regression indicated that there was not a significant association between health literacy level and time in TTR (r square equals 0.001; p equals 0.89).

Conclusion: Although this study did not show a correlation between health literacy level and time in therapeutic range in a population of anticoagulation patients managed through a telephone-based service, approximately one third of patients included were identified as having limited literacy, highlighting the importance of using universal precautions when communicating with patients on warfarin therapy.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-036

Poster Title: Evaluation of a comprehensive pharmacist education consult service for patients on oral anticoagulants

Primary Author: Frank Rigelsky, Cleveland Clinic Hillcrest Hospital; **Email:** frigelsk@ccf.org

Additional Author (s):

Purpose: Pharmacists providing warfarin education to patients can be considered a standard practice. With the development of the direct oral anticoagulants (DOAC), pharmacists can also be the leaders in providing patient education for these therapies. The purpose of this study was to describe a process for a comprehensive pharmacist oral anticoagulant education consult service and review the impact on warfarin and direct oral anticoagulants education trends in a 500 bed hospital.

Methods: In October of 2013, Hillcrest Hospital started a pharmacist warfarin education consult service that was used at other system facilities to meet compliance with Patient Safety Indicator VTE-5 measure. Leaders of the hospital and the department of pharmacy decided to provide education for all patients on warfarin, regardless of indication or whether it was new or continuation of therapy. However, this Patient Safety Indicator and education consult service was limited specifically to warfarin patient education. As the use and indications of DOACs began to increase, the need to expand this consult service became apparent. An oral anticoagulant education consult service was implemented in May 2015. All providers receive a Best Practice Alert (BPA) for a pharmacist education consult upon entering the first order for that admission for either warfarin or DOAC. Pharmacists received the consults and then completed the education process. This study reviewed the impact in the number of DOAC and warfarin patient educations that had been completed by a pharmacist.

Results: From October 2013 to May 2015, pharmacists completed 4,541 patient warfarin educations. In 2014, 1,920 warfarin educations were completed for an average of 162 per month (range: 137 to 178). In 2015, warfarin education decreased to 1600 patients and an average 133 per month (range: 119 to 154). For 2016 year-to-date, the monthly average has decreased to 103 per month (range 89 to 119) for a projection of 1230 patients for the year. Since the start of the new process, pharmacists completed 984 DOAC patient education from June 2015 to May 2016 for an average of 82 per month (range: 51 to 103). During this same

time period, the number of warfarin educations continued to decrease with 1418 patients for an average of 119 per month (range: 89 to 138).

Conclusion: The results of this study demonstrated the decline in the use of warfarin by the number of completed pharmacist patient educations corresponding with the rise in pharmacist DOAC patient educations. Implementing a comprehensive pharmacist anticoagulation consult service has been able to provide education to an additional patient population. Consideration for expanding the pharmacist patient education consult for DOACs to other facilities in the health system is in process.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-037

Poster Title: Assessing the appropriateness of venous thromboembolism (VTE) prophylaxis in the internal medicine and cardiology services in a Lebanese hospital

Primary Author: Marwan Sheikh-Taha, Lebanese American University; **Email:** marwantaha@yahoo.com

Additional Author (s):
RIm Moukhadder
Narik Zadikian

Purpose: Most hospitalized patients have at least one risk factor for venous thromboembolism (VTE).
The decision to initiate VTE prophylaxis with heparin or a related drug depends on the patient's individual risk of thromboembolism and bleeding. The purpose of our study was to assess the appropriateness of VTE prophylaxis in hospitalized patients.

Methods: A prospective chart review was conducted at the Sacred Heart Hospital, Beirut, Lebanon. All patients admitted to the internal medicine (IM) and cardiology services during the months of March and April 2016 were included. The Padua predictive score for VTE of patients was calculated, and contraindications to thromboprophylaxis, if present, were recorded. The choice of the anticoagulant used and its appropriateness with respect to dosing and monitoring parameters (CBC, platelet count, and stool occult blood) were also evaluated.

Results: A total of 88 patients with a mean age of 67 ± 18 years were included in the assessment; 59 in IM and 29 in cardiology. A total of 65 patients qualified for VTE prophylaxis out of which only 39 (60%) received anticoagulation with enoxaparin (26 out of 42 (61.9%) in IM and 13 out of 23 (56.5%) in cardiology). Three patients in the IM service qualified for VTE prophylaxis but had active bleeding which was considered a contraindication for receiving anticoagulation therapy. One patient in IM who did not qualify for VTE prophylaxis received enoxaparin. Seven patients (6 in IM and 1 in cardiology) with creatinine clearance of < 30 ml/min did not receive enoxaparin dose adjustment due to kidney dysfunction. Thirteen patients (10 in IM and 3 in cardiology) were not adequately monitored while on enoxaparin therapy. One patient in IM experienced major bleeding while on enoxaparin which necessitated

discontinuation of the drug. None of the patients developed VTE or thrombocytopenia during hospital stay.

Conclusion: VTE prophylaxis in hospitalized patients was underutilized and not adequately monitored in a big number of patients. Strategies should be done to raise awareness of the magnitude of the problem and its consequences.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-038

Poster Title: Enoxaparin treatment dose and bleeding: a focus on obesity and moderate renal impairment

Primary Author: Jamie Smelser, University of Iowa Hospitals & Clinics; **Email:** jamie-smelser@uiowa.edu

Additional Author (s):
Alex Mersch

Purpose: Enoxaparin lacks compelling evidence for dose adjustment recommendations in patients with moderate renal impairment (creatinine clearance 30 to 60 mL) and/or obesity; hence, unadjusted weight-based treatment doses of enoxaparin in patients with obesity and moderate renal impairment may cause supra-therapeutic levels, potentially with a higher risk of bleeding. Analysis of dosing in these patient populations may help determine appropriate dosing recommendations thereby improving standardization, safety, and quality of care provided to patients.

Methods: A retrospective chart review was conducted for patients receiving enoxaparin treatment doses as an inpatient at an academic tertiary medical center from April to August 2015. Patients were included in the study if they were older than 18 years of age and had received at least three treatment doses of enoxaparin. Patients were excluded if they were not receiving treatment dosing, required multiple dose changes with no valid reason for change (e.g., the dose change was not based on bleeding or anti-factor Xa level), had severe renal impairment defined as a creatinine clearance less than 30 mL/min, or had no serum creatinine listed within the past 7 days. Patients were stratified into four separate groups: 1) moderate renal impairment (creatinine clearance 30 to 59 mL/min); 2) obesity (BMI greater than 30 kg/m2; 3) coexisting moderate renal impairment and obesity; or 4) control population (with neither comorbidity). This study was approved by the Institutional Review Board. The primary objective was to compare bleeding rates during inpatient enoxaparin administration and up to 72 hours after discontinuation between the control population and patients with moderate renal impairment, obesity, or both comorbidities.

Results: One hundred fifty-two patients were included in the review. Patients with obesity (n=38) and the group with both comorbidities (n=22) had a mean BMI of approximately 40

kg/m2 which was close to twice the BMI of control (mean 24.2 kg/m2, n=54). Patients with moderate renal impairment (n=38) and the group with both comorbidities had a creatinine clearance of approximately 40 mL/min which was about half the renal function of control (mean 103 ml/min). A total of 20 bleeds were identified in the overall study population (n=152) with 3 bleeds occurring in the control group and 17 bleeds in the populations with moderate renal impairment, obesity, or both comorbidities. The control group had a significantly lower bleeding rate (5.5 percent) compared to the composite bleeding rate (17 percent) in the patients with obesity, moderate renal impairment, or both comorbidities (p=0.046). There were no significant differences in bleeding rates when control (n=3) was compared to individual populations (obesity, 7 bleeds; moderate renal impairment, 7 bleeds; both comorbidities, 3 bleeds). Mean total daily dose of enoxaparin amongst the groups was not significantly different: patients with obesity, 1.95 mg/kg/day; patients with moderate renal impairment, 1.8 mg/kg/day; both comorbidities, 1.84 mg/kg/day; and control 1.85 mg/kg/day.

Conclusion: The results support pharmacokinetic and pharmacodynamic differences of enoxaparin in patients with obesity, moderate renal impairment, or both comorbidities compared to patients without these conditions. When combined, these patient populations have a significantly higher bleeding incidence compared to those without obesity and/or renal impairment. Bleeding rates were not significantly different between control and any individual study population. However, this lack of significance is likely due to not having a robust sample size. Total daily dose of enoxaparin was similar between all groups suggesting a lower dose may be necessary for patients with obesity, moderate renal impairment, or both comorbidities.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-039

Poster Title: 4-Factor prothrombin complex concentrates (Kcentra) for reversal of warfarin-related anticoagulation in patients with intracranial hemorrhage: changing processes to expedite INR reversal

Primary Author: Jamie Smelser, University of Iowa Hospitals & Clinics; **Email:** jamie-smelser@uiowa.edu

Additional Author (s):
Brett Faine

Purpose: Warfarin anticoagulation therapy is used in the management of a variety of clinical conditions and is a significant predictor of mortality in patients with intracranial hemorrhage (ICH). ICH accounts for 90 percent of warfarin-related deaths. Reversal of anticoagulation in patients with warfarin-associated ICH is a medical emergency, as anticoagulation is associated with hematoma expansion, neurologic deterioration, and increased risk of death and major disability. Prompt reversal of warfarin anticoagulation, with phytonadione (vitamin K) and 4-factor prothrombin complex concentrates (4PCC), may decrease progression of ICH and reduce mortality.

Methods: A retrospective chart review was conducted at an academic tertiary medical center for patients receiving 4PCC who had been diagnosed with a warfarin-related ICH. Patients who received 4PCC via the initial protocol that was developed upon adding 4PCC to Formulary (August 2013 through November 2014, n=74) were analyzed. Review of that data suggested that improvements in ordering processes were necessary to expedite the administration of 4PCC to the patient. Subsequently, the protocol was revised with input from Neurology, Neurosurgery, Hematology, and Emergency services to include a Pharmacist Collaborative Practice Protocol (PCPP) which, after an initial 4PCC order of 25 units/kg placed by an LIP, authorized pharmacists to place a subsequent 4PCC order dependent on the initial INR result at our hospital: if the INR is less than 3.9, no additional 4PCC is given; if the INR is 4 to 6, an order for 10 units/kg (max 1000 units) of 4PCC is placed; if the INR is greater than 6, an order of 25 units/kg of 4PCC (max 2500 units) is placed. After implementation of the PCPP, 38 patients (May 2015 to May 2016) were evaluated to compare timing of 4PCC order, verification by a pharmacist, and time to administration from Emergency Department (ED) arrival.

Results: Results of the pre- (n=74) and post-implementation (n=38) (respectively) are as follows: average time from ED arrival to 4-factor prothrombin complex concentrates order, 92 plus/minus 91 minutes vs. 48 plus/minus 40 minutes; average time from order to pharmacist verification of the initial order placed by LIP, 13 plus/minus 16 minutes vs. 9 plus/minus 7 minutes; pharmacist verification to nurse administration of 4-factor prothrombin complex concentrates, 50 plus/minus 33 minutes vs. 41 plus/minus 19 minutes; and ED arrival to administration of 4-factor prothrombin complex concentrates, 135 plus/minus 130 minutes vs. 99 plus/minus 52 minutes.

Conclusion: ICH is a medical emergency. Hematoma expansion is common and coagulopathy increases the frequency of its occurrence and its extent, and is associated with worse outcomes. Revised processes for ordering 4PCC (allowing LIP to order regardless of outside hospital INR) and implementation of a PCCP which focused on expediting ordering and administration to patients with warfarin-related ICH, reduced the time of getting 4PCC to the patient and subsequently, the time from presentation to reversal of anticoagulation. Future studies should evaluate the impact of early anticoagulation reversal on clinical outcomes in patients presenting to the ED with an ICH.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-040

Poster Title: Making the switch from dipyridamole to adenosine in pharmacologic cardiac stress testing

Primary Author: Janemarie Viscardi, Staten Island University Hospital Northwell Health; **Email:** jav362@gmail.com

Additional Author (s):
Christine Chun

Purpose: Staten Island Universtiy Hospital Northwell Health is an urban academic facility with 704 beds. The pharmacy supplies both the inpatient and outpatient cardiac stress testing with medications. The cardiac stress lab conducts approximately 200 pharmacological stress tests every month. As an institution, we have tried to limit the utilization of regadenoson due to the increased cost.
Dipyridamole was the drug of choice for pharmacological stress testing at Staten Island University in 2015. Due to a national shortage of dipyridamole, a change was warranted; and that change was adenosine.

Methods: First steps were to figure out adenosine's stability. Basing drug information in conjunction with 797 sterility standards, we determined that adenosine had low-risk stability of 14 days at room temperature when prepared under a laminar flow hood and sterile conditions. However, in order to ensure safety, we chose to use medium-risk stability parameters in which our preparations would be stable for 9 days under refrigeration.
A literature search for administration was conducted and what was discovered was a 6-minute infusion based on a concentration of 3 mg/mL. This information was presented to the cardiologists of the stress lab and a consensus was reached. The 6-minute infusion was shown to be cost effective and did not impair the photographs of the stress test. However, after a month of using this treatment protocol, patients were experiencing crushing chest pain after approximately three minutes of the infusion. Patient satisfaction declined due to this (especially with patients who required a bi-annual stress test).
Literature was revisited, and a four minute infusion protocol was discovered and approved by cardiology. In addition to determining a lesser infusion time, we were looking to decrease side effects, and increase patient experience.

Results: The remaining aspects of this enterprise were the logistics of implementation. The main concern being the possibility of adenosine being administered incorrectly (i.e. dose, administration time). We worked closely with the Alaris Continuous Quality Improvement Committee and the end result was the creation of a four minute dosing chart. The chart lists possible patient weights and corresponding doses and volume of drug to be infused.
Data from the first 8 months of use show 1569 adenosine stress tests with a cost avoidance of $296,668. Regadenoson was still utilized in patients who had a contraindication to Adenosine. However, in the same eight month period, there were 47 tests in which only 2.74% of total stress tests, regadenoson was ordered.

Conclusion: We found that adenosine was an equally effective alternative for stress testing. In addition to the clinical efficacy, we found its use to be cost effective.

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-041

Poster Title: Comparison and evaluation of a higher versus lower heparin weight-based dosing protocol for the treatment of deep vein thrombosis and pulmonary embolism

Primary Author: Jaclyn Yodice, Morton Plant Hospital; **Email:** jaclyn.yodice@baycare.org

Additional Author (s):
Christine Price
Jovino Hernandez

Purpose: Deep vein thrombosis and pulmonary embolism pose life threatening complications. It is important to provide adequate anticoagulation within the first twenty-four hours of diagnosis. The CHEST guidelines recommend a weight based heparin dose of 80 units/kg followed by 18 units/kg/hour. However, studies suggest that a lower weight based dosing regimen may improve outcomes without resulting in over anticoagulation. The purpose of this study is to determine if a lower weight based heparin protocol of 60 units/kg followed by 15 units/kg/hour will achieve therapeutic anticoagulation more rapidly than a higher weight based heparin protocol of 80 units/kg followed by 18 units/kg/hour.

Methods: IRB approved, retrospective cohort study performed at two community hospitals within the same healthcare system. A total of 116 patients were enrolled between July 2015 and April 2016 with a diagnosis of deep vein thrombosis and/or pulmonary embolism who received intravenous heparin through a hospital approved protocol. Infusion rate changes for both protocols were made according to aPTT values and an algorithm that titrated responses to a therapeutic range. The primary endpoint evaluated was the time to reach therapeutic aPTT range. Secondary endpoints included percentage of patients within therapeutic range at 24 hours, percentage of patients with subtherapeutic and supratherapeutic values at 6 and 24 hours, average dose required to reach therapeutic range, and adverse event outcomes. An estimated sample size of 58 patients in each group was calculated for this study to have 80 percent power to detect a 7 hour difference in the primary end point at a two-sided alpha level less than or equal to 0.05. Nominal data was compared using Pearson Chi-Square test or Fisher's Exact test. Discrete and continuous variables were compared using the two-sample t-test or Mann-Whitney test for non-normally distributed data.

Results: A total of 58 patients in each group were compared and analyzed for the primary and secondary endpoints. Results showed a significant difference in the primary endpoint of time to reach therapeutic aPTT range. The lower weight based heparin group reached therapeutic range in a median of 14 hours compared to a delayed time of 24 hours for the higher weight based group (p-value equal to 0.006). Both groups had the same percentage of subtherapeutic aPTT values, but the higher weight based group experienced significantly more supratherapeutic values at 6 and 24 hours (p-value equal to 0.013, p-value equal to 0.001). The average dose required to reach therapeutic range was 14.7 units/kg/hour (lower weight based group) and 15.6 units/kg/hour (higher weight based group). Adverse event outcomes were analyzed and no significant differences were found (8 vs. 13 events respectively; p-value equal to 0.225).

Conclusion: The lower weight based heparin protocol resulted in a significantly reduced time to reach therapeutic range. The higher weight based heparin protocol resulted in a significantly increased number of supratherapeutic aPTT values that caused a delayed time to reach therapeutic aPTT range. In conclusion, a reduced weight based dose of heparin 60 units/kg followed by 15 units/kg/hour achieved therapeutic anticoagulation more rapidly than a higher weight based dose of heparin 80 units/kg followed by 18 units/kg/hour.

Submission Category: Clinical Services Management

Session-Board Number: 6-042

Poster Title: Implementation of a novel resident-led pharmacy transitions-of-care service

Primary Author: Kate Perica, University of Colorado Health; **Email:** katharine.perica@uchealth.org

Additional Author (s):
Lisa Slater

Purpose: Our PGY-1 pharmacy residency program recently expanded, which creates an opportunity for additional learning and staffing elements. The need for managing patients through their transition from the inpatient setting back into the community after discharge is well documented throughout medical and pharmacy literature. The purpose of our initiative was to develop a pharmacy transitions of care service (PTOCS) in our hospital using available resources to enhance resident learning and simultaneously streamline the patient discharge process to ensure a safe transition. A novel approach was utilized to establish the PTOCS, using a layered learning model with pharmacists, residents, and volunteer interns.

Methods: A longitudinal staffing requirement was implemented for our six hospital and two community based PGY-1 pharmacy residents to operate our PTOCS. The community based residents each staffed once weekly while the hospital residents each staffed once every other week. The service operated Monday through Friday from 4:00pm to 8:00pm. Volunteer pharmacy interns were added midyear to staff alongside the residents. A PTOCS sign-out was created within the electronic health record and a secure online portal was developed for training tools and references. A prioritization schematic was developed and modified over the course of the year to determine which patients to enroll in the service. A clinical pharmacist attended multi-disciplinary discharge rounds for two medicine teams, identified patients, and facilitated communication within the service. The PTOCS staff responsibilities included: ensuring that a proper medication history was completed, documenting the patient's prescription insurance status, counseling the patient about expected discharge therapies, communicating anticipated medication barriers to the medicine teams, transmitting a discharge medication list to the patient's usual community pharmacy, and calling the patient two days after discharge to answer questions, encourage medication adherence, and triage discharge questions to reduce readmissions. Frequent feedback from the PTOCS staff was used to inform improvements to the service to optimize workflow.

Results: A PTOCS was established and fully staffed by pharmacy residents and interns beginning in August 2015. Implementation of the service allowed for more clinical staffing opportunities for the residents. Resident improvement suggestions informed iterative improvements through the first four months of service implementation and led to refined patient identification, optimized workflows, and stable processes. Creation of a patient prioritization scheme allowed for flexibility in the number of patients enrolled given PTOCS staff availability. The prioritization included assessing medication related barriers (i.e. insurance, compliance, low-health literacy), readmission status, chronic diagnoses (i.e. heart failure), and diagnosis of a condition that would result in several new discharge medications. During the latter 6 months of the year, 247 patients were enrolled in the PTOCS, 141 discharge medication lists were faxed to community pharmacies, and 146 patients were reached by phone after discharge. During the follow up phone calls, 34% of patients had no questions or concerns; 19% had a logistic question for the resident or intern; 34% required the resident or intern to use clinical skills to answer questions; and 13% of calls resulted an intervention that would prevent an adverse outcome or a referral to a provider for additional management.

Conclusion: In one year, we created a novel pharmacy transitions of care service led by pharmacy residents and volunteer interns which has allowed our hospital to fulfill a previously unmet need. Although the service is only currently available for 20 hours per week, the development of a patient prioritization schematic has created a sustainable program that allows us to grow based on available staff resources.

Submission Category: Clinical Services Management

Session-Board Number: 6-043

Poster Title: Impact of pharmacist involvement on time to first antibiotic administration for emergency room patients with severe sepsis or septic shock

Primary Author: Kerry Rinato, Hospital Corporation of America Far West Division; **Email:** krinato@gmail.com

Additional Author (s):
Antoinette Pretto-Sparkhul
Laura Viti
Susan Batcheller
Olushola Adeleye

Purpose: Current evidence suggests that for each hour delay in antibiotic administration in severe sepsis or septic shock there is a linear increase in mortality. In the first quarter of 2015, the median time to antibiotic administration facility-wide was 148 minutes. Considering that the majority of “code sepsis” activations occur in this facility’s emergency department, this initiative was aimed at training pharmacists to respond to the emergency department “code sepsis” process in an effort to decrease time from triage to antibiotic administration.

Methods: In the third quarter of 2015, a decentralized pharmacy program was developed for the emergency department of a 692 bed urban community hospital that saw 160,542 visits in 2015. Two pharmacists were assigned to staff the emergency department for 12 hour shifts during peak visit times from 12 pm to 12 am daily. These pharmacists had no advanced certification or formal training in critical care pharmacotherapy. A source driven, evidence-based protocol that allowed for pharmacist ordering of antibiotics was developed by the facility’s antimicrobial management committee. This protocol was built into the computerized provider order entry (CPOE) system and made available in CPOE for use by physicians and pharmacists. A training module on sepsis pharmacologic disease state management and empiric antibiotic selection based on known or suspected infectious source was developed by pharmacy leadership and completed by all pharmacists. The emergency department “code sepsis” process was re-designed to include pharmacist response and intervention. The program commenced in January of 2016 and data was collected through March 2016.

Results: Data was reviewed on all 759 “code sepsis” activations; 74 for the first quarter of 2015 and 685 for the first quarter of 2016. The median time from triage to initial antibiotic administration was 148 minutes for the first quarter of 2015 and 109 minutes for the same period in 2016.

Conclusion: Pharmacist involvement in the emergency department “code sepsis” process was associated with a reduction in median time from patient triage to antibiotic administration in patients with severe sepsis or septic shock by about 26 percent. Considering that this impact was seen in the initial three months of initiative implementation, pharmacist emergency room services have been increased from 12 hours to 24 hours a day.

Submission Category: Clinical Services Management

Session-Board Number: 6-044

Poster Title: Usefulness of the pharmaceutical care for treatment with dementia outpatients

Primary Author: Yuhki Sato, Oita University Hospital; **Email:** syuhki@oita-u.ac.jp

Additional Author (s):
Aoi Yoshiiwa
Ryosuke Tatsuta
Eishi Miyazaki
Hiroki Itoh

Purpose: The maintenance and improvement of medication adherence is important, and the medication counseling offered to dementia patients by pharmacists also plays an important role in providing effective dementia treatment. However, no reports on pharmacists educating dementia patients continuously via an outpatient department have been found to date. To achieve maintenance of taking medicine instruction and medicine adherence at the Oita University hospital in the outpatient memory care department of our hospital, where dementia patients undergo their medical examinations, pharmacist delivered the new drug management instructions. The influence of this instruction on medication adherence was assessed in the present study.

Methods: The study design was a case-control study to compare with before and after the instruction by a hospital pharmacist. Patients in the intervention group received pharmacist instruction and necessary education about their prescribed medications from 1 August 2015 through 31 May 2016. We compared the medication adherence in intervention group and control group. We also investigated the reasons why doctors requested these specific instructions, the intervention contents used by the pharmacist, and the outcome using a Mini-Mental State Examination (MMSE) before and after the instructions began. Pearson's Chi-square test and Wilcoxon's signed-rank test was used as statistical analysis. Statistical significance was accepted at $P < 0.05$ in all analyses. SPSS software (version 20.0) was used.

Results: A total number of 39 patients within the age of 54-85 years received instructions from a hospital pharmacist. There were significant differences in medication adherence between two groups. The 3- and 6-month medication adherence after the instructions in the intervention group was significantly increased more than the control group ($P < 0.05$). But MMSE had not

changed in two groups. We examined the association of medication adherence with age, sex, clinical dementia rating, living alone, and pharmacist instruction. As a result, medication adherence was significantly higher in patients received pharmacist instruction.

Conclusion: The instructions given by pharmacists in dementia outpatient departments improved their medicine use continuation rate, and connected to the maintenance of anti-dimentia medicine regimens by improving patients' medicine-taking adherence and compliance.

Submission Category: Clinical Services Management

Session-Board Number: 6-045

Poster Title: Successful medication initiative development and implementation in a large health system

Primary Author: Karen Smethers, The Resource Group, Ascension; **Email:** ksmether@gmail.com

Additional Author (s):
Roy Guharoy
Jeffrey Seggerman
Dan Leffler
Lynn Eschenbacher

Purpose: Ascension is the nation's largest nonprofit health system with 2,500 sites of care in 24 states and the District of Columbia. The One Ascension Quadruple Aim provides a solid foundation for effective medication management by providing care that is high quality and low cost, improves health outcomes, and results in exceptional person, family and provider experience. This is embraced by the Therapeutic Affinity Group, a multidisciplinary team that develops evidenced-based medication initiatives to deliver high quality care that is safe, and delivers patient value. The Therapeutic Affinity Group initiative development and implementation process will be described and corresponding savings presented.

Methods: An expert group, comprised of members from across Ascension, agree on the scope of an initiative through a charter, research evidence-based practice, and develop medication initiative SBAR and FAQ documents along with executive summary slides. The initiatives are reviewed by the Therapeutic Affinity Clinical Subcommittee, and the Therapeutic Affinity Group, followed by a 14 day comment period from Ascension clinicians. Once feedback is received and vetted through the Care Excellence Committee, final approval is given by the Chief Clinical Officer. A memo to senior leadership at each site communicates the initiative and the 90 day time frame for implementation. Each initiative is monitored for successful compliance through a red/green dashboard display. The comprehensive process creates strong buy-in and agreement for need to implement each initiative to provide high quality and low cost care for patients.

Results: Successful implementation of more than 100 Therapeutic Affinity Group medication initiatives has been achieved over the past three years. The top cost-saving initiatives include

the following: antimicrobial stewardship including fluoroquinolone formulary streamlining and intravenous to oral sequential therapy conversion, inhaler to nebulization transition, influenza virus vaccine standardization, formulary insulin product standardization, intravenous immune globulin guidelines for use, evidence-base anticoagulation use in PCI, alteplase catheter clearance guideline, provision of high cost hematology/oncology agents in the outpatient setting, nitroprusside guidelines for use, and use of dipyridamole for myocardial perfusion imaging. Each year, the savings realized at each health-system increased as the comprehensive nature of the initiative process was recognized. During the 2014 fiscal year, 7.6 million was identified as savings, 15.2 million in fiscal year 2015, and greater than 23 million in fiscal year 2016.

Conclusion: The Therapeutic Affinity Group initiative development and implementation process has resulted in the successful implementation of more than 100 medication initiatives at Ascension facilities resulting in 45 million in funds for local investment. These evidence-based initiatives support the mission to provide care that is high quality, low cost, and delivers patient value.

Submission Category: Clinical Services Management

Session-Board Number: 6-047

Poster Title: Outcomes of a prescription bedside delivery program on hospital readmission in a community teaching hospital

Primary Author: Tyler Tomasek, CLEVELAND CLINIC, SOUTH POINTE HOSPITAL; **Email:** tomaset@ccf.org

Additional Author (s):
Daniel Lewis
Jason Milner

Purpose: Medication nonadherence and adverse drug reactions are a risk factor for hospital admissions. Many patients transitioning from hospital to outpatient care allow their prescriptions to go unfilled. In 2012, Cleveland Clinic South Pointe Hospital established a prescription bedside delivery program to serve patients being discharged from the hospital. Upon patient request, the pharmacy will fill prescriptions, deliver medications to the patient, and provide medication counseling. This service allows the pharmacist to address any clinical questions and access issues with prescribers before the patient leaves the hospital. Pharmacists also evaluate appropriateness and provide education. Transportation barriers to fill their prescription are eliminated. This study evaluates the impact of an enhanced bedside delivery service on 30-day readmission rates and patient satisfaction.

Methods: This is a retrospective study reviewed by the Cleveland Clinic institutional review board. Study populations include a sample of inpatients who received bedside delivery prior to discharge from South Pointe Hospital from January 2015 to December 2015. Patients were identified as having received bedside delivery by two methods: 1) pharmacy technician bedside delivery confirmation in the electronic medical record, and 2) audit of prescription history in the outpatient pharmacy electronic database. A chart review was then performed for the matching patient encounters. Demographics, including primary diagnosis, dates of admission and discharge were collected. HCAHP survey responses were collected to evaluate patient satisfaction. Completed surveys for the specified time period were screened in a blinded manner to evaluate if they matched the medication bedside delivery patient population, and evaluated for differences in responses to medication answers.

Results: From 1/1/15 to 10/31/15, South Pointe Hospital had a 30-day readmission rate of 16.7 percent (n=5405 patient admissions). During this same time period, a sample of patients who received pharmacy bedside delivery services had a 30-day readmission rate of 10.2 percent (n=566), p=0.000067. From 1/1/15 to 12/31/15, patients who received bedside delivery and responded to HCAHP survey question, “When I left the hospital, I clearly understood the purpose for taking each of my medications”, were more likely to answer “strongly agree” than those not receiving bedside delivery (60.6 percent, n=104 vs 50.3 percent, n=773; p=0.049). Patients who received bedside delivery were also more likely to respond favorably to other medication domain questions, however, these results did not meet statistical significance. Evaluation of impact on readmission for patients with heart failure, chronic obstructive pulmonary disease, and pneumonia were also evaluated.

Conclusion: This study suggests prescription bedside delivery service provided by a dedicated pharmacist team prior to hospital discharge can help to reduce 30-day readmissions and increase patient satisfaction. These improvements are likely due to increased medication adherence and medication understanding.

Submission Category: Clinical Services Management

Session-Board Number: 6-048

Poster Title: Novel approach to pharmacist participation on daily patient rounds

Primary Author: Janemarie Viscardi, Staten Island University Hospital Northwell Health; **Email:** jav362@gmail.com

Additional Author (s):
Christine Chun

Purpose: Staten Island University Hospital Northwell Health is an urban academic facility with 704 beds. The pharmacy has a split model with satellites, as well as a main pharmacy for dispensing. Five years ago, we implemented a robot, which assisted in the filling of patient medications. This workflow model saved the pharmacists' time in regards of dispensing medications; allowing for them to be physically present on patient care rounds.
However, after a trial period of 7 days on rounds, it was concluded that pharmacy was only involved 20% of the time. The remaining time would be spent on other medical aspects of interdisciplinary care. In order to provide a pharmacist's presence without them physically being there, the pharmacy developed Profile Rounds.

Methods: Profile rounds starts with the pharmacy printing up each patient's profile. The satellite pharmacist who is responsible for those patients review each patient chart thoroughly; looking for specific interventions. These interventions consist of basic things like drug interactions, Intravenous to oral conversion, renal dosing adjustments, deep vein thrombosis prophylaxis, duplicate therapy, reducing the amount of unnecessary medications, recommending therapies for symptomatic patients on high dose opioids, and review of basic electrolytes and international ratios. Little yellow stickers with the suggestions denote the changes on the profile. These profiles are then placed in binders, brought up to the respective nursing units, and given to the residents and hospitalist. The prescriber on rounds reviews the profiles and annotates acceptance or refusal on the same yellow sticker. The books are then returned to pharmacy where a universal spreadsheet is created for each satellite, which lists all the suggested interventions, whether or not they were accepted; as well as a log to prevent repetitive interventions from occurring,

Results: The results of this project are extremely encouraging. In the 1st eight days of rounding, the pharmacy made 155 recommendations with an acceptance rate of 43%. Of the

recommendations, the two main categories in which the most interventions were made were “IV to PO” conversions and DVT prophylaxis indications and agents.

Conclusion: The development of these Profile Rounds enabled the pharmacists to have an active role on patient care rounds without their physical presence. This not only improved patient medication therapy, but it also maximized the utilization of the pharmacists' role within the hospital setting. By using this healthcare model, the clinical and dispensing aspects of patient care within the institution was met.

Submission Category: Clinical Services Management

Session-Board Number: 6-049

Poster Title: Pharmacy-clinical nutrition collaboration on oral nutritional supplement education in an ambulatory care services county-wide health system

Primary Author: Jerry Wong, Harris Health System; **Email:** jerry.wong@harrishealth.org

Additional Author (s):
Leisa Bryant
Sarah Bodine
Goldina Erowele
Jacqueline Milton-Brown

Purpose: A 2014 review of the number of patients with a prescription for an oral nutritional supplement indicated that 47% of patients did not meet the Formulary Command Center (FCC) criteria for oral nutrition supplementation. Pharmacy and Clinical Nutrition collaborated and revised the oral nutritional supplement ordering and monitoring process to reduce and/or prevent the misuse and overuse of oral nutritional supplements in the Ambulatory Care Services (ACS) setting. The goal is to achieve > 90% compliance.

Methods: A Pharmacy-Clinical Nutrition taskforce was formed to revise the FCC Oral Nutritional Supplements criteria. Their action plan noted the following issues: 1) Update pertinent nutrition risk factors for malnutrition; 2) No regular follow-up with a dietitian to evaluate nutrition status of patients prescribed oral nutritional supplements; and 3) Misuse of oral nutritional supplements as in cases of food insecurity and access. The taskforce revised an algorithm to clarify the oral nutritional supplements protocol. Prescriptions were only allowed up to a 60-day supply to increase patient follow-up; FCC required a nutrition assessment by a clinical dietitian to extend the FCC approval to facilitate a multidisciplinary approach to addressing malnutrition. Clinical Nutrition contacted the IT department to create an order set to combine prescriptions for oral nutritional supplements with nutrition orders to simplify the process for physicians.
Pharmacy provided a list to Clinical Nutrition each month of patients who received a prescription for oral nutritional supplements. Clinical Nutrition followed by reviewing the list to verify that patients received a nutrition appointment for an assessment prior to the end of the 60-day supply for initial FCC approval.

Results: Clinical Nutrition formed a sub-group within ambulatory care services to create an assessment and education plan including a guideline for when to recommend oral nutritional supplements for patients identified as malnourished or at risk for malnutrition by the medical provider. Assessments were planned to last an average of 30 minutes each and consisted of "Food First" interventions to educate patients and their families on culturally specific methods for food preparation and meal planning, as well as providing a list, as applicable, of community food resources (e.g. food pantries, soup kitchens) for patients depending on their socioeconomic status. The dietitian then recommended, if needed, a plan for supplementation following the assessment. The top reasons that patients were recommended for oral nutritional supplements were determined to be due to unintentional significant weight loss combined with either a cancer diagnosis, severe dysphagia, BMI less than 18.5, or HIV diagnosis.

Conclusion: The Pharmacy-Clinical Nutrition collaboration helped introduce more patients to the wealth of information that dietitians can provide. Oral nutritional supplement prescriptions decreased by approximately 20%. Patients who had access to readily prepared foods, family support and the ability to prepare food at home were more likely to be independent of oral nutritional supplements. Physicians worked more closely with the on-site dietitian as they became more familiar with the collaborative process.

Submission Category: Clinical Services Management

Session-Board Number: 6-050

Poster Title: Implementation of a pharmacist-driven transitional care process targeting patients at risk for readmission based on an internally developed readmission risk assessment (RRA) tool

Primary Author: Kevin Yeh, Boston Medical Center; **Email:** kevin.yeh@bmc.org

Additional Author (s):
Alyssa Sterling
Kanan Shah

Purpose: Decreasing hospital readmissions is a multi-disciplinary, organizational initiative to improve patient care and to obtain financial support through hospital reimbursement programs. The inpatient pharmacy department at Boston Medical Center (BMC) offers many services to help prevent medication related readmissions. Historically, pharmacist interventions were not targeting patients based on their risk for readmission. The Readmission Risk Assessment (RRA) initiative was designed to establish a workflow for decentralized pharmacists to perform targeted interventions for patients at-risk for readmission using an internally developed assessment tool.

Methods: The strategy team at BMC created a risk tool that calculates a score upon admission and categorizes patients as very high, high, moderate, or low risk for readmission. The RRA pharmacy team was asked to create an inpatient model to assist with decreasing medication related readmissions by providing direct pharmacy services for at-risk adult internal medicine patients. A model was developed to perform the following interventions for very high and high risk patients: admission and discharge medication reconciliation, patient counseling, and discharge medication delivery. In addition, pharmacist follow-up telephone calls were performed for high and moderate risk patients; very high risk patients were called by a separate group. Initial training was performed using a mock electronic health record environment. Each pharmacist was required to review one patient intervention of each type with a RRA-trained pharmacist to ensure competency and consistency before performing independently. A training manual detailing each service was developed for pharmacist reference. Medication related assessment and recommendations were provided to the multidisciplinary team caring for the patient via direct communication and documentation in the electronic medical record. In an attempt to provide services for all qualifying patients, pharmacy residents and Advanced Practice Pharmacy Experience (APPE) students assisted with these services with the primary

preceptor providing initial training and sign off. All pharmacy services and interventions were documented to track progress and capture impact.

Results: Thirty-five pharmacists were trained and signed off in the RRA process. During the first eight weeks of implementation, medication reconciliation was completed on 81 percent of 242 eligible admissions and 61 percent of 221 eligible discharges. Patient counseling was performed on 53 percent of patients whose medication reconciliation was completed by a pharmacist. Patients were not counseled if discharged to a long-term care facility, hospice facility, or with comfort care measures. Follow-up telephone calls were attempted on 74 percent of 373 eligible patients discharged home; 58 percent of these patients were reached. Pharmacists performed interventions for 19 percent of patients reached by telephone including the following: reviewing medication changes, resolving medication issues with outpatient pharmacies, sending prescriptions with prescriber authorization, and facilitating follow-up appointments. A notable increase in pharmacy services was observed when APPE students were present; students assisted with 14 percent and 11 percent of completed admission and discharge medication reconciliations, respectively. Pharmacy students also assisted with seven percent of discharge follow-up phone calls. Success with pharmacy services for all eligible patients is limited by collapse of clinical services in the evenings and on weekends. Data tracking for all interventions is limited by pharmacist utilization of system specific documentation.

Conclusion: BMC's RRA pharmacy initiative has enabled pharmacists to focus transitional care interventions on patients who would benefit the most from pharmacy services. Pharmacy students proved to be a valuable resource to assist in performing medication histories, patient counseling, and post-discharge telephone calls. Next steps are to expand clinical services and to create a student rotation experience focused on transitions of care. These additions will increase the number of patients with pharmacy interventions while working towards decreasing medication related readmissions.

Submission Category: Critical Care

Session-Board Number: 6-051

Poster Title: Assessment of rectal quetiapine utilization in critical care settings

Primary Author: Sarah Nelson, Mayo Clinic; **Email:** nelson.sarah3@mayo.edu

Additional Author (s):
Jonathan Leung
Brianne Ritchie
William Bobo
Maria Lapid

Purpose: Delirium in the intensive care unit (ICU) is described as a syndrome characterized by acute cerebral dysfunction accompanied by a change in baseline mental status, inattention, and either disorganized thinking or altered consciousness. Current guidelines recommend the use of atypical antipsychotic agents for the treatment of ICU delirium. Quetiapine is an orally available atypical antipsychotic with recently published pharmacokinetic data to suggest the same dosage of quetiapine administered rectally results in nearly twice the drug exposure as that administered orally. Given the paucity of data related to the safety and efficacy of rectally administered quetiapine, we sought to conduct a retrospective chart review to examine its use for the treatment of ICU delirium at our institution.

Methods: This was a single center, retrospective study that was approved by the Mayo Clinic, Rochester Institutional Review Board. We evaluated all adult ICU patients administered rectal quetiapine between January 2014 and November 2015. Patients were excluded from our analysis if less than 18 years of age, initiated on rectal quetiapine in a non-ICU setting, were ordered quetiapine for the sole purpose of sleep, or were prescribed quetiapine prior to admission. In addition to demographic data we collected quetiapine dose, frequency, conversion to oral dosage form, and concomitant psychotropics used for agitation/delirium. We also collected time in delirium based on Confusion Assessment Method for the ICU (CAM-ICU) positive screenings, length of stay, dismissal status, change in the corrected QT (QTc) interval after quetiapine initiation, and other adverse events noted in the electronic medical record. Our primary endpoint was to describe the dosing methods and rationale of quetiapine when given as a suppository. Secondarily we sought to assess the safety of rectal quetiapine by evaluating electrocardiograms and clinical documentation.

Results: During the study period there were 48 patients (50% women, mean age 71.4+16.4 years) who received rectal quetiapine in an ICU setting. Patients were admitted to either a surgical/trauma ICU (72.9%), neurosciences ICU (12.5%), or the medical ICU (14.6%). The rationale for implementing this dosage form was due to a nothing by mouth (NPO) status (n=36), ileus (n=2), gastrointestinal discontinuity (n=7), or for other/unknown reasons (n=6). The initial total daily dose of quetiapine ordered was 41+37.4 mg reaching a mean maximum daily dose of 53.3+47.9 mg. This dosage form was used for a median duration of 24 hours (interquartile range(IQR) 24-59.5 hours). Several patients (n=26) were transitioned to an oral dosage of quetiapine, of which only 7 had an appropriate conversion based on bioavailability. Seventeen patients were switched from quetiapine suppositories to an equal dose of the oral tablets; with 6 patients specifically noted to require rapid oral quetiapine dose escalations. Only 19 patients had both pre- and post-quetiapine dose electrocardiogram of which 8 of these patients had increase of the corrected QT interval by greater than 20 msec (range 20-52 msec).

Conclusion: Over the duration of approximately 2 years, quetiapine suppositories were sparingly utilized for the management of ICU delirium. This dosage form was mostly utilized in surgical patients with a NPO status. When an enteral route became available to administer medications, based on pharmacokinetic data, quetiapine was rarely appropriately converted to the oral formulation, resulting in decompensation in some cases. Rectal quetiapine appears to be a viable option when oral access is not available and when parenteral antipsychotics cannot be given. Clinicians should be reminded that conversion to the oral formulation requires a doubling of the dose.

Submission Category: Critical Care

Session-Board Number: 6-052

Poster Title: Rebound elevation of international normalized ratio 48 hours after administration of four factor prothrombin complex concentrate

Primary Author: Melissa Raich, Cleveland Clinic Hillcrest Hospital; **Email:** melissa.m.raich@gmail.com

Additional Author (s):
Frank Rigelsky

Purpose: Four-factor prothrombin complex concentrate, or 4F-PCC, is a hemostatic blood product derivative containing clotting factors II, VII, IX, X, and proteins C and S. Kcentra®, the brand name 4F-PCC, is indicated for the urgent and emergent reversal of vitamin K antagonist therapy in patients with acute major bleeding or when an urgent or emergent surgery or invasive procedure is necessary. Dosing is based on the pretreatment international normalized ratio (INR); a concomitant dose of intravenous vitamin K 10 mg is also given. Repeat doses of 4F-PCC are not recommended. However, there are no published case reports of patients requiring another dose of 4F-PCC after a rebound elevation of the INR approximately 48 hours after the initial dose.
A 64 year old Caucasian male weighing 80.4kg presented to the emergency room with extreme malaise, perirectal pain, and bloody bowel movements. His past medical history was positive for atrial fibrillation (on warfarin for stroke prevention), diabetes mellitus, hypertension, and peripheral artery disease. The patient was diagnosed with sepsis secondary to a necrotic perirectal abscess with a lactate of 2.6, atrial fibrillation with rapid ventricular response, and an elevated INR of 8.8. The patient's INR had been checked one month prior and was within therapeutic range at 2.3. Atrial fibrillation with rapid ventricular response was managed initially with a diltiazem infusion 5-15 mg/hr titrated to a heart rate less than 100. The diltiazem infusion was switched to an amiodarone infusion when the patient's mean arterial pressure remained below 65 mmHg. The surgeon suspected necrotizing fasciitis based on CT scan, and urgent reversal of the INR was necessary. Six units of fresh frozen plasma (FFP) was prescribed, and the INR only decreased to 3.7. The decision to prescribe 4F-PCC was made based on deteriorating hemodynamics and worsening respiratory status of the patient. The patient received 2000 units intravenously over 15 minutes along with vitamin K 10mg intravenously over 30 minutes. This dose was rounded from 2010 units (25 units/kg for an 80.4kg patient) according to hospital policy. The INR, rechecked 30 minutes later, decreased to 1.6. The patient

was taken to the operating room where an extensive necrotizing infection extending from left perirectal area inferiorly to the left lateral gluteal side-flank was incised and drained, and the surrounding necrotic tissue was extensively debrided. Forty eight hours later the patient was again urgently taken to the operating room for further debridement and to perform a diverting colostomy to optimize healing potential. An INR was checked at this time, and was found to be 6.4, which was confirmed with a second lab draw. 4F-PCC 35 units/kg was ordered, and the patient received 3000 units intravenously over 15 minutes. Vitamin K 10mg was given intravenously over 30 minutes. An INR was rechecked 30 minutes after administration, which was 1.3. The patient was taken back to the operating room, and no further complications occurred. Subsequent INRs remained less than 1.2 over the next several days. The patient was placed on venous thromboembolism prophylaxis 3 days after the second surgery. Warfarin therapy was restarted without bridging one week after the second surgery, with no thromboembolic events noted during this time.

An evaluation of the current medical literature produces a lack of patient case reports requiring additional doses of 4F-PCC due to a rebound increase of the INR. A drug interaction with warfarin and amiodarone may have contributed to the rebound elevation of the INR in this patient, but it is difficult to determine specifically what caused the INR to rebound after an appropriate dose of 4F-PCC for warfarin reversal.

Methods:

Results:

Conclusion:

Submission Category: Critical Care

Session-Board Number: 6-053

Poster Title: Impact of pharmacy-led education and intervention in management of ICU delirium

Primary Author: Sarah Volgas, Baptist Health Medical Center; **Email:** sarah.volgas@baptist-health.org

Additional Author (s):
Tonya Robertson
HyeJin Grant
Corey Hayes
Robert Furrey

Purpose: Intensive Care Unit (ICU) delirium is a common complication frequently occurring in inpatient critical care units and is highly associated with poor patient outcomes. Unfortunately, ICU delirium frequently goes unrecognized and underdiagnosed, and therefore untreated. The purpose of this study was to determine the impact of pharmacist-led education on assessment, prevention, and treatment of ICU delirium and to implement a new pharmacy consult service for the management of delirium.

Methods: The ICU delirium consult service was developed by pharmacy and launched October 1st, 2015 after approval by the institute's pharmacy and therapeutics committee. The consult service prompted the pharmacist to conduct both a home and hospital medication review, with recommendations being presented to the consulting physician. The consult service also gave pharmacists the authority to manage antipsychotic therapy. The scope was limited to the general medical ICU.
Before protocol initiation, a thirty minute in-service was required of all nurses working in the unit. The in-service focused on delirium causes, prevention, assessment, and treatment as recommended by the 2013 Society of Critical Care Medicine's "Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit." Attendees were required to take a pre- and post-quiz to assess learning.
During the one month study period, documentation of Confusion Assessment Method for the ICU (CAM-ICU) on all patients was monitored daily by the pharmacist. Recommendations were made on all patients with a positive CAM-ICU. Formal consults were followed daily and pharmacist interventions were documented in a progress note. At the conclusion of the study,

an IRB exempt retrospective review was conducted. CAM-ICU documentation in October of 2015 was compared to October of 2014, as well as haloperidol, midazolam, and fentanyl use.

Results: In October 2014, 71.8 percent of patients had CAM-ICU documented consistently throughout ICU stay compared to 86.0 percent of patients in October 2015, for a 19.8 percent improvement in assessment rates (p equals 0.0025). The number of positive CAM-ICU documentations increased by 59.3 percent in 2015. Haloperidol use decreased by 11.7 percent (p equals 0.3097), midazolam by 32.4 percent (p equals 0.0045), and fentanyl by 32.6 percent (p equals 0.0023). Five pharmacy delirium consults were placed during the study period.

Conclusion: Pharmacist education and intervention improved assessment of delirium in the medical ICU through use of CAM-ICU. With the increased documentation of CAM-ICU came an increased number of patients with a positive CAM-ICU. This suggests more delirious patients were appropriately identified in the study group than the control group. Haloperidol, midazolam and fentanyl use did significantly decrease in the study group. However, due to the inability to adjust for patient acuity, direct correlation between reduction in haloperidol, midazolam and fentanyl use to pharmacist-led education and intervention could not be made.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-054

Poster Title: Dimethyl fumarate: adherence, effectiveness, and safety

Primary Author: Maria Fortes, Hospital POVISA; **Email:** susana.fortes.gzlez@gmail.com

Additional Author (s):
Jose De Miguel
Leticia Herrero
Lucia Villamayor
Carmen Freire

Purpose: Dimethyl fumarate (DMF) is a new oral drug for the treatment of relapsing-remitting multiple sclerosis (RRMS). It is a therapy approved for adult patients (18-65 years) with a baseline score of 0 to 5.5 on the Expanded Disability Status Scale (EDSS) by the Health System of the state. The aim of this study was to evaluate the effectiveness, safety and adherence of DMF in RRMS in clinical practice.

Methods: We conducted a descriptive transversal study. Inclusion criteria: patients with RRMS who received treatment with DMF between April 2015 and June 2016.
Data were collected from digital medical records and the hospital pharmacy software.
Study variables: age, sex, adherence, previous treatment, time since diagnosis, basal EDSS, mean dose, treatment duration, relapses and adverse events.
Adherence was evaluated by the Medication Possession Rate (MPR), calculated as mg taken x 100 divided by mg prescribed. Adherent patients were defined by MPR ≥ 85%. Effectiveness was assessed by clinically documented relapses and the number of new or enlarging lesions on brain magnetic resonance imaging (MRI). Safety was evaluated by laboratory abnormalities and adverse events.

Results: A total of 20 patients (65.0% female) with an average age of 39.8 years (range 27-64) were included. Mean score on baseline EDSS was 1.8 (0-5.5). 40.0% of the patients had previously received treatment (7 patients interferon beta-1a, 1 patient glatiramer acetate). The median time since diagnosis to the beginning of DMF was 356 days (44-4126).

Initially, 90.0% of patients received DMF twice daily at a dose of 120 mg for 14 days. The mean daily dose was 469 mg (range 398-480) and median duration of DMF 236 days (26-453). The mean MPR was 95.7%, being adherent 85.7% of patients.
During the study, 25% of patients clinically relapsed. Half of relapses were treated with oral methylprednisolone, while the rest of them needed hospitalization for a course of intravenous steroids. Of the 7 patients with an additional MRI, 42.9% of them developed new or enlarging lesions.
Two patients discontinued treatment with DMF, only one due to adverse events. The overall incidence of adverse events was 83.3%. The most common were: flushing (55.6%), gastrointestinal events (55.6%) and lymphopenia (16.7%). The median lymphocyte count decreased over 33.3%, although median values remained within normal limits 1.9x103/mm3 (0.5-4.6). JC virus was detected in two patients.

Conclusion: Oral treatment appears to be a promising strategy in the treatment of RRMS, due to the high adherence rate showed in the study.
According to our limited results, DMF demonstrated more effectiveness in clinical measures than neuroradiological images, controlling the disease activity in 75% of patients.
The drug has a favorable safety profile, because most events were mild and did not result in discontinuation of treatment. These data are consistent with results from clinical trials.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-055

Poster Title: Appropriate prescribing of methylnaltrexone bromide at a community hospital: a medication use evaluation

Primary Author: Brad Hein, The Christ Hospital; **Email:** brad.hein@thechristhospital.com

Additional Author (s):
Andrea Bergen

Purpose: Opioid-induced constipation (OIC) is a common adverse effect associated with the use of opioids for pain management. Unlike most other adverse effects, tolerance does not develop to OIC. Therefore, it is important that preventative measures are instituted in patients maintained on chronic opioid therapy. If a patient develops OIC, treatment should consist of high dose, stimulant laxatives. Peripherally-acting opioid antagonist therapy should be considered in cases where the response to stimulant laxative therapy is insufficient and other interventions, such as opioid dose decrease and opioid rotation, are not feasible or likewise ineffective. The purpose of this study was to evaluate the use of methylnaltrexone at a community hospital.

Methods: This institutional review board-approved retrospective chart review evaluated patients who had received at least one dose of methylnaltrexone between May 4, 2014 and June 29, 2015. Patients had to also be receiving consistent opioid therapy and have a diagnosis of OIC in the medical record. Data was collected on: demographics, active cancer and cancer type, creatinine clearance and opioid medication utilized. Methylnaltrexone data included prescribing physician specialty, dose and number of doses administered, time between last bowel movement and first methylnaltrexone dose, the number of laxatives tried before using methylnaltrexone and the length of time elapsed between last laxative dose and first methylnaltrexone dose. Efficacy was evaluated by measuring time to bowel movement after methylnaltrexone administration.

Results: 108 patients were included in the evaluation. The average age was 57 years and the majority of patients were female (71 percent). 14 percent of patients had a calculated creatinine clearance of less than 30 mL/min. Methylnaltrexone was most often prescribed by internal medicine (40 percent). Interestingly, 27 percent of prescriptions were in the emergency department. The most common dose was 12 mg (60 percent of patients) and most patients

received just one dose (75 percent). The time of last bowel to methylnaltrexone administration was highly variable. 20 percent of administrations were for patients having a bowel movement in 0-2 days prior and 65 percent of patients in the 3-7 day window. The majority of patients tried at least one laxative prior to methylnaltrexone (80 percent), however this left 20 percent of patients with methylnaltrexone as the first treatment. The time that elapsed between the last laxative and first methylnaltrexone doses was also highly variable. It is important to note that 15 percent of patients went less than a day. 80 percent of patients had a document bowel movement after methylnaltrexone administration, with the majority of patients having relief within hours. Only one patient had an appropriate renal dose reduction.

Conclusion: Methylnaltrexone was effective for the great majority of patients experiencing OIC. Areas of future study include the use in the emergency room. It is unknown if this use is appropriate and if admission can be avoided, it may be a cost-avoiding practice. An order set may be of value to ensure that first-line treatments are given, adequate time elapses before methylnaltrexone is utilized and the dose is appropriate for renal function.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-056

Poster Title: Evaluation of use of dipeptidyl peptidase-4 inhibitors in an academic teaching hospital in Japan

Primary Author: Makiko Iwasawa, Kitasato University School of Pharmacy, Division of Drug Information; **Email:** makiko@pobox.com

Additional Author (s):
Koichiro Atsuda

Purpose: Unlike the guidelines of the American Diabetes Association, Japanese clinical guidelines do not state which anti-diabetic agents should be used as first line agents. Dipeptidyl peptidase (DPP)-4 inhibitors are therefore often prescribed for patients newly diagnosed with type 2 diabetes mellitus (DM). There is evidence that DPP-4 inhibitors have better glucose-lowering effects in Asians than in non-Asians, and because of the low incidence of side effects, the use of these agents has increased in Japan, with nine products now commercially available. This study examined the prescribing patterns of DPP-4 inhibitors and evaluated the appropriateness of their use.

Methods: The study was approved by the Institutional Review Board of Kitasato University Hospital (KUH), Japan. A retrospective chart review of patients receiving DPP-4 inhibitor treatment was conducted at KUH between October 1 and November 30, 2015. Patients older than 14 years who received inpatient prescriptions for DPP-4 inhibitors in the formulary (sitagliptin, saxagliptin, linagliptin, alogliptin, vildagliptin, or teneligliptin) were included in the study. The following data were collected from electric medical records (EMR): demographic parameters - age, sex, weight, height, and body mass index (BMI); characteristics of type 2 DM treatment - duration of type 2 DM, previous anti-diabetic treatment, class and name of concomitant hypoglycemic agents, and dosage, date prescribed, and duration of DPP-4 inhibitor treatment; clinical parameters - HbA1c, serum creatinine, AST, ALT, allergies, major diagnosis, comorbidities, and concurrent medications. The name and department of the physicians who prescribed the DPP-4 inhibitors were also recorded. The outcomes evaluated included the utilization patterns of DPP-4 inhibitors, factors that influenced the selection of the agents, and appropriate medication use such as dosage adjustments based on the degree of the patients' renal impairment (RI).

Results: A total of 394 patients were enrolled in the study (mean age 68.5±10.9 years, 68.3% males, 31.7% females, and mean BMI 23.8±4.6 kg/m2). Of the 394 patients, 95 (24.1%) were on DPP-4 inhibitor monotherapy and 299 (75.9%) were on combined therapy. The DPP4 inhibitors prescribed were sitagliptin 129 (32.3%), linagliptin 91 (22.8%), teneligliptin 69 (17.3%), vildagliptin 62 (15.5%), alogliptin 30 (7.5%), and saxagliptin 19 (4.8%). The patients were stratified into three groups: normal renal function or mild RI (>50mL/min) n=256 (65.0%); moderate RI (>30,≦50mL/min) n=71 (18.0%), and severe RI (≦30mL/min) n=31 (7.9%). A total of 34 (8.6%) patients were receiving dialysis. The DPP-4 inhibitors that require dosage adjustments based on the degree of RI were saxagliptin, alogliptin, sitagliptin, and vildagliptin. Prescriptions for these four agents were 240 of the total 400 prescriptions (60.0%). The proportion of patients with more than moderate RI was 44.3%. Of the 240 prescriptions, the number of inappropriate dosage adjustments was 36 (15.0%), although no case of hypoglycemia was reported. Dosage adjustment was not necessary for linagliptin and teneligliptin. Of the 160 prescriptions for these two agents, the proportion of patients with moderate or severe RI or dialysis was 55.7%.

Conclusion: We found that the use of sitagliptin, linagliptin, teneligliptin, and vildagliptin accounted for 87.8% of prescriptions for the six available DPP-4 inhibitors. Based on this finding we will consider narrowing down our formulary. Linagliptin and teneligliptin were selected even for patients with normal renal function, with the degree of RI appearing not to affect the selection of DPP-4 inhibitor. Regarding dosage adjustment, the rate of adherence to label recommendations was high (85.0%), although there is still room to improve adherence by providing education to prescribers and pharmacists.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-057

Poster Title: Reformulation of formulary process, structure, and policy in a large health system

Primary Author: Indrani Kar, University Hospitals; **Email:** indrani.kar@uhhospitals.org

Additional Author (s):
Joseph Moss
Jason Glowczewski
Shawn Osborne

Purpose: A health system consisting of an academic medical center, pediatric hospital, free standing oncology center, women's hospital, and eleven community hospitals implemented a system formulary structure and review process in 2002 with three policies. These three policies included a system formulary structure, local formulary structure, and formulary review process. The acquisition of five new hospitals and the absence of integration between system formulary and system quality committees prompted a re-assessment of the formulary structure and review process in 2015. This evaluation and reformulation of the formulary process would provide effective and timely formulary decisions for the health system.

Methods: A new pharmacist resource for the health system led the evaluation and reformulation of the formulary process. Interdisciplinary discussions were conducted to assess formulary structure, review process, and formulary category definitions. The original policies were reviewed and compared to policies from similar health systems throughout the United States. After these discussions and review, the three system formulary policies were consolidated into two policies for formulary structure and review process. Specifically, the voting structure was updated to reflect new acquisitions and system structure for the health system adult and pediatric formularies. The review process was reorganized to reflect appropriate integration with system quality committees and addition of new subcommittees. The electronic formulary request process was revitalized, by developing an updated request form and creating new processes for emergency and expedited requests. The formulary approval categories were further defined to formulary, restricted, non-formulary, and non-stocked. Particular to medication review, the monograph template was streamlined to enhance effectiveness of reviews. The informatics handoff was updated to document change requests made for the electronic medical record, medication education tool, and online formulary. In order to quantify work effort, a project management system was implemented to track

changes. Finally, an internal website was made available to promote transparent access to formulary policies, decisions, and drug use guidelines.

Results: The two new formulary policies reflected an efficient structure and review process specific to the health system's two formularies, adults and pediatrics. The consolidation from multiple separate formularies to two formularies occurred over a period of approximately four years. The policies received approval and support from the interdisciplinary system formulary committee, health system policy voting body, and the system Chief Medical Officers' committee. The formulary structure and process have been well received by staff, with policy approval, online formulary integration, and website launch.

Conclusion: System formulary management continues to be an interdisciplinary endeavor. Inclusion of multidisciplinary discussions and review of other health system formulary policies allowed for appropriate updates specific to this health system to be recommended. For the changes to be a success, health system leadership support was required for acceptance of the updated process and structure. The health system will continue evaluating the system formulary management process to maintain efficiency and effectiveness.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-058

Poster Title: Incidence and severity of adverse events associated with mammalian target of rapamycin inhibitors in Korean major center

Primary Author: Youngae Kim, Seoul national university hospital; **Email:** achernar719@gmail.com

Additional Author (s):
Kwang-Woong Lee
Hyeyoung Kim
Nam-Joon Yi
Kyung-Suk Suh

Purpose: Due to beneficial effect of mammalian target of rapamycin (mTOR) inhibitors, such as renal protection or anti-tumor activity, sirolimus (SRL) and everolims (EVL) are used more recently as the indication of HCC is expanding. But even though recent studies proved that there was no increased risk for serious adverse events (AEs), there have been concerns about potential serious AEs such as hepatic artery thrombosis (HAT), graft failure. There are very few reports about safety of mTOR inhibitor regimen in Korean population, therefore, in this study; we investigated the incidence and severity of AEs of mTOR inhibitors in liver transplant recipients.

Methods: We retrospectively reviewed the 1,198 patients who had undergone liver transplantation (LT) in Seoul national university hospital (SNUH) from January 2007 to September 2015 [786 living donor liver transplantation (LDLT), 412 deceased donor liver transplantation (DDLT)]. The patients quitting the therapy within 90 days or enrolled in other clinical trials were excluded in AE analysis. We investigated AEs, which were already known related to mTOR inhibitors and also traced the events of acute cellular rejection (ACR) and graft failure. The evaluation of severity by Common Terminology Criteria for Adverse Events (CTCAE) was used to grade the AEs.

Results: Among 1,198 patients, 121 patients (10.1%) received mTOR inhibitors. Among all 121 patients, SRL was used for 80 patients, EVL for 25, and EVL after SRL for 16. 60 patients among them received the de novo therapy within 2 months after the transplant, and 61 received

mTOR inhibitors as conversion therapy from other CNI based regimen. Follow-up duration was 21–1,840 days in SRL group and 7–451 days in EVL group.
AEs were investigated in 88 patients [SRL (n=68) and EVL (n=34)]. In terms of immunosuppression regimen, mTOR inhibitor mono therapy was 31.7%; mycophenolate mofetil (MMF)/mTOR inhibitor, 26.9%; tacrolimus (FK)/mTOR inhibitor, 23%. Chemotherapy was combined in 23.5% and 57.4% of EVL and SRL patients respectively. Sorafenib was most common chemotherapeutic agent, which was up to 76.9% among all combined chemotherapies.
Among main AEs, HAT was not found at all and dyslipidemia was mostly common AEs (34.3%). The other AEs were stomatitis 7.8%, dermatologic problem 5.9%, incisional hernia 3.9%, and delayed wound healing 1.0%. The severity of AEs was mostly grade 1 or 2. ACR was reported in one case in the SRL mono group and the SRL/FK group each, and treated adding FK or MMF without steroid pulse therapy.

Conclusion: Usage of mTOR inhibitors in LT is safe and AEs were acceptable.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-059

Poster Title: Real-world impact of prophylactic pegfilgrastim in diffuse large B-cell lymphoma (DLBCL) patients receiving cyclophosphamide, doxorubicin, vincristine, and prednisolone (CHOP) with or without rituximab chemotherapy in Korea

Primary Author: Mi-ri-nae Lee, Asan Medical Center; **Email:** l0121mirinae@naver.com

Additional Author (s):
Hye-Won Han
Jae-Youn Kim
Hyesun Gwak

Purpose: Febrile neutropenia (FN) is a major and potentially life-threatening complication of myelosuppressive chemotherapy. Pegfilgrastim which is the second generation granulocyte-colony stimulating factor can reduce neutropenia risk during the chemotherapy course. But, there are limitations of pegfilgrastim use in several types of cancer and chemotherapy because of the criteria of national health insurance in Korea. Pegfilgrastim of CHOP (cyclophosphamide, doxorubicin, vincristine, prednisolone) with or without rituximab chemotherapy in diffuse large B-cell lymphoma (DLBCL) occupies large portion in insurance coverage. This study aims to examine real-world impact of prophylactic pegfilgrastim in patients receiving CHOP-based chemotherapy in DLBCL.

Methods: This single-center, nonrandomized, retrospective cohort study was conducted at the Asan Medical Center in Korea after approval by institutional review board. Pegfilgrastim was introduced at July 2014 in the center. Prophylactic pegfilgrastim (PP) group consisted of patients under age 65 who were diagnosed with DLBCL after introduction of pegfilgrastim (from July 2014 to June 2015). Non-PP group consisted of patients under age 65 who were diagnosed with DLBCL before introduction of pegfilgrastim (from July 2013 to June 2014). PP group included 77 patients and non-PP group included 83 patients. All patients had received their 1st cycle of (R)CHOP chemotherapy within the study period of time and received at least 1 cycle of (R)CHOP chemotherapy. Patients' baseline data and events related neutropenia were obtained from electronic medical records and patients charts. The primary end point was comparison of FN incidence at 1st cycle and in all cycles. The secondary end point was comparison of neturopenic events incidence at 1st cycle and in all cycles, comparison of FN or neutropenic events incidence by cycles. FN and neutropenic events were compared using chi-square tests.

In addition, risk factor of developing FN and neutropenia was analyzed by logistic regression. Primary author Lee was involved in overall research. Unit manager Han was responsible for the statistical advice and team manager Kim and Professor Gwak conducted research review as co-authors.

Results: Prophylactic pegfilgrastim were used to all patients with (R)CHOP regimen in DLBCL through their chemotherapy courses after introduction of pegfilgrastim in Asan Medical Center. The incidence of FN at 1st cycle was lower in PP group than non-PP group (PP 6 cases [7.8 percent] vs. non-PP 16 cases [19.3 percent], p equals 0.035). PP group had lower incidence of FN than non-PP group in all 866 cycles (PP 31 cases [7.0 percent] vs. non-PP 48 cases [11.3 percent], p equals 0.031). The incidence of grade 3 or 4 neutropenia was similar to the incidence of FN. There were significantly statistical differences by cycles, but neutropenia incidence of PP group was lower than non-PP group in general. In multiple logistic regression, hemoglobin less than 12 g/dL (Odd Ratio 2.15, 95 percent CI 1.27 to 3.62, p equals 0.004), platelet less than 100 k/mm3 (Odd Ratio 5.15, 95 percent CI 1.43 to 18.16, p equals 0.011), serum creatinine greater than or equal to 1.4 mg/dL (Odd Ratio 4.46, 95 percent CI 1.17 to 17.04, p equals 0.029) were associated with FN occurrence.

Conclusion: Prophylactic pegfilgrastim was associated with fewer neutropenic events in patients receiving (R)CHOP regimen in DLBCL, regardless of cycles. It is reasonable to use prophylactic pegfilgrastim during all chemotherapy cycles including initial cycle considering that higher incidence of neutropenic events at 1st cycle. In addition, consideration should be given to patient-related risk factors when determining the appropriate use of pegfilgrastim.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-060

Poster Title: Medication-use evaluation of anidulafungin in a secondary care hospital

Primary Author: Maria Leon-Martinez, Comprehensive Pharmacy Service; **Email:** maria.victoria@cpspharm.com

Additional Author (s):
Nancy Morales-Berrios
Hilda Aleman
MIguel Colon
Pedro Jusino

Purpose: Appropriate use of antifungal agents is essential to limit resistance and increase the likelihood of good treatment response. The purpose of this medication use evaluation was to assess anidulafungin use in a secondary care hospital and develop and implement recommendations in order to reduce monthly anidulafungin costs per patient day.

Methods: A retrospective evaluation was conducted of all patients prescribed anidulafungin from January 1, 2015 to June 30, 2015. The following data was collected for each anidulafungin order: results of blood cultures, duration of anidulafungin therapy, prior use of antimicrobial and antifungal agents, documentation of signs and symptoms of suspected fungal infection, total parenteral nutrition (TPN) use and the use of medical devices such as: mechanical ventilators, intravenous access and urinary catheters. All data was recorded from electronic medical records and analyzed with descriptive statistics such as means and percentages.

Results: A total of 48 patients were evaluated in the time period specified. All patients evaluated reported positive cultures for Candida species. Forty–six percent of patients reported a positive culture for Candida glabrata while the remaining fifty–four percent reported positive cultures for other Candida species. The positive cultures were sourced from fifty–six percent in sputum and sixty percent in urine. Eighty–one percent of these cultures resulted from patients utilizing mechanical devices such as mechanical ventilators and urinary catheters. Seventy–five percent of all patients received at least one dose of fluconazole before commencing therapy with anidulafungin. All anidulafungin orders were initiated by, or followed up by, an infectious disease specialist. All patients were dosed correctly. Recommendations were evaluated one month after implementation and a savings of $0.58 per patient day was achieved.

Conclusion: After analyzing the data, it was found that sixty percent of patients started on anidulafungin were due to Candida species from any source regardless of the presence of documented signs and symptoms related to a fungal infection in the doctor's progress note. The remaining forty percent of patients who received anidulafungin were considered treatment – justified due to positive cultures and documented signs and symptoms of fungal infection in the progress note. This evaluation demonstrated that there is a great opportunity to improve the use of anidulafungin in the institution.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-061

Poster Title: Characterization of admitting diagnoses in medically hospitalized patients prescribed clozapine: a focus on gastrointestinal and pulmonary events

Primary Author: Jonathan Leung, Mayo Clinic, Rochester, MN; **Email:** leung.jonathan@mayo.edu

Additional Author (s):
Sarah Nelson
Jason Barreto
Robert Morgan

Purpose: Clozapine is the antipsychotic of choice for treatment resistant schizophrenia. While clozapine has demonstrated superiority over other antipsychotics, rigorous monitoring is required to prevent or detect adverse drug events. In addition to agranulocytosis, clozapine is associated with hypotension, seizures, cardiomyopathy, myocarditis, pneumonia, and gastrointestinal hypomotility which may result in hospitalization. We assessed the reason for hospitalization in patients prescribed clozapine between 1/1/2003 and 8/1/2015 admitted to non-psychiatric medical units.

Methods: In this IRB approved retrospective chart review, patients prescribed clozapine were identified via pharmacy records. Once clozapine patients were identified, available electronic medical records were evaluated to identify any medical hospital admissions. Patients with schizophrenia or schizoaffective disorder were included if they were over the age of 17 and were admitted for a non-psychiatric medical concern. We collected patient demographics, admitting service type, whether a psychiatry consult was obtained, clozapine dosing/levels, interactions, smoking status, and reason for clozapine changes. Given the exploratory nature of this study, descriptive statistics were used to describe outcome variables.

Results: 104 patients, representing 248 hospitalizations, were admitted to a medical unit. Psychiatry consults were requested in 25% of admission, primarily for the purpose of assessing polypharmacy or recommending clozapine re-titrations. The predominant admission type was for the management of pulmonary (32.2%) or gastrointestinal (19.8%) illnesses. The leading pulmonary illness documented was pneumonia, accounting for 57.5% of pulmonary admissions; and gastrointestinal hypomotility, ranging from constipation to death, represented 61.2% of

gastrointestinal admissions. Three deaths (2 gastrointestinal, 1 cardiomyopathy) were associated with clozapine therapy. Admissions for seizure involved 5 patients in 5 separate admissions. Myocarditis was not a reason for hospitalization of any patient; although 2 patients were admitted for pericarditis in which 1 was considered idiopathic. A diagnosis of idiopathic cardiomyopathy was diagnosed in one patient and complications from this ultimately led to death. Admissions for the management of clozapine-associated severe neutropenia did not occur in this cohort of patients. However 2 patients who received concomitant chemotherapy for malignancy during an inpatient admission developed neutropenia and clozapine was subsequently discontinued. Two patients discontinued clozapine to due to neutropenia but in each case concomitant chemotherapy was given. Ciprofloxacin, a potent inhibitor of clozapine, was associated with clozapine toxicity in several cases.

Conclusion: Pneumonia has been proposed to occur in part by clozapine-induced sialorrhea and subsequent aspiration. Gastrointestinal hypomotility if not monitored for closely can have significant consequence, and has been described as the leading cause of death associated with clozapine. These finding in combination with the growing number of case publications should raise awareness regarding the consequences of clozapine-associated pneumonia and gastrointestinal hypomotility, which can have life-threatening consequences. Larger well-conducted studies are needed to evaluate strategies to minimize or prevent these clozapine-associated adverse events which may result in increased morbidity and mortality.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-062

Poster Title: Study of the association of urinary tract infections occurrence and the use of azathioprine in kidney transplant patients

Primary Author: Aline Milane, Lebanese American University; **Email:** aline.milane@lau.edu.lb

Additional Author (s):
Pascale Salameh
Antoine Barbari

Purpose: Immunosuppressive agents are destined to reduce rejection rate after kidney transplantation. However, they simultaneously increase the risk of opportunistic infections in transplant recipients.

Methods: The study is retrospective and was approved by the institutional review board. 300 kidney transplant patients were followed for infections from the transplantation date and during 24 months after surgery. Infections that patients were screened for included urinary tract infections (UTIs), EBV, CMV, HCV, HBV, Parvovirus and Polioma Virus. Immunosuppressive regimen prescribed to our patients' population included the use of azathioprine. We performed a logistic regression analysis to study the association of UTIs occurrence and the average prescribed dose of azathioprine.

Results: The mean age of our patients was 35.8±13.7 years old. 43% were males and 57% females. 98 patients out of 200 (32.6%) had a UTI in the 24 months post-transplantation. The average prescribed dose of azathioprine dose was 77.5±38.1 mg in patients who had a UTI and 71.4±25.3 mg in patients who did not have a UTI. Logistic regression analysis did not show a significant association of azathioprine dose with the occurrence of UTI in our patients (OR=1.022 [90% CI: 0.988-1.047; p=0.070].

Conclusion: The life saving effect of immunosuppressive drug put patients at a risk of opportunistic infections. The UTIs occurrence in our patients' population was not associated with the azathioprine dose prescribed as part of the immunosuppressive regimen.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-063

Poster Title: Improving adherence to Centers for Disease Control and Prevention (CDC) recommendations for quadrivalent meningococcal (QM) vaccination in anatomical asplenia

Primary Author: Nicholas O'Rourke, Mayo Clinic; **Email:** orourke.nicholas@mayo.edu

Additional Author (s):
Whitney Bergquist

Purpose: There is increasing complexity in CDC recommended vaccines for patients undergoing splenectomy. Given this trend, ensuring a reliable system for ordering these vaccines remains a pivotal role for pharmacists. A discrepancy was discovered between our institutional order tool guidance and CDC recommendations for QM vaccination in anatomical asplenia. Specifically, this order tool allowed the prescriber to select quadrivalent meningococcal polysaccharide (QMP) vaccine, yet CDC recommends quadrivalent meningococcal conjugate (QMC) vaccine for all adult patients with anatomical asplenia. This revelation allowed for an opportunity to better guide prescribers to select the appropriate vaccine by improving our splenectomy vaccines order tool.

Methods: We conducted a medication use evaluation of QM vaccine prescribing in patients who had under gone splenectomy and investigated compliance with CDC recommendations. Compliance was calculated by dividing the number of QMC orders by QM orders. We utilized a data base at our institution to identify all QMP and QMC vaccines that were ordered for hospitalized patients from February through August of 2015. The option of QMP in the splenectomy vaccines order tool was removed on June 1st, 2015, which was used to separate the pre-intervention and post-intervention phase. We conducted a retrospective chart review of all identified patients to confirm inclusion and exclusion criteria. Inclusion criteria: QM vaccine orders with a documented indication for splenectomy. Exclusion criteria: indications for QM vaccine other than splenectomy, pediatric patients and other vulnerable populations. This project was approved by the institutional review board.

Results: A total of 90 QM vaccine orders were initially identified by our data base search. Following the retrospective chart review for inclusion and exclusion criteria, 43 QM vaccine orders were included in the final analysis. There were 30 QM vaccine orders placed in the pre-intervention phase; 14 QMC orders and 16 QMP orders. There were 13 QM vaccine orders

placed in post-intervention phase; 12 QMC orders and 1 QMP order. Adherence to CDC recommendations for QM vaccines in splenectomy patients increased nearly 2-fold from 47% in the pre-intervention phase to 92% in the post-intervention phase.

Conclusion: By eliminating the option of QMP in the splenectomy vaccines order tool, compliance with CDC recommendations for QM vaccines in splenectomy patients was substantially improved.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-064

Poster Title: Demonstration of unique and differentiating features of USL255, (topiramate) extended-release capsules, through phase 1 studies

Primary Author: Anna Plasch, Upsher-Smith Laboratories, Inc.; **Email:** anna.plasch@upsher-smith.com

Additional Author (s):
Kristi Spitzmueller
Bethany Dimaculangan
Mark Halvorsen

Purpose: Extended-release (XR) antiepileptic drugs are designed to reduce dosing frequency and maintain consistent drug plasma concentrations. These features may improve treatment adherence, reduce breakthrough seizures, and minimize adverse events. Once-daily (QD) USL255, Qudexy® XR (topiramate) extended-release capsules, was designed to provide equivalent plasma exposure to twice-daily immediate-release topiramate (BID TPM-IR), with an improved pharmacokinetic (PK) profile. Presented here are clinical study results demonstrating these characteristics and other unique dosing features of USL255.

Methods: Several randomized, crossover, open-label, single-center phase 1 PK studies were conducted to evaluate the PK properties of USL255. PK equivalence between 200 mg QD USL255 and 100 mg BID TPM-IR was evaluated in a single-dose study (N=36) and a multiple-dose study (N=38); the maintenance of steady-state plasma concentrations after switching from TPM-IR to USL255 was also examined. Dosing features of USL255 were assessed in four single-dose studies. Two studies (N=80 total) evaluating a large range of USL255 doses were combined to determine dose proportionality from 25 – 1,400 mg. A third study (N=36) determined the PK effect of dosing USL255 with a high-fat meal compared with USL255 administered after an overnight fast. Finally, a fourth study (N=36) evaluated bioequivalence between USL255 capsule contents sprinkled onto soft food and the intact capsule. PK parameters assessed in all studies included area under the plasma concentration-time curve (AUC) and maximum/minimum plasma concentrations (Cmax and Cmin). For comparative assessments, AUC and Cmax values were considered PK equivalent if the ratio of the geometric least-squares mean values had a 90% confidence interval (CI) between 0.80 – 1.25. Institutional review boards approved study protocols, and participants provided written informed consent.

Results: PHARMACOKINETIC EQUIVALENCE BETWEEN QD USL255 AND BID TPM-IR: A single dose of 200 mg USL255 demonstrated PK equivalence to 2 doses of 100 mg TPM-IR administered BID (AUC0-∞ 90% CI: 0.84 – 0.99). The multiple-dose study confirmed the steady-state PK equivalence of QD USL255 to BID TPM-IR (AUC0-24 90% CI: 1.02 – 1.05), with reduced plasma fluctuations for USL255 (significantly lower Cmax and higher Cmin vs TPM-IR; $P < .001$). Further, directly switching from TPM-IR to USL255 did not result in significant changes in Cmin, indicating maintenance of topiramate plasma concentrations. DOSING FEATURES OF USL255: Dose proportionality of AUC and Cmax were observed between the dose ranges of 25 – 1,400 mg and 50 – 1,400 mg, respectively. Dosing USL255 with a high-fat meal had no significant effect on AUC and Cmax (90% CI for the fed:fasted ratios were between 0.80 – 1.25). In addition, AUC and Cmax were bioequivalent between USL255 capsule contents sprinkled onto soft food and the intact capsule (90% CI AUC0-∞: 0.98 – 1.05; Cmax: 1.03 – 1.14).

Conclusion: Once-daily USL255 exhibits favorable PK characteristics by demonstrating PK equivalence to TPM-IR under multiple conditions (single dose, multiple dose, day of switch) with decreased plasma fluctuations. The wide range of dose proportionality of USL255 allows for titration and use of different dosage strengths with confidence. Finally, USL255 can be taken with or without food, and the capsule can be opened and its contents sprinkled onto soft food for patients with swallowing difficulties. Overall, this unique combination of an improved PK profile and various dosing features suggest USL255 may be a useful treatment option for patients with epilepsy. The FDA has approved USL255, Qudexy® XR (topiramate) extended-release capsules, as initial monotherapy in patients 2 years of age and older with partial-onset seizures (POS) or primary generalized tonic-clonic (PGTC) seizures and as adjunctive therapy in patients 2 years of age and older with POS, PGTC seizures, or seizures associated with Lennox-Gastaut syndrome.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-065

Poster Title: Efficacy, tolerability, and safety of USL255, (topiramate) extended-release capsules, for the treatment of refractory partial-onset seizures

Primary Author: Kristi Spitzmueller, Upsher-Smith Laboratories, Inc.; **Email:** kristi.spitzmueller@upsher-smith.com

Additional Author (s):
Bethany Dimaculangan
Anna Plasch
Mark Halvorsen

Purpose: Despite treatment with one or more antiepileptic drugs (AEDs), as many as 30% of patients with epilepsy remain refractory to treatment. Extended-release AEDs—designed to reduce dosing frequency and maintain consistent drug plasma concentrations—may improve treatment adherence, reduce breakthrough seizures, and minimize adverse events (AEs). Once-daily USL255, Qudexy® XR (topiramate) extended-release capsules, is FDA approved as initial monotherapy in patients 2 years of age and older with partial-onset seizures (POS) or primary generalized tonic-clonic (PGTC) seizures and as adjunctive therapy in patients 2 years of age and older with POS, PGTC seizures, or seizures associated with Lennox-Gastaut syndrome. Presented here are clinical study results demonstrating efficacy, tolerability, and safety of USL255 for the adjunctive treatment of refractory POS.

Methods: Two phase 3 studies evaluated adjunctive USL255 treatment in adult patients with POS. In PREVAIL (NCT01142193; N=249), patients were randomized to placebo (n=125) or USL255 (n=124), titrated over 3 weeks (50 mg/week), and maintained at 200 mg/day or placebo for 8 weeks. The open-label extension (OLE) study (PREVAIL OLE [NCT01191086]; N=210) consisted of a 3-week blinded-conversion phase followed by a 52-week open-label treatment phase. After 11 weeks of treatment in the OLE, changes in USL255 dosage (50 mg/week up or down, maximum of 400 mg/day) and changes in concomitant AEDs and their dosages were allowed. Assessments in both studies included: median percent reduction from baseline in weekly POS frequency, 50% responder rate (proportion of patients with at least 50% reduction from baseline in weekly POS frequency), and incidence/severity of treatment-emergent AEs (TEAEs). Post hoc analyses of both studies included an evaluation of efficacy by patient age and by drug refractoriness (highly drug-resistant seizures: at least 2 concurrent AEDs and at least 4

lifetime AEDs; less drug-resistant seizures: 1 concurrent AED or less than 4 lifetime AEDs). For both studies, baseline was the 8-week period prior to the start of treatment in PREVAIL. Institutional review boards approved study protocols, and participants provided written informed consent.

Results: In PREVAIL, completion rates were 83% for the USL255 group and 91% for the placebo group; fewer than 10% of subjects in either treatment group discontinued due to AEs. Of the 217 patients who completed PREVAIL, 210 (97%) enrolled in the OLE. Of these, a total of 150 patients (71%) completed the OLE. The most common reasons for OLE discontinuation were voluntary withdrawal by patient (11%) and AEs (9.5%). During PREVAIL, 200 mg/day USL255 resulted in significantly greater median percent reduction from baseline in weekly POS frequency versus placebo (39.5% vs 21.7%, $P < .001$) and significantly higher 50% responder rate (37.9% vs 23.2%, P=.013). For the 52-week open-label phase of the OLE, median percent reduction from baseline in weekly POS frequency was 59% and the 50% responder rate was 62%. The proportion of patients with at least 1 TEAE during PREVAIL was 66% (USL255) and 50% (placebo) (P=.015), and during the OLE was 69.5%. In both studies, the majority of TEAEs were reported as mild-to-moderate in intensity. Post hoc analyses demonstrated that seizure reduction during both studies was observed across all adult age groups and in patients with highly drug-resistant and less drug-resistant seizures.

Conclusion: In these studies, USL255 was well tolerated, safe, and demonstrated significant reduction in weekly POS frequency versus placebo during the 11-week PREVAIL study, with continued seizure reduction throughout the year-long OLE. Efficacy during both studies also was observed across all adult age groups and in patients with highly drug-resistant seizures. Taken together, these data demonstrate that once-daily USL255, Qudexy® XR (topiramate) extended-release capsules, provides a safe, effective, and well-tolerated treatment option for long-term management of epilepsy in a variety of patients.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-066

Poster Title: Intractable agitation due to trazodone in two traumatic brain injury patients undergoing acute inpatient rehabilitation-involvement of CYP2D6 polymorphism as a possible mechanism.

Primary Author: Nadia Tancredi, Marianjoy Rehab Hospital; **Email:** downstreem@aol.com

Additional Author (s):
Rishi Shah

Purpose:
Case 1: 8 year old male with a past medical history of asthma and attention-deficit/hyperactivity disorder was an unrestrained passenger in the back seat of a vehicle hit by a dump truck. He was ejected from the vehicle. The Glasgow Coma Scale score was 5 at the scene. Computed tomography scan of the head revealed diffuse axonal injury and left frontal lobe contusion. He also suffered a non-displaced right rib fracture, distal radial fracture and right index finger avulsion injury. His hospital course was complicated by severe agitation as well as seizures. At the acute care hospital, he was given risperidone, lorazepam, clonidine and hydroxyzine for agitation. For sleep he was given trazodone. On admission to acute inpatient rehabilitation, he was noted to be significantly agitated and trazodone was increased from 50mg to 100mg at bedtime. Over the next three days, his agitation worsened. He was unable to participate in therapy. In attempt to control agitation, clonidine dose was increased and clonidine patch was added. Trazodone dose was again increased, to 200mg at bedtime. After the second night of 200mg trazodone, the patient had an episode of large emesis and shaking. Seizure was ruled out. He continued to have multiple episodes of emesis and agitation throughout the night, and because these coincided with the trazodone dose increase, the trazodone was discontinued. Within 24 hours of the discontinuation of trazodone, his agitation was noted to be significantly improved and he was actively participating in therapy. Over the next few days, both clonidine and risperidone doses were reduced. No other episodes of agitation were noted during the remainder of his stay.
Case 2: 33 year old male with no significant past medical history, suffered a traumatic brain injury after being struck by a train. Patient suffered diffuse axonal injury, subarachnoid hemorrhage, intraparenchymal hemorrhage, subdural and epidural hematoma. He also suffered a displaced T1 transverse process and right scapular fracture. Patient's stay in the acute care hospital was complicated by shock, respiratory failure, and pulmonary embolism

with IVC filter placement. Once medically stabilized, he was transferred to acute inpatient rehabilitation. Patient was continued on quetiapine and clonazepam for agitation. He was also noted to have difficulty sleeping, for which trazodone was added. Agitation was measured using the Agitated Behavior Scale (ABS). After trazodone therapy was initiated, his agitation worsened. Multiple medications were added in an attempt to control the agitation, but were unsuccessful. Not until trazodone was discontinued was there a significant improvement in agitation reflected in a significant drop in his ABS score. Average ABS score while on trazodone was 32, average ABS score once trazodone was discontinued was 17.5.
Trazodone is an antidepressant which acts as a serotonin antagonist and reuptake inhibitor. It has wide use as a sleep aid because of its hypnotic effects. It is extensively metabolized by Cytochrome P450 enzymes. Approximately 20% of trazodone is metabolized by CYP3A4 to meta-Chlorophenylpiperazine (mCPP), which acts as a potent serotonin agonist at the serotonin 2B and 2C receptors. It is the serotonin agonist properties of mCPP that are associated with anxiogenesis. mCPP is metabolized by CYP2D6. Genetic polymorphisms of CYP2D6 have been well-documented in the literature. Absence of or decreased functioning of CYP2D6 can lead to an accumulation of mCPP, suggesting an etiology for the worsening agitation as seen in these two patients.

Methods:

Results:

Conclusion:

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-067

Poster Title: Nutritional strategies in colorectal cancer after major intraabdominal surgery

Primary Author: Silvia Vazquez, EOXI Pontevedra Salnes; **Email:** silvia.vazquez.blanco@sergas.es

Additional Author (s):
María Fortes
María García
Lara González
Carlos Crespo-Diz

Purpose: Malnutrition is associated with high postoperative morbidity and mortality rates. Parenteral nutrition improves survival but is associated with some complications. The current trend is to establish a normal oral diet as early as possible.
The aim of this study was to assess the costs associated to the maintenance of nutritional status after major gastrointestinal surgery.

Methods: We performed a 6 months-duration retrospective observational study (from May to November 2014). All patients with colorectal cancer who underwent hemicolectomy or sigmoidectomy and received oral supplement with immunonutrients (Impact®) were included. The results were compared to a similar (diagnostic, type of surgery and nutritional status) retrospective control group which received parenteral nutrition in May-November 2013 period.
The variables collected were: age, gender, surgical interventions, length of hospitalisation, nutritional status before surgery, nutritional status after surgery and costs.
The source of data were: electronic medical records (IANUS®), pharmaceutical validation program (Silicon®) and surgical scheduling.
Nutritional status assessment was performed by the CONUT toll using the following laboratory parameters: serum albumin, cholesterol level and total lymphocyte count. Effectiveness was defined as the absence of worsening nutritional status at discharge.
All data were analysed using SPSS software (Version 19). Continuous variables were compared by T-Student. Categorical variables were compared by Chi-square.

Results: From 99 patients, 44 (44.4%) were excluded due to lacking of laboratory parameters.

55 patients were included: 28 patients (50.9%) received enteral nutrition and 27 patients (49.1%) received parenteral nutrition. Baseline characteristics were similar in both groups: age (years) 72.1±12.7 vs 69.2±12.9, p=0.407; gender (female) 12 (42.9%) vs 7 (25.9%), p=0.187; surgical intervention (hemicolectomy) 14 (50%) vs 14 (51.9 %), p=0.891 and patients with normal nutrition 19 (67.9%) vs 14 (51.9%), p=0.093. The enteral nutritional formula was adequate in 21.4% of cases against 22.2% achieved with parenteral nutrition (p=0.578). Regarding to the length of hospital stay, mean duration was 7.5 days (minimum 5, maximum 19 days) for the enteral support and 9 days (minimum 5, maximum 63 days) for parenteral group (p=0.143).
Average cost per patient for enteral and parenteral nutrition were 52.4€ and 163.7€, respectively.

Conclusion: The study demostrated that nutritional screening was not performed in a large number of patients. Due to lack of this data half of patients were discarded.
Statistically significant differences were not found concerning to effectiveness (duration of hospital stay and nutritional control) between parenteral and enteral groups. The enteral formula Impact® saves 111.3 € per patient.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-068

Poster Title: Trends in erythropoiesis stimulating agents use among patients with non-myeloid malignancies treated with chemotherapy in a large tertiary care hospital in the United Arab Emirates

Primary Author: Lina Wahba, Tawam Hospital; **Email:** lwahba@seha.ae

Additional Author (s):
Alia Alawneh
Medhat Elsaid
Hassan Jaafar
Mohammed Jaloudi

Purpose: Erythropoiesis stimulating agents (ESA) are commonly used to treat chemotherapy-induced anemia (CIA) in patients with non-myeloid malignancies. The national comprehensive cancer network guidelines (NCCN) recommend against the use of these agents when cure is the intent of therapy. In addition the FDA label specified that those agents should be initiated only if the hemoglobin level < 10g/dl. It was shown that the use of ESAs has dropped dramatically in the United States due to the recent recommendations. The aim of this study is to assess the trend in the use of darbepoetin alfa (DA) for the management of CIA in a large tertiary care hospital in UAE.

Methods: An observational cross-sectional retrospective analysis was performed on the use of DA in patients with non-myeloid malignancies seen in the outpatient medical oncology clinic in the time period between October 2011- March 2012 (group1) and January 2015-June 2015 (group2). This study was approved by the institutional review board. Electronic medical records were used to collect patients demographics and related clinical characteristics. Descriptive statistics and two sample t-test were used as appropriate.

Results: Seventy patients in group 1 received darbopoetin alpha (DA) for a median duration of 8 weeks while 16 patients in group 2 received it for a median of 4 weeks. Mean age, baseline hemoglobin (Hb) in group 1 and 2 was 53.5, and 59.7 years, 9.2g/dl and 9.1g/dl, respectively. Thirty four percent of group 1 had a Hb level of more than 10 g/dl, on the other hand, only 6% had a Hb level of more than 10g/dl in group 2. Number of patients who received blood transfusion during the duration of therapy in group 1 was 6 (8.5%) and 11 (68%) in group2. Fifty

nine (84%) patients in group 1 were receiving iron therapy, 10 (62.5%) in group 2. The intent of treatment was curative in 11 (16%) of group 1 and 1 (6%) in group 2. Two tailed t-test showed statistically significant difference in blood transfusion requirement but not in the intent of chemotherapy treatment.

Conclusion: Our results showed that the change in ESA use, between the two time periods, was in compliance with the recent international recommendations. In addition it confirmed that the use of ESAs has decreased over time, while use of RBC transfusion has increased.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-069

Poster Title: Identifying and implementing a pharmacist-driven cost-savings initiative in orthopedic surgery through a community hospital and physician co-management agreement

Primary Author: Jeffrey Wilson, Dignity Health - Mercy Gilbert Medical Center/Chandler Regional Medical Center; **Email:** jeffrey.wilson@dignityhealth.org

Additional Author (s):
Maxwell Thomas

Purpose: Cost containment is one of the bigger challenges facing the health care system. Many pharmacy departments across the country have been tasked to finding savings opportunities. As a community hospital that does not employ physicians, certain savings opportunities are harder to accomplish than others. Our hospital entered into a co-management agreement with 3 local orthopedic surgery practices to work collaboratively to improve outcomes, provide financial stability, and enhance the patient experience. The structure of the co-management agreement provided an avenue to identify and operationalize a sizable cost saving initiative.

Methods: Research was completed on some of the largest expenses in our pharmacy budget to identify a few cost savings opportunities. It was noted that our orthopedics program was using intravenous acetaminophen as a standard in all of the lower extremity total joint arthroplasty patients. The usage of this agent in comparison to its oral equivalent adds an additional twenty four dollars in cost per dose. Given the lack of robust clinical data to support the superiority of this route of administration over its oral equivalent, upon institutional board review, a change to the standard plan was proposed and approved by the physician group for inclusion. The change was conversion from intravenous acetaminophen to oral acetaminophen at the same dose and frequency. Length of stay and patient satisfaction scores were measured before and after the inclusion of this intervention. Patient satisfaction scores were collected through the usage of the HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) surveys and used as the marker of pain management. The individual question on the survey that was used asks the patient how often their pain was well controlled. The number used in our reporting is the percentage of patient surveys returned that answered “always”.

Results: Length of stay was subdivided based on whether the procedure was a total hip or total knee arthroplasty. The average length of stay on total knee arthroplasty patients pre-

intervention was 2.24 days and post-intervention was 2.22 days. For total hip arthroplasty patients, the pre-intervention length of stay was 2.06 days and post-intervention was 1.79 days. The percentage of patient returned surveys that indicated their pain was always well controlled was 82.07 in the pre-intervention group and 87.16 in the post-intervention group.

Conclusion: Utilizing the benefits of a community hospital and physician co-management, a significant cost savings opportunity was able to be approved and put into place. The benefits seen in this service area have been able to be used as a catalyst for change in other patient populations. This intervention has directly contributed to a twenty percent overall reduction in intravenous acetaminophen usage at our hospital.

Submission Category: General Clinical Practice

Session-Board Number: 6-070

Poster Title: Evaluation of micafungin usage before and after antimicrobial stewardship program (ASP) implementation

Primary Author: Mohammed Khedr, St Joseph's Wayne Hospital; **Email:** lmj.richards@gmail.com

Additional Author (s):
Lynette Richards
Samia Fawzi

Purpose: The ASP, initiated in June 2016, is composed of pharmacy, infection control, and the chief of infectious disease. The ASP team reviews restricted antibiotics and antifungals within the 200 bed facility. At our institution, micafungin was approved for empiric or definitive treatment of patients with C. glabrata, C. krusei, fluconazole resistant organisms, invasive aspergillosis, and neutropenic fever. Micafungin may be used in cases of significant drug interactions and /or co-morbidities contraindicating the use of alternative agents. The purpose of this medication evaluation is to determine the impact of implementing ASP on the appropriateness of micafungin use.

Methods: A retrospective study was performed from November 01, 2014 to January 31, 2016 which included patients treated with at least 2 or more doses of micafungin. The data collected was comprised of baseline demographics, length of stay, microbiology results, urinalysis, allergy, pertinent past medical history, prior and concurrent antibiotic use, prior and concurrent antifungal use, potential drug interactions to fluconazole, total and peripheral parental nutrition, and ordering physician. Patients were then divided into pre and post ASP implementation for comparison. A t-test was used to determine statistical significance.

Results: Sixty-five patients were included in the analysis (pre-ASP=42, post-ASP=23). The mean age was 62 (29 to 97 years of age). Pre-ASP group (n= 42) fungal growth patterns were as follows: C .albicans (n=11), C. parapsilosis (n=3), C.glabrata (n=7), C. lusitaniae (n=2), C.tropicalis (n=13) and C.krusei (n=3). Fifty-two percent (n=22) were in intensive care unit. Significant drug interactions were identified in 12 cases. Sixty seven percent (n=31) had fungi in the urine, 7 percent (n=3) in tracheal aspirate, 13 percent (n=6) in blood, 9 percent (n=4) in sputum and 4

percent (n=2) bronchial washing/lungs. Seventy-three percent (n=31) of prescribing was appropriate.
Post-ASP group (n=23) fungal growth patterns were as follows: C. albicans(n=8), C. glabrata (n=2), C.krusei (n=1), C. dublinienesis (n=1), C. parapsilosis(n=2) and C.tropicalis (n=3). Sixty one percent (n=14) patients were in the intensive care unit. Significant drug interactions were identified in 7 cases. Fifty three percent (n=10) patients had fungi in the urine/ foley, 10.5 percent (n=2) pts in sputum, 5 percent (n =1) in tracheal aspirate, 21 percent (n=4) in the blood and 10.5 percent (n=2) in a leg and foot wound. Eighty-three percent (n=19) of prescribing was appropriate.
Statistical analysis by t-test, p=0.429.

Conclusion: There was a trend in improved micafungin prescribing although it was not statistically significant from baseline. Education about ASP and feedback to prescribers is warranted to ensure optimal utilization of restricted antimicrobials, cost avoidance, and decreased Multi drug resistant organisms development.

Submission Category: General Clinical Practice

Session-Board Number: 6-071

Poster Title: Impact of transitions-of-care pharmacy services on Medicare beneficiaries' 30-day readmission rates

Primary Author: Rezarta Lako, Highland Hospital; **Email:** rezarta_lako@urmc.rochester.edu

Additional Author (s):
Arin Affonso
Jeff Huntress

Purpose: Medicare patients have a high risk for readmissions, with approximately 1 in 5 being readmitted within 30 days. Medication management and comprehensive transitions of care pharmacy services are an area of focus to reduce readmission rates for this patient population and reduce healthcare costs. Stemming from the Affordable Care Act, a Community-Based Care Transitions Program was created to test models improving the transition from hospital to home. Highland Hospital is a 261 bed community hospital in Rochester, NY that participated in this program with a multidisciplinary team that included pharmacists in their model.

Methods: A Transitions of Care Pharmacist involved at the start of the Community-Based Care Transitions Program in 2011 provided comprehensive pharmacy services that included admission medication reconciliation, discharge medication reconciliation, ensuring accessibility to medications and supplies, discharge counseling and communication to visiting nursing services and primary care providers for post-discharge follow-up. The project expanded to create an additional position for a Transitions of Care Pharmacist in 2014 to assist with this patient population. Readmission rate data was collected since March of 2013.

Results: Readmission rate analysis of our Medicare fee-for-service patients enrolled in our transitions of care pharmacy services program from March 2013 to December 2015 have demonstrated a 30 percent lower 30-day all cause readmission rate to our hospital compared to those patients not enrolled in our program.

Conclusion: Pharmacist involvement in transitions of care activities including medication management can help reduce readmission rates for Medicare beneficiaries. Our resources and collaborative efforts have demonstrated reduced hospital readmission rates, promoted

healthcare cost-effectiveness and resulted in increased use of our institution's outpatient pharmacy to provide medications upon discharge.

Submission Category: General Clinical Practice

Session-Board Number: 6-072

Poster Title: Implementing practice guidelines for intradialytic hypotension (IDH) prevention and management at a small long-term acute care hospital (LTACH): one-year follow-up

Primary Author: Helena Lee, Comprehensive Pharmacy Servicies; **Email:** hlee@bridgepointhealthcare.com

Additional Author (s):
Vernetta Scott
James Park
Brian Beckett
Arnold Dallas

Purpose: Guideline were implemented for the proper prevention and management of IDH at an 82-bed LTACH in May 2015. The purpose of this study is to evaluate the impact of pharmacy intervention on clinical care and healthcare costs after one year of IDH guideline utilization.

Methods: A medication use evaluation on albumin was performed retrospectively to assess if recommendations previously made were implemented and resulted in cost minimization and improved clinical care. The guidelines require dialysis nurses to check patient's opioids and titrate high blood pressure medications before initiating dialysis. The dialysis team also had to follow new protocols to prevent and treat IDH including decreasing ultrafiltration infusion rate, restoring intravascular volume with 0.9% sodium chloride infusion, administering albumin 25% infusion, and reviewing the hemodialysis medication administration record. Data from before and after implementation of the IDH guidelines was collected then compared. The baseline period was defined as February 1 through April 30, 2015, initial implementation period was from May 1 through May 30, 2015 (Period 1), and the second review period was from March 1 through March 31, 2016 (Period 2). Investigational Review Board (IRB) was exempted for this quality improvement project. Number of dialysis sessions, total albumin cost, patient days (PDs), and medication cost per patient-day (CPPD) were compared before and after implementing IDH management and prevention guidelines.

Results: During the baseline period, 80% of patients who experienced IDH were treated with albumin, and IDH prevention was not properly done for most patients. The average PDs during the baseline period was 1,287 with an average of 95 patients per month on dialysis. Average

doses of 25% albumin (50mL) given to patients for IDH treatment were 89 vials per month during the same period. After implementing the new guidelines, during Period 1 and Period 2, PDs and number of dialysis cases were similar or higher (1,298 and 89 cases and 1,791 and 125 cases, respectively), while albumin usage had been decreased significantly in both measures to treat IDH (11 and 8 doses given, respectively). Albumin cost per dialysis case decreased from $57.11 at baseline to $6.80 and $2.80 at the Period 1 and 2, respectively. Further, albumin cost per patient day decreased from $4.15 to $0.51 then $0.20. All IDH episodes during the study period were treated or prevented successfully. The study revealed that the IDH management guidelines were not followed in the majority of patients who received albumin for IDH and the treatment of IDH was not consistent among dialysis nurses.

Conclusion: Implementing IDH management and prevention guidelines by the multidisciplinary team showed vast reduction in IDH events and albumin usage at this facility. It also played a large role in hospital-wide cost savings initiatives. A one year follow-up study showed that pharmacy intervention with the dialysis team has been effective. This study can be helpful for small hospitals which provides dialysis.

Submission Category: General Clinical Practice

Session-Board Number: 6-073

Poster Title: Implementation of a standardized process for pharmacist monitoring of medications with a narrow therapeutic window

Primary Author: Ann Lloyd, The University of Oklahoma College of Pharmacy/Saint Francis Hospital; **Email:** ann-lloyd@ouhsc.edu

Additional Author (s):
Teresa Cooper
Vivian Carson

Purpose: After implementing a new electronic medical record system in 2014, an increase in the number and type of pharmacy dosing consults occurred. Prior to 2014, daily monitoring of consult patients was managed by clinical pharmacy specialists. As dosing consult workload exceeded the capacity of the clinical pharmacy specialists, development of a comprehensive and efficient model for drug monitoring was identified as a need by pharmacy leadership as well as providers. This project was designed to standardize the process for pharmacist monitoring of patients receiving medications with a narrow therapeutic window using a tool within the electronic medical record.

Methods: Using vancomycin as a model, a clock monitoring service was implemented for hospital pharmacists to assess all patients on vancomycin seven days a week in a health system anchored by a 1,112-bed tertiary care facility with a pharmacy practice model that is largely centralized. A protocol approved by the Pharmacy & Therapeutics committee allows pharmacists to order serum creatinine and trough levels for all patients receiving vancomycin. Five clinical pharmacy specialists piloted the new model before full implementation. Education was provided online and followed with live in-service training to all pharmacists across the health system. Pharmacists are expected to assess and document in a brief monitoring note the following: baseline serum creatinine, most recent serum creatinine, last trough level, next scheduled trough level, and dialysis status. Upon completion of the documentation, a monitoring clock on the patient list resets to indicate the time passed since the last review was completed

Results: Forty pharmacists completed the live training session, 26 completed the online training, and 24 completed both training modules. The new monitoring service program was implemented on July 1, 2015. Pre-implementation, an average of 23 non-consult patients and 48 pharmacy consult patients were on vancomycin daily. After implementation, pharmacists monitor on average 19 non-consult patients and 55 patients on pharmacy consult service. The percent of patients on the pharmacy consult service has increased from 67.3% pre-implementation to 74.2% after implementation.

Conclusion: The implementation of the Vancomycin Clock Monitoring service standardized the process for pharmacist monitoring of vancomycin. It has improved efficiency of monitoring for all patients receiving vancomycin across the health system. After the successful implementation of the vancomycin monitoring program, the clock monitoring process has expanded to include clinical specialist monitoring of the following: aminoglycosides, immunosuppressants, and metabolic monitoring for antipsychotics. It is also being piloted for antimicrobial stewardship.

Submission Category: General Clinical Practice

Session-Board Number: 6-074

Poster Title: Evaluation of the training and implementation of the New Mexico pharmacist-performed tuberculosis testing program

Primary Author: Stefanie Logothetis, University of New Mexico College of Pharmacy; **Email:** slogothetis@salud.unm.edu

Additional Author (s):
Matthew Borrego
Amy Bachyrycz
Graham Timmins
Bernadette Jakeman

Purpose: New Mexico (NM) is the only state that allows pharmacists the opportunity to prescribe and administer tuberculin skin tests (TSTs). The objective of this study was to evaluate the training and implementation of the NM pharmacist-performed tuberculosis (TB) testing program.

Methods: This was a cross-sectional study of NM pharmacists who have completed the TB testing certification through the NM Department of Health and the NM Pharmacists Association between March 2011 and May 2016. Participants were asked to complete a phone survey to evaluate the training program and the implementation of the pharmacist-performed TB testing program. Data collected included: pharmacist demographics (e.g., age, gender), years since licensure, pharmacy setting [e.g., chain, independent, clinic], county of practice, reasons for obtaining optional certification, training time required, whether required training time was appropriate, quality of training program, self-perceived competency at the end of the training, methods to improve training, whether or not they are currently performing TB tests in community pharmacies, and reasons for not using certification if they are not currently testing. Descriptive statistics such as means and frequencies were performed for the study variables. The study was approved by the University of New Mexico Health Sciences Center's Human Research Review Committee.

Results: A total of 209 pharmacists and pharmacy students completed the TB testing certification training course. A convenience sample of 53 subjects was surveyed. A total of 50

out of the 53 pharmacists contacted consented to participation in the study (94 percent response rate). Practice settings were represented as follows: chain pharmacy (54 percent), independent (32 percent), clinic (4 percent), hospital (4 percent) and other (6 percent). Of the participants, 100 percent reported the quality of their training met or exceeded their expectations. All survey respondents (100 percent) strongly agreed or agreed that pharmacist performed tuberculosis testing can have a positive impact on community public health; however, only 82 percent strongly agreed or agreed to the implementation of this initiative being successful. Currently, 27 (54 percent) of the pharmacists surveyed are actively performing TB testing. Of the 27, 59 percent report administering 1 to 2 tests per week, 18 percent report 3 to 4 tests per week, 7 percent report 5 to 6 tests per week, 11 percent report 6 to 7 tests per week and 4 percent report more than 7 tests per week. Employer lack of support was the most frequent reason reported for not performing TSTs (57 percent).

Conclusion: Pharmacist-performed TB testing in NM is perceived by NM pharmacists as beneficial and having a positive impact on community health. NM pharmacists believe that their training time was adequate in order to feel confident administering the test and interpreting the results. Implementation of the program has been perceived as successful. The main hindrance to implementation was reported as employer support.

Submission Category: General Clinical Practice

Session-Board Number: 6-075

Poster Title: Current practice patterns in the management of alcohol withdrawal syndrome: a case-based survey study

Primary Author: Yoonsun Mo, Western New England University; **Email:** yoonsmo@gmail.com

Additional Author (s):
Michael Thomas
Natalia Shcherbakova
Megan Bankert
Robert Halloran

Purpose: As alcohol dependence has become a major public health problem in the United States (U.S.), many hospitals face challenges in treating patients with varying degrees of alcohol withdrawal syndrome (AWS). While benzodiazepine (BZD) has been a mainstay of therapy for the management of AWS, there are significant variations among hospitals with regard to a choice of adjunctive pharmacologic agents. Furthermore, uncertainty persists regarding the optimal management of AWS due to lack of clear guidelines and well-designed studies on a variety of different pharmacological agents. The purpose of this study was to evaluate the current practice patterns surrounding the management of AWS.

Methods: This was a survey study of pharmacists practicing in the Northeast region of the U.S., which was approved by the institutional review board of Western New England University. A survey questionnaire containing items on demographics as well as four clinical scenarios with several treatment options related to current practice in the management of AWS was developed. All hospitals with greater than 100 beds located in the Northeast region were selected from the 6th edition of the American Hospital Association guide. In March 2016, a total of 512 surveys were mailed to pharmacy directors with a postage-paid return envelope. Additionally, a separate postcard with a respondent identifier was included in the mailing. The postcards were used to determine nonrespondents. A reminder postcard was mailed to all nonrespondents 3 weeks after the initial survey. Four weeks after the postcard reminder, a second survey packet was mailed to nonrespondents. Descriptive statistical analyses were used to examine the data.

Results: Responses from a total of 44 hospitals from the nine states in the Northeast region were included in the analyses. The questionnaires were completed mainly by pharmacy directors or managers (57 percent), followed by clinical pharmacists (30 percent). A majority of hospitals (77 percent) had less than 300 beds, but one-half of the hospitals were affiliated with a medical residency program. Approximately 80 percent of respondents reported using the Clinical Institute Withdrawal Assessment of Alcohol Scale, Revised (CIWA-Ar) scales routinely to assess the severity of AWS. For the treatment of mild, moderate, and severe AWS, most institutions utilized the protocols or guidelines (71, 73, and 66 percent, respectively). However, two-thirds of the hospitals indicated that the guidelines or protocols were not in place to treat BZD-refractory AWS. A BZD-only treatment strategy was selected as the first choice for mild and moderate AWS (66 and 52 percent, respectively), whereas a BZD regimen in combination with a variety of other agents including haloperidol, dexmedetomidine, phenobarbital, or propofol was most frequently used in the treatment of severe and BZD-refractory AWS.

Conclusion: The findings suggest that considerable heterogeneity exists particularly in the treatment of severe and BZD-refractory AWS among hospitals in the Northeast region. A national survey is needed to determine if AWS treatment regimens in the Northeast region are representative of practice patterns in the U.S. Given that current guidelines from various organizations mainly focus on BZD therapy, the results of this survey highlight the need for updated, uniform practice guidelines utilizing other treatment strategies especially for more severe AWS.

Submission Category: General Clinical Practice

Session-Board Number: 6-076

Poster Title: Determining the appropriateness and safety of discontinuing metformin upon admission in the inpatient non-critically ill setting: a retrospective study

Primary Author: Robyn Moodt, University Hospitals Geneva Medical Center and Conneaut Medical Center; **Email:** robyn.moodt@uhhospitals.org

Additional Author (s):
Mate Soric

Purpose: Numerous guidelines suggest discontinuation of oral hypoglycemic agents upon hospitalization for most non-critically ill diabetic patients. The data to support this recommendation are mainly retrospective studies that showed a percentage of prescribers are not compliant with metformin prescribing guidelines. To my knowledge, there have been no large multicenter prospective studies have shown benefit in discontinuing metformin in a non-critically ill patient. Metformin has been associated with lactic acidosis, but studies have shown that it is extremely rare, happens at a similar rate as other diabetic medications, and suggests no increased mortality in patients that develop lactic acidosis while on metformin.

Methods: The institutional review board approved this retrospective study will use electronic medical records to identify eligible inpatients that had metformin continued or withheld upon admission. The following will be collected if available: patients' name, medical record number, age, gender, height, weight, serum creatinine, estimated glomerular filtration rate, point of care blood glucose readings, time and date of blood glucose readings, HbA1c, lactate levels, use of steroids, thiazides, loop diuretics, fluoroquinolones, linezolid, non-selective beta blockers, beta agonists, statins, atypical antipsychotics, and azole antifungals, length of stay, and 30-day readmission rate. A Charlson Comorbidity Index will be calculated for each patient. The provider documents will be examined to determine if the patient required surgery or IV radiocontrast dye, had excessive alcohol intake, anorexia, or a diagnosis of infection or heart failure. The primary endpoint will be a composite endpoint consisting of the mean number of glycemic events per hospital day. Glycemic event is defined as a blood glucose of < 70 mg/dL, which will be considered hypoglycemic and/or a blood glucose of >180 mg/dL, which will be considered hyperglycemic. The secondary endpoints will be hypoglycemic events per hospital day, hyperglycemic events per hospital day, incidence of lactic acidosis, geometric mean length of stay, and readmission within thirty days of discharge.

Results: Eight hundred and eighty seven electronic medical records were reviewed and 726 were excluded. The main reason for exclusion was no metformin on board upon admission. All baseline characteristics were similar between both groups except for loop diuretic use (p=0.007). The primary endpoint of mean number of glycemic events per hospital day showed 1.3 (0.80-1.93) events/day in the metformin group and 2.0(1.28-2.58) events/day in the metformin held group (p=0.21). The pertinent secondary endpoint was geometric length of stay and readmission within 30 days. The geometric mean length of stay (SD) showed 3.2 (0.3) days in the metformin group and 2.2 (0.4) days in the metformin held group (p=0.001). Readmission within 30 days did show a non-statistical significance difference (p=0.52), however, there are more patients readmitted within 30 days in the metformin group (17%) compared to the metformin held group (14%).

Conclusion: In conclusion, we did find a non-statistical significant difference between the metformin and the metformin held group in mean number of glycemic events per hospital day. However, we did not have an adequate amount of patients to reach statistical significance for our primary endpoint. Continuation of data collection will resume to confirm or reject our findings so far, and further research is needed in this area to improve practice and, more importantly, patient care.

Submission Category: General Clinical Practice

Session-Board Number: 6-077

Poster Title: Impact of a pharmacist-directed discharge medication review pilot on the accuracy of medication reconciliation in an acute care community hospital

Primary Author: Khanh Ngo, Comprehensive Pharmacy Services, CHI St. Luke's Health - The Woodlands Hospital; **Email:** kngo@stlukeshealth.org

Additional Author (s):
Erika Patel
Charles Schlembach
Kaye Rathmann
Ran Xu

Purpose: Medication errors are among the leading causes of preventable adverse drug events and often occur due to unintentional discrepancies when patients are at transitions of care, such as upon admission to and at discharge from hospital. Medication discrepancies at discharge were reported in up to 60% of patients in literature. A formal medication reconciliation process is integral to the reduction of these medication errors. Interventions by pharmacists have been shown to reduce medication discrepancies and omissions at discharge. The purpose of this project is to assess the impact of a pharmacist-directed program on reducing errors during discharge medication reconciliation processes.

Methods: A pharmacist-directed pilot program to review discharge medications was conducted from September 2014 to July 2015 at CHI St. Luke's Health-The Woodlands Hospital (SLWH), a 212-bed acute care community hospital in the Woodlands, Texas. Previously, the inpatient pharmacy had successfully implemented a pharmacy-driven process for admission medication reconciliation, which significantly reduced medication discrepancies and errors in admission medication histories. Logically, our next goal was to implement a discharge medication review process to reduce medication errors in discharge medication reconciliation. Over the study period, SLWH had 9535 admitted adult patients. All discharge medication reconciliation and review processes were conducted in the electronic medical record. The inclusion criteria of this pilot were patients greater than 18 years old and whose discharge medication reconciliations had been completed by attending physicians prior to pharmacists' review. Priority was placed on patients who were seen by multiple consulting physicians. If time permitted, pharmacists also counseled the patients on their discharge medications. Pharmacists documented the

interventions on discharge medication reconciliations and the number of recommendations accepted by prescribers. Descriptive statistical analyses were performed.

Results: During the 11-month pilot period, pharmacists reviewed 2113 adult patients' discharge medication reconciliation records, which account for 22% of adult patients admitted to SLWH. On average, there were 2.9 new discharge medications, 7.9 continued medications, and 1.2 discontinued medications per patient on the discharge After Visit Summary (AVS) document. A total of 798 (38%) patients' admission medication histories were verified by pharmacists or pharmacy technicians. Pharmacists counseled 638 (30%) of the patients on their discharge medications. Among the 2113 patients reviewed, pharmacists made recommendations on 487 (23%) patients (859 discharge medications). Recommendations were accepted on 332 (16%) patients (583 medications), and AVS was subsequently amended. The intervention acceptance rate was 68%. The majority of discharge medication errors were caused by communication breakdown between consulting physicians and attending physicians. Consequently, consulting physicians' recommendations were not incorporated in the discharge AVS before patients were discharged.

Conclusion: This study raised awareness of the medication errors during the discharge medication reconciliation processes at an acute care community hospital. After pharmacists' review, nearly 20% of patients' AVS required corrections prior to discharge in this pilot. With a pharmacist-directed program, we were able to identify errors and improve accuracy of discharge medication reconciliation. Future studies should focus on other clinical and quality outcomes such as patients' compliance to medication regimens post discharge and readmission rates to hospital or emergency department.

Submission Category: General Clinical Practice

Session-Board Number: 6-078

Poster Title: Evaluation of the post-acute care transitions (PACT) pharmacists' role

Primary Author: Kaitlin O'Rourke, Beth Israel Deaconess Medical Center; **Email:** korourk2@bidmc.harvard.edu

Additional Author (s):
Ilona Grigoryan

Purpose: The Post-Acute Care Transitions (PACT) Program is a three-year demonstration project funded by the Center for Medicare and Medicaid Innovation grant aimed at reducing readmission rates by utilizing eight nurses and four pharmacists for 30 day post-discharge follow-up. The PACT pharmacist provides medication reconciliation upon admission and discharge counseling upon patient discharge to home or an extended care facility. As the three-year grant came to a completion, this qualitative review was designed to assess pharmacists' role in care transitions and to evaluate the pharmacists' interventions.

Methods: This retrospective observational chart review collected interventions from 500 PACT patients from July 2014 through November 2014. Patients included in this review had Medicare and received primary care at one of six practices affiliated with Beth Israel Deaconess Medical Center (BIDMC) in Boston, Massachusetts. Patients were enrolled by the PACT nurse and pharmacist during hospitalization to our institution. PACT pharmacists provided medication reconciliation at hospital admission and discharge. The pharmacist also provided medication counseling and assessed barriers to medication adherence. The interventions were documented in the electronic medical record. Patient demographics, drug classes, type of intervention made, patient's discharge disposition and pharmacist's time were collected for review.

Results: The top five interventions made by pharmacists include new medication regimen (28 percent), missing medication during medication reconciliation (27 percent), medication adherence (22 percent), wrong dose (12 percent), and explaining administration technique (11 percent). The top six drug classes involved in pharmacist interventions were cardiovascular agents (33 percent), vitamins (19 percent), pain control (18 percent), antibiotics (11 percent), gastrointestinal agents (11 percent), and asthma agents (8 percent). On average, the PACT pharmacist spent 26 minutes per patient encounter. Many interventions included the Institute

for Safe Medication Practices (ISMP) high alert medications. The most frequent ISMP high alert medications involved with PACT interventions were oxycodone (28 percent), warfarin (26 percent), tramadol (12 percent), insulin glargine (12 percent), insulin lispro (11 percent), and enoxaparin (11 percent). Out of the 3,400 interventions made by the PACT pharmacists, 471 interventions involved high risk medications, approximating to one high risk medication per patient.

Conclusion: These observations indicated PACT pharmacists' interventions could impact the number of medication errors identified during reconciliation that may lead to readmission. Pharmacists possess a unique skill set which enables them to better evaluate medication use and adherence and to potentially reduce medication errors. Preliminary findings showed the PACT program reduced readmission rates in comparison to the hospital average, with the final results currently under review. The utilization of pharmacists in transitions of care has been sustained at our institution after the completion of the grant and is now funded and supported by the institution.

Submission Category: General Clinical Practice

Session-Board Number: 6-079

Poster Title: The impact of pharmaceutical medication review, medication interview before discharge and follow up on the incidence of patient satisfaction and readmissions: a randomized clinical trial

Primary Author: Lene Ravn-Nielsen, Hospital Pharmacy of Funen; **Email:** lene.ravn-nielsen@rsyd.dk

Additional Author (s):

Purpose: Transition from hospital to primary care is known to infer a risk of drug-related problems, e.g., due to miscommunication between the hospital and the primary care physician. These problems may include medication errors, side-effects, incorrect dosages or even readmission. The purpose of this study was to determine the effects of a multifaceted pharmacist intervention based on medication review, medication interview before discharge and follow up on patient satisfaction, hospitalizations, readmissions and death.

Methods: A randomized controlled multi-center study was conducted with patients at four different Acute Medicine Admission wards in Denmark. A total of 1500 patients were randomized to (i) usual care (no intervention), (ii) basic intervention (medication review), and (iii) extended intervention (a multifaceted pharmacist intervention). The multifaceted pharmacist intervention consists of a medication review, medication interview before discharge and follow up with patient, general practitioner, nursing home if relevant and pharmacy one week and six month after discharge. The criteria for inclusion were: 18 years or older, regular use of at least five prescription drugs, speaking and understanding Danish, being admitted via the Acute Medicine Admission ward. Exclusion criteria were: Terminal illness, suicidal toxic reaction, restraint patients, severe dementia and im- or expressively aphasic patients. Patient satisfaction was evaluated with a sample of the extended intervention group at six month follow up by telephone interview in a short questionnaire. Number of hospitalizations is defined as number of admissions within six month after the patients was included in the study. Readmissions are defined as thirteen days after date of inclusion. The patients were identified by reviewing the electronic patient chart. The patients had to give written consent and the study was approved by The Regional Scientific Ethical Committee for Southern Denmark.

Results: 503 patients were allocated to usual care, 499 to basic intervention and 497 to extended intervention. 801 (53 percent) out of 1500 were females and 699 (47 percent) were males. The median was 72 years. The inter quartile range, IQR was 64-80 and the range was 18-100 years. Patient satisfaction was evaluated for 173 (35 percent) patients from the extended intervention group from Odense and Svendborg. 161 (93 percent were very satisfied or satisfied with the intervention eight (five percent) were neither satisfied or unsatisfied. 158 (91 percent) found it very positive or positive that a pharmacist was involved in the medication process under admission, at transition and six month after discharge. 11 (6 percent) were neutral. 4 patients (2 percent) was unable to answer the questionnaire. 115 (66 percent) patients commented the intervention.

Conclusion: The multifaceted pharmacist intervention was associated with a high degree of patient satisfaction and the patient comments indicates that this multifaceted tailored intervention delivered by clinical pharmacists should be an integrated part of the medication process in order to increase the continuity of the medication treatment. Results of hospitalizations, readmissions and deaths will be presented at the poster.

Submission Category: General Clinical Practice

Session-Board Number: 6-080

Poster Title: Thromboprophylaxis practice in surgical patients and clinical outcomes: analyze to optimize

Primary Author: Almudena Ribed, Hospital General Universitario Gregorio MArañón, Pharmacy Deparment; **Email:** almudena.ribed@salud.madrid.org

Additional Author (s):
Ana Lorenzo-Pinto
Esther Duran-García
Ana Herranz-Alonso
María Sanjurjo-Sáez

Purpose: Venous tromboembolism (VTE) remains a significant problem in surgical patients. Nevertheless, prophylaxis is not always well implemented in clinical practice. The aim of this study is to evaluate thromboprophylaxis patterns in patients undergoing orthopedic and abdominal surgery and their concordance with the institutional protocol. The secondary objective is to analyze 30 and 60-days postoperative outcomes.

Methods: A cross-sectional, observational, prospective and descriptive study was designed. The study has been carried out in accordance with the World Medical Association Declaration of Helsinki.
Adult patients undergoing total hip surgery, total knee surgery or patients with hip fractures and undergoing colon or stomach surgery hospitalized from May to June 2015 were included in the study. These surgeries were selected because of a high probability of development of VTE according to the literature and our institution's anticoagulation multidisciplinary team. The primary end-point was the adequacy of thromboprophylaxis according to the institutional protocol. Patients were follow-up during admission and within 30 and 60 days post discharge.

Results: 114 patients were followed up (77 orthopedic and 37 abdominal, mean age: 67.2; female: 56.1%, VTE high risk: 89.5%). A total of 96 patients (84.2%) initiated the adequate thromboprophylaxis during hospitalization according to their VTE risk and 94.8% at discharge. Deviations compare to the protocol were observed in 66 (57.9%) patients. Reasons for non-concordance: incomplete information given in the discharge summary (32.5%; most of them

orhopedic patients), incorrect post-surgical starting time (15.8%), omission of mechanical prophylaxis (13.2%), misdosing (9.6%) and omission of pharmacological prophylaxis (2.6%, all underwent colon or stomach surgeries).
Any patients developed VTE after 30 and 60 days post-discharge, 31 (27.2%), 14 (12.3%) patients had a readmission to the hospital and 10.5% needed a re-intervention. None of the readmissions or visits to the Emergency Department was related to VTE causes.

Conclusion: This study provides useful information for surgeons in daily clinical practice. Thromboprophylaxis is prescribed in most patients undergoing orthopedic and abdominal surgery in our institution. However, there are some aspects that leave room for improvement including mechanical prophylaxis, heparin timing, and extended thromboprophylaxis collected at patient discharge summary.

Submission Category: General Clinical Practice

Session-Board Number: 6-081

Poster Title: Pharmacist-managed penicillin allergy skin testing in an inpatient rehabilitation hospital setting

Primary Author: Stacia Rumer, Craig Hospital; **Email:** srumer@craighospital.org

Additional Author (s):
Erin Miller

Purpose: History of penicillin allergy is linked to increased length of hospital stay and increased exposure to antibiotics associated with Clostridium difficile and vancomycin-resistant enterococci, as well as antibiotic costs up to 63 percent higher than patients who do not report allergy to penicillin. Of 30 million US patients labeled as penicillin allergic, up to 95 percent do not have a true penicillin allergy. As a component of an antimicrobial stewardship program, penicillin allergy testing can verify which patients do not exhibit an IgE-mediated reaction which would permit optimal antibiotic selection, adverse reaction avoidance, reduced microbial resistance, and cost savings.

Methods: Patients who report a penicillin allergy are interviewed to determine the characteristics of the reaction. If the reaction is determined not a true allergy, the pharmacist updates the patient's allergy status. If the penicillin allergy status needs to be further clarified, the pharmacist proceeds with the penicillin allergy skin testing protocol. To be eligible, patients must avoid histamine-suppressive agents during the previous 48 hours and must not meet any exclusion criteria. Exclusion criteria include: recent (within last 5 years) immediate reaction, severe hypersensitivity reaction to penicillin (such as hemolytic anemia and Stevens Johnson syndrome), and severe immunosuppression. Once inclusion criteria is established, a trained pharmacist performs a scratch test utilizing a positive control (histamine), a negative control (saline), penicillin G 10,000 units/ml, and benzylpenicilloyl polylysine 0.00006 ml/L (PRE-PEN). The result is considered positive for penicillin allergy if a wheal greater than 3 mm appears within 10 minutes for either penicillin or benzylpenicilloyl polylysine. If the scratch test is not positive, an intradermal test is performed in which saline, penicillin, and benzylpenicilloyl polylysine are injected to form approximately 3 mm blebs. The result is positive if a wheal greater than 3 mm larger than the original intradermal injection appears within 10 minutes for penicillin or benzylpenicilloyl polylysine. If the result is negative (no wheal reaction relative to saline), the patient's allergy is removed from the record.

Results: Of 747 patient discharges from March 2015 through May 2016, 23 patients were identified for protocol. Four patients were interviewed and determined not to have true allergies, and penicillin allergy was removed from the medical record per protocol. Twelve patients received penicillin allergy skin testing with all of them negative for penicillin allergy, and penicillin allergy was removed from the medical record. Two patients reported a severe reaction, such as anaphylaxis to penicillin; therefore, penicillin allergy skin testing was not preformed per protocol and the allergy remained on the medical record. Three patients either declined or failed to complete the entire penicillin allergy skin testing protocol; therefore, the allergy remained on the medical record. Two patients failed to have a positive reaction to histamine scratch test, so the penicillin allergy skin testing protocol could not be completed and the allergy remained on the medical record.

Conclusion: Our consistently negative results for penicillin allergy align with findings from previous, larger studies. By safely eliminating inaccurate penicillin allergy information, our patients have the opportunity to receive less toxic, less costly, and more appropriate therapy to treat future infections.

Submission Category: General Clinical Practice

Session-Board Number: 6-082

Poster Title: Impact and cost benefit of pharmacy student provided medication reconciliation in community hospital

Primary Author: Alyssa Shangraw, St. Peter's Health Partners, Samaritan Hospital; **Email:** alyssa.shangraw@sphp.com

Additional Author (s):
Olivia Emerson
Piyushkumar Amin

Purpose: Transition of patients from home or facility to the hospital is a time that can lead to potential medication errors. Research has proven that pharmacy derived medication reconciliation is an effective process that can reduce medication errors. Pharmacy interns' or pharmacists' involvement at the start of a patient's admission to obtain an up to date and complete medication list can reduce potential medication errors. For this study, initiating medication reconciliations by pharmacy staff prior to patient's admission into two community hospitals was evaluated to determine if medication errors could be decreased and reviewed for potential cost savings.

Methods: We describe the impact of a pharmacy facilitated medication reconciliation process in the Emergency Department (ED) and Pre Admission Testing (PAT) prior to admission to the hospital. The two hospitals are 150 and 75 bed acute care centers that admit approximately 700 and 350 patients per month, respectively. The pharmacy team included pharmacists, pharmacy interns, and pharmacy rotation students. The pharmacy team completed patient medication history and reconciliation in the emergency room of each hospital prior to the providers entering and completing the patient's inpatient orders for approximately eight to eleven hours a day, seven days a week. Patients were also seen once admitted to the floors, if they were not seen by the pharmacy team in the ED prior. If discrepancies were found once a patient was admitted to the hospital, prescribers were contacted and notified of the differences for consideration of changes. Patients were also seen in PAT prior to arrival for surgery if they were going to be admitted overnight for observation at the 150 bed hospital only. Behavioral health patients were excluded from this review.

Results: Over one year of review, there was an increase of medication reconciliations completed for patients admitted throughout the hospital of 13 percent at the 150 bed hospital and 63 percent at the 75 bed hospital. Pharmacy reviewed about 7000 medications each month for patients, and spent approximately 140 hours each month performing medication reconciliation. On average, this hybrid model of pharmacy rotation students and paid pharmacy interns saved the hospital approximately ten dollars per medication reconciliation versus completion by a pharmacist. This is about 71,000 dollars per year at the larger hospital and 26,000 dollars per year at the smaller hospital. The pharmacy team was able to decrease the number of discrepancies that reached the patients, which demonstrated potential to improve patient safety.

Conclusion: Pharmacy led medication reconciliation in the ED and PAT prior to patient's admission into the hospital has shown positive outcomes, and decreases in medication discrepancies that could potentially reach the patient. Dedicated support throughout the hospital, from senior leadership down to the pharmacy staff, can increase the success of a medication reconciliation program.

Submission Category: General Clinical Practice

Session-Board Number: 6-083

Poster Title: The effect of pharmacy counseling on the patient hospital experience

Primary Author: Bradley Shinn, The University of Findlay College of Pharmacy; **Email:** shinn@findlay.edu

Additional Author (s):
Stephon Poulton
Thomas Foti

Purpose: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey and 30-day readmission rates play a substantial role in hospital reimbursement decisions. The purpose of this study was to utilize a pharmacy intern to develop and implement a pharmacist-managed medication counseling program in a community hospital which historically had minimal pharmacist-patient interactions. After demonstrating success with this pilot study, these data will be utilized to encourage hospital administrators to commit necessary resources to expand the program throughout the hospital on a permanent basis.

Methods: This project was approved by the hospital administration and by the Institutional Review Board (IRB) associated with the pharmacy intern's college of pharmacy. Hospital patients were counseled between May and August, 2015 by a pharmacy intern who had completed two professional years in his pharmacy program. This study was conducted on a single medical-surgical unit within the hospital. The pharmacy intern reviewed the medical record of each patient and then reviewed each medication-related recommendation and specific counseling points with a hospital pharmacist prior to discussing them with the patient. The intern then obtained the appropriate medication handouts and counseled each patient. The counseling sessions consisted of medication indications, administration recommendations, and positive medication benefits and potential adverse effects that may be expected. Counseling emphasis was given to new medications initiated during hospitalization, but chronic medications were also discussed, as indicated. Patients were counseled throughout their hospital stays and at discharge. Patient demographic information was collected and tracked for readmission rates and HCAHPS scores. All interactions were documented in the electronic medical record (EMR). At the conclusion of the study, a survey of other healthcare workers (HCWs) was conducted to assess overall satisfaction with this pilot program.

Results: A total of 139 patients were counseled with 156 interactions documented. Analgesics, antibiotics, and anticoagulants were the top three medication categories for which counseling was provided. HCAHPS scores for the study nursing unit were at their lowest points in April, 2015 (45.2 percent). During the course of the study, HCAHPS scores consistently increased, peaking at 76.6 percent in September, 2015. Once the study concluded, these scores decreased to less than 60 percent over the next three months. Patients discharged from the study nursing unit also had lower readmission rates compared to patients who did not receive pharmacy counseling. The overall readmission rate between May and August was 9.06 percent for the entire hospital, 7.46 percent for all medical-surgical units, and 2.4 percent for the pharmacy-counseled group. The follow-up survey showed that this program was well-accepted by other HCWs within the hospital. More than 80 percent of those surveyed strongly agreed that this program increased interprofessional interactions and support expansion of the program throughout the hospital.

Conclusion: This pilot program demonstrates that a pharmacist-managed counseling program can improve patient-reported hospital satisfaction scores and healthcare outcomes, as measured by hospital readmission rates. Reduced readmission rates should also result in financial benefits for the hospital, which may provide funds for an expansion of this counseling program. This program was also strongly supported by other HCWs, who expressed high satisfaction with this pharmacy-based service. These data support continued implementation and expansion of this program throughout the hospital.

Submission Category: General Clinical Practice

Session-Board Number: 6-084

Poster Title: Impact of multidisciplinary transition-of-care rounds on average length of stay in a community teaching hospital

Primary Author: Lori-Belle Slone, King's Daughters Medical Center; **Email:** loribelle.slone@kdmc.kdhs.us

Additional Author (s):
Brittany Riley
Charbel Salem
Heidi Moore

Purpose: Decreasing length of stay is a primary focus in many hospitals due to reimbursement and the risk of hospital-acquired infections. Length of stay is often increased and discharged delayed due to poor communication and silo management among health-care providers. The purpose of this study was to determine if multidisciplinary transition of care rounds would decrease the average length of stay in a community hospital.

Methods: In June 2015, the hospital began conducting multidisciplinary transition of care rounds on four select nursing units. These rounds were implemented in addition to multidisciplinary patient rounds that may have occurred. The team included case management, social work, charge nurse, hospitalist, and the clinical pharmacist for that nursing unit. The meetings were led by an administrative team that consisted of a physician (chief medical informatics officer), nurse (director of transitions of care), and pharmacist (clinical manager). They were designed to be 30 minutes in length (per unit), twice a week. The team addressed barriers to discharge, anticipated barriers to a smooth transition and broken system processes. Pharmacists designed a transition of care rounding tool to be utilized by the team. The rounding tool identified barriers for discharge (i.e. foley, lines, drains to be removed) and medication issues needed addressed for a smooth transition of care (i.e. IV antibiotics, prior-authorizations/patient assistance needed for medications). This study was exempt from IRB approval. Pre-implementation data was collected from October 2014 through May 2015. The month of June 2015 served as a washout period. Post-implementation data was collected from July 2015 through February 2016. Data collected was the average length of stay for each unit and the hospital overall. All data was analyzed using an independent samples t-test. Data analysis was performed using IBM SPSS.

Results: Average length of stay for the Heart and Vascular Intermediate Unit was 5.9335 days in the pre-implementation period and 5.13 days in the post-implementation period (p-value equals 0.002). Average length of stay for the Heart and Vascular Surgical Unit was 4.7625 days in the pre-implementation period and 4.0238 days in the post-implementation period (p-value equals 0.006). Average length of stay for the Heart and Vascular Step down unit was 5.1761 days in the pre-implementation period and 4.7988 days in the post-implementation period (p-value equals 0.008). Average length of stay for the Respiratory Step-Down Unit was 5.225 days in the pre-implementation period and 4.3862 days in the post-implementation period (p-value equals 0.001).

Conclusion: Implementation of transition of care rounds significantly reduced the length of stay on all four nursing units piloted on. Further studies are needed to determine if this would hold true for all nursing units in the hospital.

Submission Category: General Clinical Practice

Session-Board Number: 6-085

Poster Title: Evaluation of effectiveness of pharmacist-driven education on inhaler technique for hospitalized patients at a community teaching medical center

Primary Author: Khushbu Thaker, Hunterdon Medical Center; **Email:** thakerkhushbu@gmail.com

Additional Author (s):
Ashmi Philips
Hinal Patel
Thom Nguyen
Navin Philips

Purpose: The Hospital Readmissions Reduction Program was created in 2010 under the Affordable Care Act to reduce hospital readmissions within 30 days of discharge for applicable disease states. As a result, in 2012, Centers for Medicaid and Medicare Services (CMS) began reducing Medicare payments to hospitals with excess readmissions. This program was expanded in 2015 to include readmissions for chronic obstructive pulmonary disease (COPD) exacerbations. The purpose of this study was to evaluate the effectiveness of pharmacist-driven education during hospitalization in improving patient inhaler technique.

Methods: This was a single center, non-randomized, prospective study conducted from January to April 2016 which received expedited Institutional Review Board approval. Patients 18 years of age or older, admitted to the general medical floors utilizing dry-powder and soft-mist inhalers were included in the study. Patients on metered-dose inhalers were not included in the study with the exception of those on budesonide/formoterol. Those discharged to settings other than home or admitted to the intensive care unit, behavioral health, pediatric and maternity floors were also excluded. For patients who met the selection criteria, a pharmacist performed the following steps: evaluation of baseline inhaler technique, education on proper utilization and evaluation of post-education and post-discharge technique. Data was collected on 7 device types using a standardized survey with corresponding step-wise checklists. Post-discharge assessment was completed via telephone encounter 2 to 5 days following discharge. The primary endpoint was the percent change in inhaler technique scores from baseline to post-education. The secondary endpoints included percent change in scores from post-

education to post-discharge, commonly missed steps based on device type, and 30-day hospital reutilization rates.

Results: A total of 43 patients and 58 devices were assessed at baseline. Post-discharge assessments were conducted for 23 patients and 32 devices. Average baseline technique score was approximately 82 percent. This score significantly improved immediately following education as indicated by a percent change of 18.9 (p-value less than 0.0001). Comprehension was sustained 2 to 5 days post-discharge indicated by a percent change of 0.70 (p-value 0.293). Through comparing the step-wise checklists, breathing out prior to inhalations was identified as the unanimously missed step for all device types. The 30-day hospital reutilization rate was 13 percent with no readmissions related to COPD or asthma exacerbations.

Conclusion: Pharmacist-driven education during hospitalization significantly improved inhaler technique adherence and comprehension was sustained at short-term follow-up.

Submission Category: General Clinical Practice

Session-Board Number: 6-086

Poster Title: Retrospective analysis assessing the relationship between health literacy and medication adherence

Primary Author: Anthony Zaki, Northeastern University School of Pharmacy; **Email:** anthonyzaki@gmail.com

Additional Author (s):
Michael Gonyeau

Purpose: Adults with limited health literacy have difficulty understanding and using health information. Therefore, patients rely on pharmacist counseling and medication labels to better adhere to their medications, but can they truly decipher the information provided? Poor medication adherence can lead to a higher rate of hospitalizations and use of emergency services. The purpose of this study is to evaluate the relationship between health literacy and medication adherence. We hypothesize that patients at greater risk of poor health literacy will be less adherent to their medications.

Methods: The institutional review board approved this retrospective, observational study of 234 patients admitted to a general medicine service at a hospital in Boston, Massachusetts over a one-year period. Pharmacist and pharmacy student medication reconciliation notes were evaluated for medication adherence which was assessed using pharmacy refill records. Rapid Estimate of Adult Literacy in Medicine-Revised (REALM-R) scores were also collected. Subjects included were at least 18 years old, English-speaking, taking at least one prescription medication, and had completed a REALM-R evaluation. Patients were considered non-adherent if less than 80 percent of doses for any individual medication or less than 75 percent of doses of all medications were taken. Subjects with a REALM-R score of less than or equal to six were defined as at risk for poor health literacy. The primary outcome was identified as the relationship between poor health literacy and medication adherence. Bivariate pearson correlations were calculated to assess the primary outcome. All analyses were performed with the Statistical Package for the Social Sciences (SPSS) Version 23 with a two-tailed alpha of 0.05 used to measure significance.

Results: 171 of 234 patients met eligibility with a mean age of 56.35 plus or minus 19.47, average of 10 plus or minus 5.51 medications and mean REALM-R score of 6.76 plus or minus

2.16. 23.3 percent of patients were at risk for poor health literacy. 61.05 percent of patients were adherent to their medication regimen. Patients at risk for poor health literacy as well as those under the age of 60 had lower adherence rates (r equals 0.158, p less than 0.05; r equals 0.277, p less than 0.01). Patients with higher education levels had higher health literacy scores (r equals 0.404, p less than 0.001).

Conclusion: A relationship between health literacy and medication adherence exists, illustrating the importance of educating patients to encourage proper medication usage. While these data include a mostly adherent population that is at low risk for health literacy issues overall, a clinically significant benefit to patient health may be achieved through increased patient education.

Submission Category: Geriatrics

Session-Board Number: 6-087

Poster Title: Potentially inappropriate medications in elderly Japanese patients: effects of pharmacists' assessment and intervention based on screening tool of older persons' potentially inappropriate prescriptions criteria version 2

Primary Author: Takeshi Kimura, Kobe University Hospital; **Email:** kimutake@med.kobe-u.ac.jp

Additional Author (s):
Fumie Ogura
Tatsuya Nishioka
Ikuko Yano
Midori Hirai

Purpose: Potentially inappropriate medications (PIMs) in the elderly have become a global problem. Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP)/Screening Tool to Alert doctors to Right Treatment (START) criteria have been reported to be effective in improving prescription quality, as well as clinical, humanistic, and economic outcomes. The STOPP/START criteria were updated in October 2014; however, few studies have evaluated the STOPP criteria version 2 (STOPP criteria ver.2) for its application in elderly patients. The objective of this study was to evaluate the efficacy of pharmacists' assessment and intervention based on the STOPP criteria ver.2 in elderly Japanese patients.

Methods: A prospective observational study was conducted at three medical wards of our University Hospital between April and September 2015. New inpatients aged 65 years or older were included. Pharmacists performed medication reconciliation at the time of admission, and detected PIMs based on the STOPP criteria ver.2. If pharmacists judged that the benefit outweighed the risk of changing a medication, they intervened to discontinue or change it. The number of patients with PIMs, the number and contents of PIMs, and the number of medications changed after pharmacists' intervention were calculated.

Results: In total, 429 patients were included in this study (mean age 75.4 plus/minus 6.1 years, 55.2 percent males); of these, 183 patients (42.7 percent) and had one or more PIMs detected using STOPP criteria ver.2. The mean time required for pharmacists' assessment was 6.6 plus/minus 3.1 minutes per patient. The mean number of medications taken was 7.9 plus/minus 4.4 per patient, and patients with PIMs took significantly more medications

compared with those without PIMs (10.2 plus/minus 4.5 versus 6.2 plus/minus 3.4, P less than 0.01). The total number of PIMs was 363; 170 were discontinued or changed after pharmacists' intervention. The most frequent PIMs were related to benzodiazepines, with a detailed classifications as follows (changed/total): (1) benzodiazepines for 4 or more 4 weeks (48/122), (2) drugs that predictably increase the risk of falls in older people (benzodiazepines) (24/46), and (3) drugs that predictably increase the risk of falls in older people (Hypnotic Z-drugs) (11/23). The second most frequent PIMs were related to non-steroidal anti-inflammatory drugs (NSAIDs), with a detailed classifications as follows: (4) NSAIDs with established hypertension or heart failure (16/26), (5) NSAIDs if eGFR was below 50 ml/min/1.73m2 (11/14), and (6) COX-2 selective NSAIDs with concurrent cardiovascular disease (5/10).

Conclusion: Pharmacists' assessment and intervention based on STOPP criteria ver.2 were useful in effectively detecting and correcting PIMs in elderly patients. In Japan, because most PIMs were related to benzodiazepines and NSAIDs, these medications should be used carefully in elderly patients. Some of PIMs detected using STOPP criteria ver.2 (e.g. benzodiazepines or antipsychotics) had high risks of developing withdrawal symptoms or disease recurrence by prescription changes; therefore, the pharmacist should adequately evaluate the risk of disease exacerbation in each case and carefully determine whether the prescription should be changed.

Submission Category: Geriatrics

Session-Board Number: 6-088

Poster Title: Optimizing geriatric pharmacotherapy in a community hospital

Primary Author: Ursula Zienkiewicz, St. Joseph's Wayne Hospital; **Email:** uzienkie@sjhmc.org

Additional Author (s):
Lynette Richards

Purpose: The geriatric population has a wide array of complex disease states resulting in poly-pharmacy and other drug therapy complications. Studies have shown a geriatric pharmacist can improve patient care and outcomes. It was determined there was a need to provide targeted care for older adults at our 200-bed community hospital with a predominately geriatric population. The purpose of this evaluation is to determine if components of geriatric consult services can be effectively incorporated into current staff pharmacist responsibilities.

Methods: A pharmacist was assigned to complete medication reviews for inpatients 65 year old or greater on a medical-surgical floor. Medical records were reviewed for geriatric medication appropriateness (poly-pharmacy, medications that increase falls or delirium, prescribing cascade), medication reconciliation discrepancies, renal dose adjustments, significant drug interactions, expired orders, and other medication related issues. Nursing and physician staff was alerted of medications that could increase the risk for falls or delirium, of any medication reconciliation discrepancies and expired medication orders that should be continued. Pharmacist performed renal adjustments and screened for drug interactions.

Results: In total, 655 patient admission profiles were reviewed which included 168 unique patient encounters between October 28th, 2015 and April 25th, 2016. Geriatric medication inappropriateness was identified and clinicians were alerted in 23 cases. Out of the 655 profile reviews, the following interventions were made: medication reconciliation discrepancies (n=280), renal dose adjustments (n=13), drug interactions (n=1), expired orders (e.g. pain medications, sleep aids, anxiolytics) (n=74), IV to PO conversions (n=3), route changes (n=25). Overall, there were 419 interventions made. 8 adverse drug reactions on admission and 2 adverse drug reactions during admission were noted.

Conclusion: Results from this study will be used to develop workflows that address the demands of the geriatric population. Limitations to the study included the lack of clinical

outcomes, medication errors, and patient satisfaction surveillance. Some barriers to providing the most effective care included, pharmacist coverage limitations, training, and clinical knowledge deficit on geriatric specific drug therapy management. A redesigned workflow can optimize pharmacotherapy management in the geriatric population.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 6-089

Poster Title: Analysis of alerts and drug library limits in smart pumps following implementation

Primary Author: Kendra Delibert, UAB Hospital; **Email:** kendra.delibert@gmail.com

Additional Author (s):
Jedidiah Burroughs

Purpose: UAB Hospital recently transitioned to a new smart pump system at the main campus, community hospital, and infusion clinic in the spring of 2015. UAB implemented over 1,300 smart pumps throughout the institution. There are three libraries accessible within the pump: adult, pediatric and infusion center profiles. The smart pumps use a library that consists of soft and hard stops/limits for each drug. These limits are determined by the hospital. The purpose of this project was to evaluate the medications most frequently firing alerts within the smart infusion pumps and the accuracy of the drug libraries to prevent alert fatigue.

Methods: The following information was collected for each library: number of alerts, medication name, frequency of alert and type of alert. The 20 medications from each library that initiated the most alerts during the period of August 23rd- September 22nd, 2015 were evaluated for accuracy of the library. From this information, the smart pump libraries were updated. After making changes based on opportunities found, reports were run to assess if the change led to a decrease in the number of alerts. Information obtained from an assessment tool will be used to educate staff about the overrides and changes made.

Results: For the adult profile, changes were made to the limits of propofol and nitroglycerin. After implementation, the number of alerts for nitroglycerin was reduced by 23% and the number of alerts was reduced by 15% for propofol. For the infusion clinic profile, changes were made to the limits for gemcitabine, oxaliplatin and carfilzomib. Post-implementation the number of alerts for gemcitabine reduced by 49%, the number of alerts reduced for oxaliplatin by 58% and the number of alerts reduced by 38% for carfilzomib. For the pediatric profile, changes were made to vasopressin, gentamicin, lorazepam bolus, milirinone and tobramycin. The alerts were reduced by 34% for vasopressin and gentamicin, 90% for lorazepam bolus, 51% for milrinone and 60% for tobramycin.

Conclusion: This project evaluated the top twenty medications firing alerts for the three drug profiles at UAB Hospital. The majority of the top twenty medications firing alerts from each profile had accurate limits per the literature. After looking at the reports which evaluate the limits hit, it was shown that majority of the alerts were not due to the previous limits. In order to reduce the number of alerts, new reports will need to be generated to evaluate which type of alert is firing in order to make changes or re-educate staff.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 6-090

Poster Title: Utility of smart pump infusion dosing limits to prevent intravenous (IV) medication errors

Primary Author: Antoinette Duronio, Windsor Regional Hospital; **Email:** antoinette.duronio@wrh.on.ca

Additional Author (s):

Purpose: Smart pump technology continuously evolves with new safety features added to aid in reducing intravenous infusion and medication errors. Despite these advances, intravenous medication administration errors continue to occur. The purpose of this analysis was to determine the type, number, and severity of potential errors prevented following the introduction of advanced smart pump technology at our institution.

Methods: An observational analysis was conducted on data collected from June 3, 2015 to March 3, 2016 inclusive, to review the impact on harm prevention with IV infusions utilizing key safety features in the Baxter Sigma Spectrum infusion device. Safety features reviewed included: loading dose, bolus dose, and rate change limit alerts. These safety features were not available on previous infusion devices in our organization. Reports of loading dose soft limit alerts, bolus soft limit alerts, and rate change alerts were generated from continuous quality improvement software. Data analysis included the number of high-alert medications generating a rate change alert during titration, the number of alerts generated due to a dose exceeding the upper soft limit, and the number of alerts which resulted in the clinician modifying the programmed dose. Each of the events reviewed were assigned a score utilizing the IV Medication Harm Index, which included an assessment of the potential severity of bolus, load, and rate dosing change errors.

Results: A total of 68 loading dose soft limit alerts occurred. Forty two percent of alerts resulted in the clinician modifying the dose to one within the library limits; 62 percent of which were high-alert medications. Eleven of these events corresponded to an IV Medication Harm index of 8.45.
A total of 215 bolus dose soft limit alerts occurred, all resulting from high-alert medications. Thirty one percent of alerts resulted in a dose modification within the library limits. Majority (92.5 percent) of the bolus dose alerts occurred for propofol. Twenty eight percent of propofol

bolus alerts resulted in the clinician modifying the dose. Sixteen potential over dose events were associated with an IV Medication Harm index of 7, while fifteen were associated with a Harm Index of 10.
A total of 5983 rate change alerts occurred. 4.2 percent of all alerts resulted in a cancellation of rate change. Thirty eight percent of alerts were for high-alert medications, with 5.9 percent of these alerts resulting in a cancellation of intended rate change. The IV Harm Index for vasopressor events was 10, whereas all other events resulted in a Harm Index of 7.

Conclusion: This analysis highlights the importance of setting dosing limits with both loading and bolus dosing for continuous infusions in drug error reduction software. Significant error reduction occurred with the introduction of loading and bolus dosing limit safety alerts. Rate change alerts, while resulting in a low percentage of rate change cancellations, had an impact on safety due to the large volume of these alerts. These safety features, which were not previously available to our institution, reduced errors occurring with infusions of high-alert medications and had a significant impact on safety as noted by the Harm Index of these potential errors.

Submission Category: I.V. Therapy/ Infusion Devices/ Home Care

Session-Board Number: 6-091

Poster Title: Evaluating the accuracy and precision of chemotherapy preparations-single center site analysis

Primary Author: Stephen Eckel, UNC Eshelman School of Pharmacy; **Email:** seckel@unch.unc.edu

Additional Author (s):
Stephanie Salch
Ashley Paruscio
Lindsey Amerine

Purpose: Small errors in preparing chemotherapy may result in unintended consequences due to narrow therapeutic indices. Inaccurate dosing could lead to toxic adverse events, ineffective treatment, drug wastage, and increased costs.
The vast majority of hospitals utilize the volumetric method in the preparation of medications. Recent published data evaluating the accuracy of this method demonstrated that while the mean percent volume difference was -0.53%, only 71.7% of prepared doses were within ± 5% of the ordered dose and 87.4% of the prepared doses were within ± 10% of the ordered dose. To further explore the accuracy of volumetric preparations, our study utilized the gravimetric method of preparation to verify the accuracy and precision of the volumetric method at 5 different hospitals.

Methods: A prospective, non-intervention, multi-site study was conducted in order to generate baseline estimates of accuracy and precision in the medication preparation process. Five different hospitals in the United States participated with each hospital collecting data to capture a minimum of 1,500 doses.
Data was collected through the following process. An electronic balance was placed and calibrated in one hood. Once the medication was ready to be prepared, the empty syringe was weighed. Recorded information included medication name, dose to be dispensed (mg), calculated volume (ml), technician preparing the dose, time of day, day of week, and weight of syringe. A second person verified that the information recorded was correct. The dose was prepared in the usual manner. After the pharmacist checked that the dose was correct (i.e. ready to be dispensed), the full weight of the syringe was documented and recorded. The

accuracy and precision of each preparation was evaluated using the above data points and the specific gravity of the respective medication.

Results: Data is being presented from a single site within the multi-center trial. A total of 1,522 doses were prepared, representing 56 different medications. These were recorded over a 4 month period. A total of 190 preparations were dispensed to the patient in a syringe and the rest in an IV bag. Nearly 87.5% of the medications were in solution, while the rest needed to be reconstituted prior to use. The top 5 medications in number were cytarabine, etoposide, paclitaxel, carboplatin, and vincristine. The mean percent volume difference was -0.32%, median percent volume difference was 0.12% with a standard deviation of 10.58%. The accuracy of doses was 95.34% within ± 10% of the ordered dose and 90.14% within ± 5% of the ordered dose.

Conclusion: While the majority of preparations were within the acceptable range of either ± 5% or ± 10% and improved from recent published data, there continues to be medications that fall outside of this range. Current processes using volumetric preparation are not reliable enough to ensure accuracy of each dose for every patient. Further review of opportunities to improve precision and accuracy in the IV preparation process needs to be prioritized.

Submission Category: Infectious Diseases

Session-Board Number: 6-092

Poster Title: Adherence to Infectious Diseases Society of America guidelines for the treatment of uncomplicated urinary tract infections in community pharmacies

Primary Author: Wissam Kabbara, Lebanese American University; **Email:** wissam.kabbara@lau.edu.lb

Additional Author (s):
Mohamad Meski
Wijdan Ramadan
Pascale Salameh

Purpose: Urinary tract infections (UTIs) are common indications for prescription of antibiotics for otherwise healthy women. The 2010 IDSA guidelines highlight the importance of local resistance patterns and the propensity for collateral damage in the choice of empirical antibiotics for uncomplicated cystitis. Non-adherence to guidelines and the increased use of fluoroquinolones have raised concerns regarding antimicrobial resistance. In Lebanon, resistance of Escherichia coli and Klebsiella to fluoroquinolones is consistently increasing (reaching around 40 percent in 2015). The purpose of this study is to evaluate antibiotic prescribing practices and adherence to IDSA guidelines for the treatment of uncomplicated UTI in Lebanon.

Methods: This observational prospective study was conducted in 15 community pharmacies in Lebanon over a period of 1 year. We collected information on 376 female patients receiving antibiotics for the treatment of uncomplicated cystitis. Males, patients diagnosed with complicated UTI or sexually transmitted disease, pregnant women, patients younger than 18 years, and patients with history of chronic kidney disease were excluded from the study. Assessment of the appropriateness of drug therapy was based on the clinical practice guidelines by the IDSA. A regimen of nitrofurantoin 100 mg bid for 5 days or fosfomycin 3 grams single dose were considered appropriate. Susceptibility of Escherichia coli to trimethoprim/sulfamethoxazole (TMP-SMX) in Lebanon is around fifty percent; therefore, an empirical regimen of TMP-SMX was considered inappropriate unless a culture was obtained that showed a susceptible strain. Pivmecillinam is not available in Lebanon and was not considered as a potential regimen. Empirical drug treatment was considered inappropriate for all other prescribed antibiotics. Data were entered and analyzed using SPSS, version 23.0. A

descriptive analysis was first carried out, using frequency and percentage for nominal and dichotomous variables, and mean and standard deviation for continuous variables. For the bivariate analysis, the chi square test was used to compare nominal variables between groups. In all cases, a p-value < 0.05 was considered statistically significant. The study was approved by the Institutional Review Board.

Results: A total of 376 patients were included in this study: the mean age was 38 years, 52 percent reported having one UTI per year, 9 percent reported antibiotic allergy, and a culture was obtained in 26 percent of the patients. The prescribed antibiotic was appropriate in only 35 percent of the patients. Age did not significantly affect the appropriateness of the prescribed antibiotic: 36 percent of patients under the age of 50 were prescribed appropriate medication versus 31 percent of patients over the age of 50 (p=0.508). The frequency of attacks per year significantly affected the choice of antibiotic: 23 percent of patients with 3 attacks or more per year received an appropriate medication versus 37.5 percent of patients with less than 3 attacks per year (p=0.025). The dose and duration of the prescribed antibiotic was appropriate in 73 and 58 percent of the patients respectively, with a significant inappropriate dose and duration with fluoroquinolones as compared to nitrofurantoin and fosfomycin (p < 0.001 for the dose and p=0.014 for the duration of therapy). Out of the 376 patients, only 80 (21 percent) patients were prescribed an overall appropriate regimen (appropriate antibiotic, dose, and duration).

Conclusion: This study demonstrates a high prevalence of inappropriate use of antibiotics for the treatment of outpatient uncomplicated urinary tract infections in Lebanon. This is mainly attributable to inappropriate indication, dose and/or duration of therapy with fluoroquinolones. In an era of increasing bacterial resistance and dwindling antimicrobial choices for Gram negative infections, interventions that improve physicians' prescribing practices through education on appropriate therapy for uncomplicated UTIs are needed.

Submission Category: Infectious Diseases

Session-Board Number: 6-093

Poster Title: Reducing the inappropriate use of ertapenem for antimicrobial prophylaxis in non-colorectal intraabdominal surgery

Primary Author: Kyung Kim, San Joaquin General Hospital; **Email:** kkim@sjgh.org

Additional Author (s):
Jered Arquiette

Purpose: Surgical site infection is the most common cause of nosocomial infection among surgical patients. For most intra-abdominal surgery, antimicrobial prophylaxis is recognized as effective at preventing surgical site infections when compared with placebo. To date, there is little evidence to suggest that use of broad-spectrum antimicrobial agents results in lower rates of postoperative surgical site infection compared with older, narrow-spectrum antimicrobial agents. The purpose of this study was to assess the effect of pharmacist-directed provider education and the development of a standardized guideline on the use of ertapenem for non-colorectal intra-abdominal surgical site infection prophylaxis.

Methods: This was a single center observational study with retrospective and prospective phases. The retrospective phase consisted of reviewing the charts of all surgical patients who received ertapenem between January 2015 and December 2015 to determine the baseline rate of ertapenem use as surgical prophylaxis for non-colorectal intra-abdominal surgery. A standardized antimicrobial guideline, which was derived from current clinical practice guidelines for antimicrobial prophylaxis in surgery, was devised in order to facilitate appropriate prescribing patterns of pre-operative antimicrobial agents. The pharmacist then provided education to the surgeons about antimicrobial stewardship. The prospective arm consisted of reviewing the charts of all patients who received ertapenem after the educational initiative (December 2015 to March 2016) to determine the number of ertapenem doses used for non-colorectal intra-abdominal surgical prophylaxis. The primary endpoint was a comparison of the number of ertapenem doses used in non-colorectal surgical prophylaxis before and after the educational initiative. The secondary endpoints included the incidence of surgical site infection in spite of antimicrobial prophylaxis and the change in the drug costs associated with antimicrobial prophylaxis.

Results: After pharmacist-directed provider education and the development of a standardized guideline, the annualized number of ertapenem doses used by surgeons decreased by 89 percent for non-colorectal surgical site infection prophylaxis. For other indications, the use of ertapenem by surgeons decreased by 88 percent for colorectal surgical prophylaxis, by 52 percent for trauma use, and by 65 percent for other surgery related use. The annualized cost reduction on ertapenem for non-colorectal surgical prophylaxis was 6,540 dollars per year. After accounting for the use of alternative prophylactic antibiotic regimens, the annualized cost savings with cefazolin plus metronidazole would be 4,070 dollars per year and 3,500 dollars per year with cefoxitin. The rates of surgical site infection were 9.2 percent in retrospective phase and no surgical site infections were identified in the prospective phase.

Conclusion: Pharmacist-directed provider education and the development of a standardized guideline notably decreased the inappropriate use of ertapenem in surgical site infection prophylaxis. An additional observed benefit of pharmacist education was an overall decrease in the use of ertapenem by surgeons for all indications. Moreover, the use of broad-spectrum antibiotics may be reduced without adversely affecting clinical outcomes.

Submission Category: Infectious Diseases

Session-Board Number: 6-094

Poster Title: Comparison of timely oseltamivir to delayed therapy in hospitalized patients

Primary Author: Samuel LaFollette, Kaweah Delta Health Care District; **Email:** samuelrlaf@gmail.com

Additional Author (s):
Mate Soric

Purpose: To compare the benefit of oseltamivir treatment initiated within 24 hours of admission to therapy started after 24 hours. Most prospective randomized controlled trials with oseltamivir have been done in the outpatient setting in patients who receive oseltamivir within 48 hours of symptom onset. The CDC currently states that oseltamivir may have benefit when given after 48 hours of symptom onset in severe, complicated, or hospitalized patients. This study will assess the benefit of timely oseltamivir treatment in hospitalized patients (given within 24 hours of admission) compared to delayed administration (given after 24 hours of admission).

Methods: This study was approved by the Institutional Review Board. A retrospective chart review evaluated influenza positive hospitalized patients treated with oseltamivir. The patients must be 18 years or older and receive 75 mg of oseltamivir twice daily. Patients may receive 30 mg daily or twice daily when appropriate based on renal function. The patients must also have a positive influenza test. Patients will be excluded if they are pregnant, if they received oseltamivir prior to admission to the hospital, if they are on a ventilator at baseline, or if they have been treated for pneumonia within the last month. The primary endpoint will be a composite of pneumonia confirmed on radiograph, hypoxia defined as arterial saturation < 90%, mechanical ventilation, requiring hemodynamic support, intensive care unit admission, and all-cause 30-day mortality. Secondary endpoints will be each individual primary endpoint as well as severe complications which is defined as radiographic pneumonia with hypoxia, mechanical ventilation, ICU admission, hemodynamic support, and all-cause 30-day mortality as well as length of stay. Data to be collected will include: age, weight, sex, oxygen saturation, maximal temperature, comorbidities at baseline, smoking status, serum creatinine, urea, maximal white blood cell count, maximal lymphocyte count, chest radiograph, and mortality.

Results: There were a total of 124 patients collected with 62 included in both the timely and delayed group. For the primary composite endpoint 29/62 patients in the timely group experienced one of the critical endpoints compared to 27/62 patients in the delayed group (p=0.718). Each of the individual secondary endpoints were also not statistically different. Geometric mean length of stay was 76.9 hours in the timely group and 68.3 hours in the delayed group (p=0.38).

Conclusion: No significant differences in any critical outcome were found between timely and delayed oseltamivir therapy when defined as therapy before 24 hours of admission compared to after 24 hours of admission. No significant difference was seen in total length of stay between delayed and timely therapy.

Submission Category: Infectious Diseases

Session-Board Number: 6-095

Poster Title: Impact of an antimicrobial stewardship program (ASP) at a long-term acute care hospital (LTACH): four-year follow- up

Primary Author: Qutina Mack, Comprehensive Pharmacy Servicies; **Email:** qsmack@gmail.com

Additional Author (s):
Helena Lee
Ashebir Woldeabezgi
Brian Beckett
Diane White

Purpose: The initial purpose of this project, in June 2012, was to document the impact of an antimicrobial stewardship program (ASP) in an 82-bed free-standing LTACH and its effect on healthcare costs over a one-year period (Year 1). The ASP has since been continued for four successive years. This is the report of the fourth year of documenting the effectiveness of the ASP.

Methods: During years 2 through 4, the ASP committee was comprised of one infectious disease (ID) physician, all intensivists at the hospital, all pharmacists and one infection control preventionist; the committee in Year 1 was limited to two ID physicians, one pharmacist and one infection control preventionist. Developed in year 1 and carried fourth through Year 4, ASP tools included a standard antimicrobial order form and antimicrobial use policies which required prescribers to de-escalate empiric therapy within 72 hours. During Year 1, the policy also restricted the use of the following antimicrobials by requiring an ID consult within 48 hours: aminoglycosides, ceftaroline, colistimethate, daptomycin, fidaxomicin, linezolid, tigecycline and antiretroviral medications. However due to limited working hours of ID physician, intensivists were also allowed to continue all antimicrobial orders during Year 2. The committee communicated standards and monitored for appropriate dosing, lab values (serum creatinine), cost-effective drugs, culture and sensitivity reports, interval and de-escalation recommendations, and peak and trough levels. Patient days (PDs), medication cost per patient-day (CPPD), average length of stay (ALOS), and the case mix index (CMI) data were compared before and after implementing the ASP. The data was collected over time and analyzed annually through April 30, 2016.

Results: During the baseline year before ASP implementation, defined as June 2011 to May 2012, PDs were 22,228 with an ALOS of 27.7 days. PDs and ALOS during the same months period in years 1 and 2 were 21,304 and 27.2 days and 14,633 and 27.0 days, respectively. During years 3 and 4, PDs and ALOS were 13,356 and 25.8 days, and 18,548 and 27.9 days respectively. During the same time period, CMI increased from 1.29 at baseline to 1.36 at year 3 and 1.40 at year 4. Overall, drug cost per patient-day for year 4 was $56.00, a decreased of 28.3% from $78.14 at baseline. Antibiotic cost per patient-day for year 4 was $29.71, a 26.8% decrease from $40.60 at baseline. Antifungal cost per patient-day of $2.46 for year 4, slight increase of 3.7% from $2.38 at baseline. Antiviral cost per patient-day of $0.40 for year 4, a decrease of 90.2% from $4.07 at baseline.

Conclusion: ASP implementation at an 82-bed LTACH showed similar ALOS compared to baseline for years 1 through 4 even with a CMI increase of 8.53% over the same four year period. Regardless of the higher severity of patient conditions as indicated by the increase in CMI, antimicrobial and antiviral usage decreased for each of the four years of the ASP. The ASP was instrumental in improving the quality of care and patient safety at the facility and save approximately $1,059, 695 over the past 47 months.

Submission Category: Infectious Diseases

Session-Board Number: 6-096

Poster Title: Treatment response rates among cirrhotic hepatitis C patients under the care of a clinical pharmacist at an urban academic medical center

Primary Author: Michelle Martin, University of Illinois Hospital and Health Sciences System / University of Illinois at Chicago College of Pharmacy; **Email:** mmichell@uic.edu

Additional Author (s):
Myrna Rivas
Victoria Ramos
Grace Go
Darby Rosenfeld

Purpose: Treatment options for hepatitis C virus (HCV) have evolved immensely over the last five years. New direct-acting antiviral agents offer sustained virologic response (SVR) rates in the high 90% range. However, clinical trials demonstrate lower SVR rates in cirrhotic patients. Due to payer restrictions, many patients do not receive treatment until they progress to cirrhosis. Differences among baseline patient characteristics, tolerability, and adherence often yield different real-world SVR rates than clinical trial results. The purpose of this study is to evaluate the SVR rates among cirrhotic patients who received HCV treatment at an urban, academic medical center.

Methods: This retrospective chart review was approved by the institutional review board. Investigators reviewed the electronic medical records of cirrhotic patients who began HCV treatment under the care of a clinical pharmacist at the liver clinic from January 1, 2014 to February 3, 2016. Investigators collected baseline characteristics, including age, gender, ethnicity, body mass index (BMI), stage of liver disease, concurrent medications, comorbidities; previous HCV treatment history; current HCV regimen and dosage; lab results pertaining to disease progression and medication use; Child Turcotte Pugh (CTP) Class; and any interruption, discontinuation, or modification of HCV treatment. Adverse events, adherence, hospitalization, and infection rates were assessed. The data were analyzed using descriptive statistics, Fisher's exact test, and Pearson's chi-square test. The primary endpoint was the number of cirrhotic patients that reached SVR in each of the HCV treatment regimens utilized.The secondary endpoint was the evaluation of SVR rates by baseline patient characteristics.

Results: Two-hundred-forty-eight cirrhotic patients started treatment; 24 patients had not yet reached 12 weeks after treatment; 39 patients were missing labs, lost to follow-up or transferred care. The remaining 185 patients were 68-percent male, 51-percent black, had a mean age of 60.4 years, and BMI of 29.4. Sixty-one percent had genotype (GT) 1a, 71-percent were CTP A, 36-percent were treatment-experienced, 12-percent were post-transplant, 36-percent had diabetes, 22-percent had psychiatric disease, and 17-percent had hepatocellular carcinoma.

Overall SVR percentages for all GTs and regimens were different by CTP A, B, and C (88, 74, 60; P equal to 0.014); higher in females than males (93 versus 79; P equal to 0.012); and different by ethnicity (P equal to 0.025). The SVR rates did not differ by HCC, babyboomer status, BMI, insurance, presence of diabetes or psychiatric disease (P greater than 0.05).

Overall, CTP A, B, and C SVR percentages in GT1 patients were 67, 100, 0, and 50 with sofosbuvir and ribavirin; 80, 82, 84, and 33 with simeprevir and sofosbuvir; 89, 92, 73, and 75 with ledipasvir/sofosbuvir; and 89, 91, 83, 100 with ledipasvir/sofosbuvir and ribavirin. SVR percentages for GT2 and GT3 were 50 and 71 with sofosbuvir and ribavirin.

Conclusion: Sustained virologic response rates in cirrhotic patients at the urban, academic medical center were comparable or numerically lower than SVR rates reported in clinical trials. The cirrhotic patient population included many difficult-to-treat post-transplant and treatment-experienced patients. Future directions include evaluation of the impact of payer restrictions and treatment availability on patient outcomes.

Submission Category: Infectious Diseases

Session-Board Number: 6-097

Poster Title: Randomized, double-blind comparison of tenofovir alafenamide (TAF) versus tenofovir disoproxil fumarate (TDF), each co-formulated with elvitegravir, cobicistat, and emtricitabine for initial HIV-1 treatment: week 96 results

Primary Author: Patricia Martin, Gilead Sciences; **Email:** patty.martin@gilead.com

Additional Author (s):
David Wohl
Shinichi Oka
Nathan Clumeck
Marshall Fordyce

Purpose: Tenofovir disoproxil fumarate (TDF) has been associated with renal toxicity and reduced bone mineral density (BMD). Tenofovir alafenamide (TAF) is a novel prodrug of tenofovir (TFV) that reduces TFV plasma concentrations by 90 percent, thereby decreasing off-target side effects. Two international, randomized, double-blinded, phase 3 trials in distinct regions directly compared TAF vs TDF, each co-formulated with elvitegravir/cobicistat/emtricitabine (E/C/F). At Week 48, E/C/F/TAF met the primary objective of non-inferior efficacy with improved renal and bone secondary safety endpoints compared to E/C/F/TDF. We describe longer term follow up of efficacy, safety, and tolerability endpoints through Week 96.

Methods: Antiretroviral naïve adults with HIV-1 RNA at least 50 copies per milliliter were randomized 1 to1 to receive elvitegravir, cobicistat, emtricitabine and tenofovir alafenamide (E/C/F/TAF) or elvitegravir, cobicistat, emtricitabine and tenofovir disoproxil fumarate (E/C/F/TDF). The primary objective was the proportion of patients with HIV-1 RNA of less than 50 copies per milliliter by FDA snapshot analysis at Week 48. Pre-specified secondary outcomes were percentage change in hip and spine BMD, change in serum creatinine, safety and tolerability. Week 96 viral suppression (HIV-1 RNA less than 50 copies per milliliters) by FDA snapshot analysis, bone and renal safety, and tolerability endpoints are reported. All sites received institutional review board approval.

Results: 1,733 subjects were randomized and treated. The median baseline characteristics: CD4 count was 405 cells/µL and VL 4.58 log10c/mL. Viral suppression was 86.6 percent (TAF) and

85.2 percent (TDF) , (difference 1.5 percent; 95 percent CI [-1.8, 4.8 percent], p value equal to 0.36). Viral outcomes did not vary by age, sex, race, geography, or baseline CD4 or viral load. Mean percent decrease in BMD was significantly less in the TAF group at the lumbar spine (-0.96 [3.72] versus -2.79 [3.92], p value less than 0.001) and total hip -0.67 (3.89) versus -3.28 (3.97), p value less than 0.001. Median percent change in eGFR from baseline was -2.0 (-12.4, 9.4) for TAF and -7.5 (-17.4, 2.9) for TDF. P value less than 0.0001. Urine protein to creatinine ratio, urine albumin to creatinine ratio, Beta 2 microglobulin to creatinine ratio and retinol binding protein to creatinine ratio all favored TAF (p values less than 0.0001). There were greater increases in lipids with TAF versus TDF but no difference in rate of initiation of lipid-modifying agents (TAF: 3.8 percent versus TDF: 4.4 percent). There were no cases of renal tubulopathy with TAF versus two on TDF, including one that led to discontinuation.

Conclusion: Through Week 96, rates of virologic suppression were high and similarly maintained in both the TAF and TDF groups. E/C/F/TAF continued to have a statistically superior bone and renal safety profile compared to E/C/F/TDF. These longer-term data support the use of E/C/F/TAF as a safe, well tolerated, and durable regimen for initial and ongoing HIV-1 treatment.

Submission Category: Infectious Diseases

Session-Board Number: 6-098

Poster Title: Switching from boosted atazanavir (ATV) plus emtricitabine/tenofovir disoproxil fumarate (FTC/TDF) to a tenofovir alafenamide (TAF) based single-tablet regimen (STR): week 48 data in virologically suppressed adults

Primary Author: Patricia Martin, Gilead Sciences; **Email:** patty.martin@gilead.com

Additional Author (s):
Bart Rijinders
Christoph Stephan
Mehri McKellar
Scott McCallister

Purpose: Antiviral regimens containing tenofovir disoproxil fumarate (TDF) have been associated with renal toxicity and reduced bone mineral density (BMD). TAF is a novel prodrug that reduces tenofovir plasma concentrations by ninety percent, thereby decreasing off-target side effects. TAF is co-formulated into a single-tablet regimen (STR) that contains elvitegravir (EVG) 150 milligrams, cobicistat (COBI) 150 milligrams, emtricitabine (FTC) 200 milligrams and TAF 10 milligrams (E/C/F/TAF). This study assessed whether efficacy, safety, and tolerability were non-inferior in patients who switched to a regimen containing TAF versus in those remaining on one containing TDF.

Methods: This randomized, active controlled, multicenter, open-label, phase 3, non-inferiority trial enrolled a total of 1,436 virologically suppressed (HIV-1 RNA less than 50 copies/ml) HIV positive adults. Patients had a baseline estimated glomerular filtration rate of 50 milliliters per minute or greater and were taking one of four TDF-containing regimens for at least 96 weeks before enrollment. The four regimens were EVG, COBI, FTC and TDF (E/C/F/TDF); efavirenz plus FTC/TDF; COBI-boosted ATV plus FTC/TDF or ritonavir-boosted ATV plus FTC/TDF. Written consent was obtained by investigators. Patients were randomly assigned (2 to1) to switch to open-label E/C/F/TAF or to continue their prior regimen. The current data are from a pre-specified sub-analysis of patients on ritonavir or COBI boosted ATV plus FTC/TDF prior to the switch. The primary endpoint was the proportion of patients with HIV-1 RNA of less than 50 copies per milliliter at 48 weeks after randomization. Pre-specified secondary outcomes were percentage change in hip and spine BMD, and change in serum creatinine (SCr).

Results: At Week 48, 390/402 (97.0 percent) of those who switched to E/C/F/TAF and 183/199 (92.0 percent) of those continuing boosted ATV plus FTC/TDF had HIV-1 RNA less than 50 copies/mL (difference, 5.1 percent; 95 percent CI: 0.9 percent to 9.2 percent, p value equal to 0.006). No patients in this sub-analysis had virologic failure with resistance. In patients who switched to E/C/F/TAF, hip and spine BMD improved significantly compared to boosted ATV plus FTC/TDF (p values of less than 0.001). Tests of quantitative proteinuria and specific tubular proteinuria also improved significantly (p value less than 0.001). SCr mean change (mg/dL) from baseline was 0.00 in the E/C/F/TAF group and plus 0.03 (p value equals 0.003) in the boosted ATV arm plus FTC/TDF. E/C/F/TAF patients had statistically higher changes from baseline in fasted total cholesterol and low-density lipoproteins (LDL; p value less than 0.001). The change in TC to high density lipoproteins (HDL) ratio was non-significant with a rise of plus 0.0 in the E/C/F/TAF arm and plus 0.01 in the boosted ATV arm (p value equals 0.011). There was no significant difference in the number of patients initiating lipid modifying medications (p value equals 0.14).

Conclusion: In both the overall population and in prior boosted ATV plus FTC/TDF users, those switching to E/C/F/TAF had significantly more virologic success. The switching arm showed differences in SCr, along with significant improvements in proteinuria, albuminuria and tubular proteinuria. There were significant improvements in spine and hip BMD, less osteopenia and increases in TC, LDL, HDL and unchanged TC to HDL ratio. Longer term follow-up is needed to better understand the clinical impact of these changes.

Submission Category: Infectious Diseases

Session-Board Number: 6-099

Poster Title: Creation and use of a computerized retrospective algorithm for reportable indication-specific antibiotic stewardship metrics

Primary Author: Gregory Matsuura, Yakima Valley Memorial Family of Services; **Email:** gregorymatsuura@yvmh.org

Additional Author (s):
Kelly Artiga

Purpose: Overexposure of antibiotics leading to resistance is a perpetual concern. The Centers of Disease Control and Prevention (CDC) recommend interventions targeting common infectious syndromes such as community acquired pneumonia. The Infectious Diseases Society of America (IDSA) recommends implementation of facility-specific guidelines for infectious diseases to improve outcomes. Obtaining locally relevant process and outcome data in a timely manner for antibiotic stewardship programs continues to be universally problematic. The purpose of this study is to describe the creation of a reproducible electronic process with conventional information technology resources, to limit confounders associated with computerized processes from frequently silo departments.

Methods: A pharmacist programmed the institution's software to link data to a specific patient and admission associated with pneumonia. International Classification of Disease, Ninth Revision and Tenth Revision, Clinical Modification (ICD-9-CM), (ICD-10-CM) codes were used in this retrospective analysis. Data was extracted from the January 1st, 2015 to March 31st, 2016 of patients diagnosed with pneumonia. Patients were excluded if overlapping infections were documented within the same visit or had profound comorbid conditions such as neutropenia or currently receiving transplant medications. Overlapping infections were categorized into six general areas: gastrointestinal, cardiovascular and intravascular related infections, skin and skin structure, bone, urinary tract and central nervous system. Medication barcode administration data was used to link antibiotics given to a specific patient and then cross-linked to cultures results electronically. Using an off-the-shelf database program (Microsoft access) with an open database connectivity (OBDC) that directly links using common OBDC drivers we extracted data specific to pneumonia associated patient outcomes.

Results: Over the analyzed time frame, there were 17,024 patients admitted to the institution. Of these, 1,055 patients with ICD-9-CM and ICD-10-CM codes for pneumonia. Then, 199 patients were excluded due to an overlapping infectious diagnosis during their visit. Overlapping diagnosis (not mutually inclusive) included 43 patients with gastrointestinal infections, 39 cardiovascular and intravascular related infections, 20 skin and skin structure infections, 8 bone infections, 91 urinary tract infections, and 2 central nervous system infections. Microbiologically, pseudomonas aeruginosa was isolated from 14 patients from either sputum, blood or bronchiolar lavage.

Conclusion: The developed electronic process can be repeated and altered for a specific infectious diagnosis with minimal time commitment or the need of specialized IT support. By utilization of this process, a computerized process can include large cohorts of information to assist with analysis of infectious processes in a timely and repeatable fashion. Additionally, the algorithm can be modified to determine de-escalation and escalation rates for a specific diagnosis while removing potential confounders such as additional infectious diagnoses, thereby fulfilling both antibiotic use and other proposed outcome metrics as stated in the IDSA guidelines.

Submission Category: Infectious Diseases

Session-Board Number: 6-100

Poster Title: Utilization of ceftaroline in a large tertiary care, public, metropolitan hospital with an active antibiotic stewardship program (ASP)

Primary Author: Dhara Mehta, Bellevue Hospital Center; **Email:** dhara.mehta@bellevue.nychhc.org

Additional Author (s):
Harold Horowitz
Bella Kohn
Michael Blumenfeld

Purpose: Ceftaroline is a fifth generation cephalosporin indicated for the treatment of skin and soft tissue infections (SSTI) and community-acquired pneumonia. Since it displays activity against methicillin resistant Staphylococcus aureus (MRSA), the Bellevue Hospital, Pharmacy and Therapeutics committee added ceftaroline to the hospital formulary for the treatment of serious MRSA infections with approval from the infectious disease (ID) service and subject to antibiotic stewardship review. A medication use evaluation was performed to assess appropriateness of use.

Methods: A list of all patients 18 years of age and older with an order for ceftaroline between October 1, 2012 and March 18, 2016 was generated from the hospital's electronic medical record. The data collected included: age, gender, ceftaroline dose and frequency, renal function, duration of therapy, associated culture and sensitivity data, presence of an ID consult or approval, indication for ceftaroline use, and etiology of infection. Rapid MRSA testing was not performed for S. aureus cultures.

Results: Thirty-seven patients received ceftaroline during the study period. 23/37 (62%) of patients had a documented MRSA infection. The indications for ceftaroline therapy were: MIC ≥ 1 mcg/mL to vancomycin (61%), documented vancomycin failure (26%), vancomycin intolerance (4%), medication initiated at outside institution (4%), and unknown (4%). The mean duration of therapy was 19 days (range 1-46.) 22/23 (96%) of patients were evaluated by ID consult. 14/37 (38%) of patients had no documented MRSA infection. 10/14 (71%) were switched in approximately 3 days once culture results became available; 7 after ID consultation and 3 by the primary team. In the remaining 4 patients, 3 had a history of vancomycin

intolerance and 1 failed conventional therapy. Among patients with positive MRSA cultures, etiologies of infections were: endocarditis (43%), bacteremia (18%), pneumonia (9%), osteomyelitis (9%), sepsis (4%), spinal abscess (4%), SSTI (4%), infected aneurysm (4%) and empyema (4%). Among those without positive MRSA cultures, etiologies were: SSTI (57%), endocarditis (14%), osteomyelitis (7%), peritonitis (7%), pneumonia (7%), and hardware infection (7%). 16/37 (43%) of patients required renal dosing of ceftaroline; dosed appropriately in all cases. In 3 cases (endocarditis, spinal abscess, bacteremia), high dose ceftaroline (600 mg IVPB every 8h) was utilized.

Conclusion: The need for ID approval and ASP review have contributed to the appropriate use of ceftaroline as intended for MRSA infections. Ceftaroline therapy was promptly changed when appropriate indication for therapy was not evident. Patients with documented MRSA received longer courses of therapy and were consulted by the ID service more frequently than those patients without MRSA infections. The availability of rapid testing for MRSA may have allowed for converting to alternative therapy sooner than the 3 days required for culture and sensitivity results to become available.

Submission Category: Infectious Diseases

Session-Board Number: 6-101

Poster Title: Tenofovir alafenamide (TAF) compared with tenofovir disoproxil fumarate (TDF) in patients with HBeAg-negative and HBeAg-positive chronic HBV (CHB): an integrated analysis of safety and efficacy from two phase 3 studies

Primary Author: Sarjita Naik, Gilead Sciences; **Email:** sarjita.naik@gilead.com

Additional Author (s):
Maria Buti
Henry Chan
Calvin Pan
John Flaherty

Purpose: Tenofovir alafenamide (TAF), a novel prodrug of tenofovir (TFV), is more stable in plasma and enhances delivery of TFV into lymphoid cells and hepatocytes while lowering circulating levels of TFV by approximately 90% compared to tenofovir disoproxil fumarate (TDF). In patients with HIV, a TAF-containing regimen demonstrated efficacy similar to that of TDF with significantly reduced bone and renal effects. TAF was evaluated in both HBeAg-negative and HBeAg-positive CHB patients. This post-hoc analysis assesses safety and efficacy of the two Phase 3 studies (NCT01940341 and NCT01940471).

Methods: In two Phase 3 studies, HBeAg-negative and HBeAg-positive CHB patients were randomized 2:1 to TAF 25 mg QD or TDF 300 mg QD, each with matching placebo, and treated for 96 weeks. After Week 96, patients receive open label TAF for 48 weeks. The primary efficacy analysis was the percent of patients with HBV DNA < 29 IU/mL at Week 48; the study was powered to demonstrate non-inferiority in efficacy of TAF compared to TDF, with a 10% margin. Key prespecified secondary safety endpoints were assessed sequentially: changes in hip and spine bone mineral density (BMD), changes in serum creatinine (sCr), and dipstick proteinuria. Markers of bone formation and resorption, and renal tubular function were also assessed. Viral resistance was evaluated by population sequencing those patients with virologic breakthrough, or viremia at time of discontinuation.

Results: 425 HBeAg-negative patients were randomized and included the following baseline characteristics: mean age 46 years, 61% males, 72% Asians, genotypes A through D (5%, 24%, 38%, 31%); 19% had HBV DNA ≥ 7 log10 IU/mL, and 21% were previously treated with

nucleos(t)ides. At Week 48, TAF was non-inferior in efficacy to TDF with virologic response rates of 94.0% with TAF and 92.9% with TDF (difference in proportions: +1.8%, 95% CI, -3.6% to +7.2%). 873 HBe-Ag positive patients were randomized and included the following baseline characteristics: mean age 38 years, 83% males, 82% Asians, genotypes A through D (7%, 17%, 52%, 23%); 47% had HBV DNA ≥ 8 log10 IU/mL, and 26% were treated previously with nucleos(t)ides. At Week 48, TAF was non-inferior in efficacy to TDF with virologic response rates of 63.9% with TAF and 66.8% with TDF (difference in proportions: -3.6%, 95% CI, -9.8% to +2.6%). A greater percentage of patients treated with TAF also achieved normalization of serum ALT values in both studies. Patients on TAF experienced significantly less declines in hip and spine BMD, and smaller declines in eGFRCG. Treatment was well-tolerated and discontinuations were low and similar in the two arms of both studies.

Conclusion: Compared to TDF 300 mg, the efficacy of TAF 25 mg in patients with both HBeAg-negative and HBeAg-positive CHB was noninferior. Safety was also improved, with less change in bone and renal parameters.

Submission Category: Infectious Diseases

Session-Board Number: 6-102

Poster Title: Internally-developed antifungal use benchmarking at a large academic medical center and integrated health system

Primary Author: Andrea Pallotta, Cleveland Clinic; **Email:** pallota@ccf.org

Additional Author (s):
Elizabeth Neuner
Vasilios Athans
Jeffrey Chalmers
Steven Gordon

Purpose: Measurement of antimicrobial use is critical component of designing and monitoring antimicrobial stewardship activities. The CDC, IDSA, SHEA, and other organizations have identified antimicrobial days of therapy per 1000 patient days (DOT/1000d) based on medication administration data as the preferred antimicrobial use metric. Although third-party software can compile antimicrobial use data using this metric, considerable limitations may exist. We characterize antifungal use (AFU) using an internally-developed benchmarking report at a large integrated healthcare system.

Methods: This benchmarking tool was piloted at Cleveland Clinic Health System (CCHS) using data from 9 inpatient acute care facilities. Data to calculate patient days were extracted from an admissions database to generate the denominator of DOT/1000d metric. All inpatient (non-observation) units were included. To generate the numerator of the DOT/1000d metric, medication administration data were extracted from the electronic medical record for systemically administered antifungal agents. In alignment with the CDC antimicrobial use Module, 6 formulary antifungals were included in the report for Q4 2015 and Q1 2016. AFU data were compared internally and against a literature-based reference of 83 DOT/1000d.

Results: During Q4 2015, mean AFU across the 9 hospitals was 31 (± 27) DOT/1000d; range 4-89. During Q1 2016, mean system-wide AFU was 38 (±30) DOT/1000d; range 6-105. For Q1 2016, AFU DOT/1000d was highest for the hospital with hematopoietic stem cell transplantation at 105 DOT/1000d. Mean AFU for 2 hospitals with solid organ transplantation (SOT) showed AFU of 81 (+ 35) DOT/1000d, range 56-105 and for the 5 hospitals providing oncology services (Onc) was 51 (+ 34) DOT/1000d , range 19-105. Four non-SOT, non-Onc

hospitals had the lowest mean AFU at 22 (+ 16) DOT/1000d, range 6-42. Use of fluconazole increased from a mean of 19 DOT/1000d to 25 DOT/1000d from Q4 2015 to Q1 2016 respectively.

Conclusion: As anticipated, interseasonal and interfacility variation in AFU was reflected in our health system DOT/1000d report. An antimicrobial benchmarking strategy allows for meaningful comparison of AFU across locations and over time. This tool highlights important differences within a health system; notably, hospitals with hematopoietic stem cell transplant, SOT, and Onc had higher AFU DOT/1000d compared to hospitals without these services. A goal for future reporting is to differentiate between empiric, pathogen-directed, and prophylactic AFU. AFU DOT/1000d provides actionable data needed to direct stewardship initiatives at the system- , hospital-, and care unit-level.

Submission Category: Infectious Diseases

Session-Board Number: 6-103

Poster Title: Evaluation of directly observed therapy with three months of once-weekly isoniazid and rifapentine for latent tuberculosis infection at an outpatient infectious diseases clinic in an academic medical center

Primary Author: Andrea Pallotta, Cleveland Clinic; **Email:** pallota@ccf.org

Additional Author (s):
Cyndee Miranda
Lucileia Teixeira

Purpose: In 2011, the Centers for Disease Control and Prevention included directly observed therapy (DOT) of three months of once-weekly isoniazid and rifapentine (3HP) as an option for treatment of latent tuberculosis infection (LTBI). 3HP for LTBI has improved adherence and acceptance of LTBI treatment compared to traditional nine-month daily administration of isoniazid. This study described experiences in an outpatient infectious diseases (ID) clinic with DOT 3HP for LTBI.

Methods: Adult patients prescribed 3HP by an ID provider from December 2011 to April 2016 were included in a quality assessment (QA) database. Patients received weekly 3HP with DOT administered by clinic medical assistant or primary care provider. Date and medication and adverse drug reactions (ADRs) were collected and maintained in a clinic binder and transferred to the QA database. QA database contained patient demographics, tuberculosis risk category, laboratory values, treatment outcomes and 3HP ADRs were collected. Patient reported ADRs included mild to high severity. The primary outcome measured the rate of DOT 3HP completion defined as receipt of > 11 doses within 16 weeks. Secondary outcomes described 3HP ADRs and reasons for discontinuation. The study utilized descriptive statistics, Fisher's Exact Test, and t-tests. The study received exempt status from institutional review board.

Results: 147 patients were prescribed 3HP. Of these patients, 17% (n=25) did not initiate 3HP leaving 122 (87%) patients in the study. 3HP group included 106 who completed all doses and DC-3HP group included 16 patients who discontinued therapy but received at least 1 dose of isoniazid/rifapentine. Baseline characteristics were similar between 3HP group and DC-3HP group with the most common tuberculosis risk category of occupational exposure and median age of 38 years. The most common reasons for not completing treatment in the DC-3HP group

were ADRs (7/16, 44%), lost to follow up (7/16, 44%), and rifapentine shortage (2/16, 12%). In the 3HP group, 66 (62%) patients experienced ADRs compared to 7 (44%) patients in the DC-3HP group (p=0.18). Gastrointestinal tract ADRs were the most common at 34% and 25% (3HP and DC-3HP groups respectively), followed by central nervous system ADRs at 26% and 38% (3HP and DC-3HP groups respectively). No patients in the DC-3HP group discontinued therapy due to hepatitis or elevations in liver function tests. In the 3HP group, 47/106 (44%) patients experienced ADRs in the first 4 weeks of therapy compared to 24/106 (25%) experiencing ADRs in the last 4 weeks of therapy.

Conclusion: In a population with tuberculosis risk category of occupational exposure, 87% percent of patients who initiated 3HP completed therapy, which is above previously published rates. Rate of ADRs was higher compared to previously published rates, likely due to the broad ADR definition. 3HP is an attractive LTBI treatment option.

Submission Category: Infectious Diseases

Session-Board Number: 6-104

Poster Title: Antifungal prescribing during initial implementation of candidemia early detection and species identification testing with T2Candida panel

Primary Author: Falguni Patel, Riverside Community Hospital; **Email:** falguni.patel@hcahealthcare.com

Additional Author (s):
Elizabeth Young

Purpose: Prescribing of antifungal agents in invasive fungal diseases, though a less prevalent hospital issue compared to bacterial infections, must be a focus of an antimicrobial stewardship program (ASP) due to their toxicity, interactions, cost, and emerging resistance. In this review, antifungal prescribing was examined during the initial implementation of the T2Candida Panel (T2) for early detection and species identification of candidemia.

Methods: We included inpatients where a T2Candida Panel was ordered during the first 61 days of the introduction at our 373-bed community hospital. Invasive fungal disease risk factors, antifungal therapy management, T2 results, concurrent blood culture results, and time to test results were obtained through chart review.

Results: Valid T2 results were reported in 59 patients. 98 percent (58/59) of patients met T2 ordering criteria. Concomitant blood cultures were ordered on 38/59 (64 percent) patients. Empiric antifungals had been prescribed in 11/59 patients (18.6 percent) prior to T2 ordering. T2 resulted in 3 to 5 hours, and was available in the hospital reporting system in an average of 6.3 hours. Of the 59 T2 results, 6/59 (10 percent) were positive, with 5/6 (83 percent) Candida albicans/Candida tropicalis and 1/6 (17 percent) Candida parapsilosis. Of the patients with positive T2 results none had been prescribed prior antifungal therapy. Appropriate antifungal therapy with either micafungin or fluconazole was ordered in positive T2 patients within 6 hours of hospital system reporting for 5/6 (83 percent) and within 9 hours in 1/6 (17 percent). All positive T2 patients had had concomitant blood cultures drawn with 3/6 (50 percent) reported as positive and those cultures reported Candida albicans in agreement with their T2 results. Of the 53 patients with negative T2 results, none had subsequent positive fungal blood culture results and 8 had been on antifungals. Of those 8 patients, antifungal therapy was discontinued in accordance to clinical status.

Conclusion: Early detection and identification of systemic fungal infection resulted in focused and appropriate antifungal therapy in our review. Antifungal therapy was appropriately initiated or discontinued in accordance with the T2Candida Panel and complementing blood cultures. Antimicrobial stewardship programs can contribute to the optimal drug management of invasive fungal diseases by monitoring current prescribing practices supported by new rapid diagnostic technologies.

Submission Category: Infectious Diseases

Session-Board Number: 6-105

Poster Title: Impact of pharmacist-led review and intervention of positive blood culture

Primary Author: Radha Patel, UCI Health; **Email:** rmp0216@gmail.com

Additional Author (s):
Helen Lee
Steve Park

Purpose: The development of rapid diagnostic testing for pathogen identification has proven beneficial in strengthening antimicrobial stewardship efforts to ensure judicious antibiotic use. However, limited data evaluating the impact of proactive bloodstream infection (BSI) review by pharmacists on clinical outcomes exist. The aim of this study is to evaluate the impact of pharmacist proactive review utilizing rapid organization identification tools on patient outcomes with positive BSI.

Methods: This is a single-center, two-phase retrospective study comparing a 3-month period pre- and post-implementation of rapid diagnostic tests in conjunction with active interventions by the infectious disease (ID) pharmacy team. Adult patients older than 18 years of age with select BSI identified via matrix assisted laser desorption/ionization time-of-flight (MALDI-TOF) and chromogenic MRSA media were included. During the intervention period, pharmacists were proactively notified daily by microbiology lab with organism identification results. The primary objective was time to optimal antimicrobial therapy in hours. Secondary objectives included clinical outcome, select antibiotic usage, and pharmacist interventions.

Results: A total of 238 unique patients were included in the final analysis: 112 patients in the intervention group and 126 patients in the historical control group. Pharmacist interventions with rapid diagnostic tests showed decreased time to optimal therapy (51.3 vs 38.3 hours, P 0.03) and improved time to organism identification (42.2 vs 17.6 hours, $P < 0.0001$). There were no differences between 30 day all-cause mortality, 30 day readmission rates with the same BSI, and overall hospital length of stay. Lastly, patients with pharmacist interventions with rapid diagnostics were found to have a decrease in intensive care unit LOS (10.8 vs 5.9 days, P 0.02). Out of the 126 patients during the intervention group, 68 (53%) were intervened by the pharmacist with a 96% acceptance rate by prescribers.

Conclusion: Utilization of rapid diagnostics tests in conjunction with pharmacist-guided proactive blood culture review led to significant reductions in time to organism identification and optimal therapy.

Submission Category: Infectious Diseases

Session-Board Number: 6-106

Poster Title: Raoultella species infection in a body fluid and sputum culture

Primary Author: Kerry-Ann Peters, Plantation General Hospital; **Email:** kenecian@yahoo.com

Additional Author (s):
Scott Brown
Scott Brown
Poonsri Pantutamnitya
Huston Powell

Purpose: Raoultella species are gram negative bacillus commonly inhabiting moist environments such as soil and water. Raoultella species cause fish poisoning in scromboid fish such as tuna, mackerel, bonito, and sardines. The poisoning is thought to be the result of the ability of these bacteria to convert histadine to histamine. Ingestion of infected fish by humans produces scromboid syndrome characterized by facial flushing, dizziness, vomiting, pruritus, urticaria, and dyspnea related to histamine production of the bacteria. Raoultella species is generally susceptible to most classes of antibiotics such as aminoglycosides, cephalosporins, carbapenem, extended spectrum penicillins, and sulfa. There are case reports of resistance to penicillin and fluoroquinolones. Human infections are uncommon, with limited number of cases in the medical literature. This report describes a case of a 44 year old man who developed both Raoultella ornithinolytica infection in a body fluid culture and Raoultella planticola infection in a sputum culture. He presented to the emergency room with complaints of abdominal pain and difficulty keeping anything down for one week. He stated the pain was sharp, radiating to back and generalized to all four abdominal quadrants. The patient reports two previous hospitalizations in the past for the same problems but stated this episode is worst. His past medical history is significant for diabetes mellitus, hypertension, and pancreatitis. On admission, blood pressure was 131/78, respiratory rate 18 breaths per minute, pulse 74, temperature 98.3, and physical exam unremarkable. His lab panels however revealed several abnormalities: serum sodium 123, serum potassium 3.2, serum creatinine 0.92, serum glucose 130, serum calcium 6.7, aspartate aminotransferase 146, alanine aminotransferase 134, lipase 24980, phosphorus 1.9, lactic acid 5.3, C-reactive protein 9.7, and magnesium 1.2. The patient's white blood cell count was normal but there was concern for sepsis. Blood, urine, and sputum cultures were obtained and empiric antibiotic therapy started with piperacillin-tazobactam and vancomycin. He was admitted for acute pancreatitis secondary to chronic alcohol use. The

patient's renal and respiratory status deteriorated during his hospital course requiring dialysis and intubation. Initial cultures showed no growth despite signs and symptoms of underlying infection. He developed pancreatic necrosis with dilated bowel and abdominal distention, but surgery was delayed for several weeks due to the risks outweighing the benefits. The second body fluid culture drawn on week nine of hospital stay grew gram negative bacillus R. Ornithinolytica. R. Ornithinolytica was susceptible to trimethoprim/sulfamethoxazole MIC 20, amikacin MIC 2, levofloxacin and ciprofloxacin MIC 1. Antibiotic treatment was changed from meropenem to levofloxacin 750 mg IV daily. The patient improved with surgery and paracentesis but had persistent leukocytosis and fevers despite antibiotic therapy prompting repeat cultures. The second sputum culture on week 15 of admission resulted positive with R. planticola. R planticola showed susceptibility to Amikacin MIC 2, Trimethoprim/Sulfamethoxazole MIC 20, and Cefepime MIC 2. Raoultella species identified by mass spectrometry using Myla, no biochemical testing performed. The identity and sensitivity of the organism was confirmed by Vitek-2. We present a case of Raoultella species infection in a body fluid and sputum culture after nine weeks hospital stay. Though Raoultella planticola did confer multidrug resistant patterns, the patient was successfully treated with Levofloxacin for two weeks followed by Amikacin and Piperacillin-Tazobactam for two additional weeks. Raoultella species is an uncommon cause of clinical infection, considered generally susceptible to most antibiotics. However, there are reports in the literature of resistant producing strains especially with R planticola.

Methods:

Results:

Conclusion:

Submission Category: Infectious Diseases

Session-Board Number: 6-107

Poster Title: Optimizing antibiotic selection for the treatment of acute bacterial skin and skin structure infections (ABSSSIs)

Primary Author: Nicholas Piccicacco, Morton Plant Hospital; **Email:** nicholas.piccicacco@baycare.org

Additional Author (s):
Lynne Krop
Jonathan Grey
Katie Martinkovic
Kathleen Shannon

Purpose: Throughout the United States, there has been an increase in emergency department (ED) visits and hospital admissions due to ABSSSIs. With the increased prevalence of methicillin-resistant Staphylococcus aureus (MRSA), vancomycin has become the empiric drug of choice for most ABSSSI cases. The purpose of this study was to compare the utilization of vancomycin and clinical outcomes in patients treated for ABSSSIs before and after the availability of rapid MRSA wound polymerase chain reaction (PCR) technology, clinical education, and a treatment algorithm based on the 2014 Infectious Diseases Society of America (IDSA) ABSSSI guidelines.

Methods: An institutional review board-approved, retrospective pre-post interventional study was conducted. The control group consisted of patients admitted between 10/01/2014 and 03/21/2015 and the post intervention group between 10/01/2015 and 03/31/2016 with a documented wound PCR result. In conjunction with an already active antimicrobial stewardship program, study interventions consisted of the availability of in-house wound PCR testing, physician and ED team education on the current IDSA guideline, and providing a treatment algorithm with an empiric-dosing chart to ED physicians, nurses, and pharmacists. Adult patients aged 18 to 99 years with a diagnosis of ABSSSI and admissions through the ED were included. Exclusion criteria consisted of a documented severe beta-lactam or vancomycin allergy, having multiple sites of infection requiring treatment, surgical site infections, admission to the intensive care unit, and documentation of an active or previous MRSA ABSSSI. The severities of ABSSSIs (mild, moderate, and severe) were classified by the definitions set forth by the IDSA guidelines. Continuous variables were analyzed by Mann-Whitney U tests and categorical variables by Chi-square tests. The primary outcome assessed was duration of

inpatient vancomycin therapy. Overall hospital lengths of stay, duration of inpatient antibiotics, 30-day hospital readmission rates, and incidence of antibiotic-associated adverse effects were also evaluated as secondary endpoints.

Results: During the study period, 144 patients (72 in each group) met inclusion criteria. Baseline demographics were similar between both cohorts, except there were significantly more females and peripheral vascular disease patients in the wound PCR group. Majority of ABSSSIs were diagnosed as cellulitis and moderate in severity. The median duration of inpatient vancomycin was significantly reduced from 3 days to 1 day (p-value equal to 0.015) with utilization of the MRSA wound PCR. Hospital lengths of stay, 30-day readmission rates, and antibiotic-associated adverse effects were similar between the two groups.

Conclusion: Along with active antimicrobial stewardship, utilization of a rapid MRSA wound PCR assay, physician/staff education, and providing an evidence-based treatment algorithm resulted in a significant reduction in the overall vancomycin usage for ABSSSIs.

Submission Category: Infectious Diseases

Session-Board Number: 6-108

Poster Title: Treatment of acute bacterial skin and skin structure infection (ABSSSI) with single dose dalbavancin in an outpatient setting

Primary Author: Sailaja Puttagunta, Iterum Therapeutics; **Email:** s_puttagunta@yahoo.com

Additional Author (s):
Urania Rappo
Pedro Gonzalez
Karthik Akinapelli
Michael Dunne

Purpose: To describe the demographics and outcomes for patients with ABSSSI treated in the outpatient setting in a phase 3 clinical trial evaluating the efficacy of a single 1500 mg dose of dalbavancin relative to the approved two-dose regimen.

Methods: This study was a double-blind, single-dummy trial in patients with ABSSSI. The protocol was reviewed by local ethics committees and the institutional review boards at each study center, and all patients provided written informed consent. Patients were randomized to receive dalbavancin 1500 mg as a single IV infusion over 30 minutes or 1000 mg IV on Day 1 followed one week later by 500 mg IV. The primary endpoint was the proportion of patients in each arm with at least a 20% reduction in the erythema associated with the infection 48-72 hours after start of treatment in the intent-to-treat population. Clinical outcome based on a composite of clinical measures was assessed on Days 14 and 28 in the clinically evaluable population. In this analysis, we compared outcomes for patients treated entirely in the outpatient setting with those for patients admitted to a hospital for the treatment of ABSSSI.

Results: In outpatients, treatment response at 48-72 hours was seen in 156/190 (82.1 percent) and 162/196 (82.7 percent) (difference, -0.5 percent [95 percent CI, -8.3 percent to 7.1 percent]) on the single- and 2-dose regimens, respectively. Clinical success at Day 14 was seen in 142/162 (87.7 percent) and 151/169 (89.3 percent) (difference, -1.7 percent [95 percent CI, -8.8 percent to 5.3 percent]); at Day 28, clinical success was seen in 136/150 (90.7 percent) and 139/150 (92.7 percent) (difference, -2.0 percent [95 percent CI, -8.6 percent to 4.5 percent]) on the single- and 2-dose regimens, respectively.

In inpatients, treatment response at 48-72 hours was seen in 128/159 (80.5 percent) and 132/153 (86.3 percent) (difference, -5.8 percent [95 percent CI, -14.1 percent to 2.6 percent]) on the single- and 2-dose regimens, respectively. Clinical success at Day 14 was seen in 125/140 (89.3 percent) and 119/133 (89.5 percent) (difference, -0.2 percent [95 percent CI, -7.7 percent to 7.5 percent]); at Day 28, clinical success was seen in 114/121 (94.2 percent) and 108/117 (92.3 percent) (difference, 1.9 percent [95 percent CI, -4.8 percent to 9.0 percent]) on the single- and 2-dose regimens, respectively.

Conclusion: Outcome rates at 48-72 hours, Day 14 and Day 28 were similar between patients treated in the outpatient or inpatient setting with either a single dose of dalbavancin or the two-dose dalbavancin regimen. Based on this experience, there is a subset of patients with ABSSSI who can be successfully treated with dalbavancin in an ambulatory setting.

Submission Category: Infectious Diseases

Session-Board Number: 6-109

Poster Title: Eradicating community acquired extended spectrum beta lactamase (ESBL) producing Escherichia coli using fosfomycin

Primary Author: Jihan Safwan, Lebanese International University; **Email:** jihan.safwan@liu.edu.lb

Additional Author (s):
Faraj Saade
Marwan Akel
Michelle Cherfan
Etwal Bou Raad

Purpose: This is the case of a 28 year old female patient who presented to a community pharmacy setting with a chief complaint of uncomplicated cystitis (UC). She reports having symptoms of dysuria, burning upon urination, micturition, and hematuria without any fever or flank pain. While taking the history, the patient informs the clinical pharmacist in charge that she has a history of UC since five years, and she is using norfloxacin to treat it whenever she experiences such symptoms. She admits using this antibiotic around three times each year by her own and for a less than optimal duration, like for 2 to 4 days. Upon presentation, the pharmacist asked her to perform a urinalysis with a culture, which revealed an ESBL producing Escherichia coli (E. coli) infection. The isolated bacterium was sensitive to only two oral antibiotics which were fosfomycin and nitrofurantoin, while the rest of the susceptibility included parenteral ones including imipenem/cilastatin, cefoxitin, cefotetan, and gentamicin. The patient informed her healthcare provider that she would prefer an outpatient treatment if possible. The clinical pharmacist decided to administer an unusual antibiotic regimen which included fosfomycin 3 grams every 3 days for 7 doses. Upon finishing the above treatment regimen, the patient reported only diarrhea as a side effect to fosfomycin, while the urinary tract infection symptoms disappeared by the second dose. A urinalysis and culture were later performed and they confirmed the eradication of the causative microorganism. Community acquired ESBL producing E. coli is a virulent bacterium that is a result of collateral damage due to the misuse of antibiotics like beta lactams and fluoroquinolones, as in this case. The technique of treatment that this clinical pharmacist used to eradicate this pathogen is reasonable due to the fact that fosfomycin achieves high urinary concentrations within 4 hours that remain high up to 48 hours after a single 3 grams dose. While fosfomycin is currently only

FDA-approved for the treatment of UC in women as a one-time dose of 3 grams, several studies have shown clinical efficacy in the treatment of ESBL producing E. coli cystitis when the dosing is extended to more than that. With its broad spectrum of in vitro activity and low rates of resistance with the available evidence, fosfomycin may serve as a useful option for oral treatment of MDR uropathogens and further research into the most appropriate dosing regimen and duration is needed. Pharmacists should actively engage with other clinicians to select the most suitable antimicrobial regimen for the treatment of acute UC since they are in a key position to appropriately dose antimicrobial regimens and limit the spread of resistance.

Methods:

Results:

Conclusion:

Submission Category: Infectious Diseases

Session-Board Number: 6-110

Poster Title: Antimicrobial stewardship in the setting of a piperacillin/tazobactam shortage

Primary Author: Justin VandenBerg, Denver Health Medical Center; **Email:** james.vandenberg@dhha.org

Additional Author (s):
Jeffrey O'Connell
Makini Alleyne
Oscar Guzman
Katherine Shea

Purpose: During 2014-2015 antimicrobial shortages were frequent and impacted numerous antibiotics. Many hospital antimicrobial stewardship programs were challenged to identify therapeutic alternatives. Nationwide, a piperacillin/tazobactam shortage began in March of 2014. Some hospitals performed automatic substitution to carbapenems, a broader spectrum agent associated with carbapenem-resistant Enterobacteriaceae when overused. Investigators sought to assess the impact of an automatic substitution from piperacillin/tazobactam to cefepime plus metronidazole on antimicrobial utilization.

Methods: This was a single center, retrospective study comparing piperacillin/tazobactam utilization before (Mar 2014-Jan 2015) and after (Mar 2015-Aug 2015) implementation of a therapeutic interchange to cefepime plus metronidazole. The interchange originally required a recommendation by a pharmacist with physician authorization; however, was eventually made an automatic therapeutic interchange through approval by the Pharmacy and Therapeutics Committee in May of 2015. Additionally, ampicillin/sulbactam was encouraged as a therapeutic alternative, when appropriate. Utilization was assessed by days of therapy per 1000 patient days (DOT/1000 pt days) of piperacillin/tazobactam as well as other commonly used intravenous antibiotics. A Student's t-test was used to compare utilization between the pre and post-intervention groups.

Results: The hospital experienced a significant reduction in mean (plus and/or minus SD) piperacillin/tazobactam DOT/1000 pt days post implementation [(118.5 plus and/or minus 10.2) vs. (5.4 plus and/or minus 8.6); $p < 0.0001$)]. A corresponding increase in cefepime [(20.6 plus and/or minus 7.6) vs. (66.0 plus and/or minus 14.4); $p < 0.001$], metronidazole [(27.9 plus

and/or minus 9.2) vs. (50.2 plus and/or minus 12.2); $p < 0.01$], and ampicillin/sulbactam [(8.4 plus and/or minus 4.6) vs. (39.8 plus and/or minus 9.5); $p < 0.001$] was demonstrated. No difference in mean (plus and/or minus SD) carbapenem or fluoroquinolone DOT/1000 pt days was experienced between groups [(47.0 plus and/or minus 12.1) vs. (52.0 plus and/or minus 10.9); p=NS] and [(111.4 plus and/or minus 22.4) vs. (108.3 plus and/or minus 13.1); p=NS], respectively.

Conclusion: Implementation of an automatic substitution from piperacillin/tazobactam to cefepime plus metronidazole was an effective strategy in the setting of a shortage in order to prevent increased utilization of carbapenems.

Submission Category: Infectious Diseases

Session-Board Number: 6-111

Poster Title: Non-lactose-fermenting culture designation before organism identification: predictive value for Pseudomonas and impact on prescribing at a community hospital

Primary Author: Nissy Varughese, Atlanticare Regional Medical Center; **Email:** nissy.varughese@atlanticare.org

Additional Author (s):
Gemma Downham
Ruth Hackney
Joseph Reilly
Manish Trivedi

Purpose: Preliminary microbiology reports have long been used as a guide for treating bacterial infections. Providers may presume a Non-Lactose Fermenting (NLF) preliminary culture result to be Pseudomonas and modify antimicrobial therapy before organism identification. Some gram-negative organisms assumed to be Lactose Fermenting (LF) now have NLF strains which can further call into question the value of this subjective fermentation test. We evaluated the sensitivity and specificity of a NLF designation, specifically for predicting Pseudomonas growth, including positive predictive value (PPV). We also investigated whether providers were utilizing these NLF preliminary results to modify antimicrobial therapy.

Methods: We evaluated all clinical lab specimens (n=997 from blood, urine, and sputum) collected between January 2015 to December 2015. Two hundred ninety-seven NLF cultures were identified, and 80 excluded since their NLF designation was not reported prior to organism identification. Sensitivity and specificity were calculated to determine value in NLF reporting, specifically for predicting Pseudomonas species. Included were 217 cultures reported as NLF before organism identification of which 54 cultures never progressed to organism identification. Seven hundred LF cultures were examined for Pseudomonas growth to be used in statistical calculations. Chart review was conducted and data collected included patient demographics such as age, sex, patient drug allergies, antibiotic prescribing changes ordered after the preliminary reporting of NLF GNRs, and all concomitant patient microbiology reports. Prescribing of antibiotics was evaluated for anti-pseudomonal coverage prior to and after NLF designation. This retrospective study was approved by the Investigational Review Board of AtlantiCare Regional Medical Center.

Results: Of the 217 NLF cultures evaluated, 32 (14.7 percent) were positive Pseudomonas. The sensitivity and specificity to predict Pseudomonas growth for cultures when NLF was reported before organism identification was 38 percent and 77 percent, respectively. Positive predictive value for Pseudomonas in this assessment was 13 percent. The most frequently identified NLF organism was E. coli, cultured 37 times as a NLF (17 percent) from blood and urine specimens. No cultures in 700 samples reported as LF grew Pseudomonas, although there were 53 cases where Pseudomonas was identified without a reported fermentation status. Observed prescribing patterns demonstrated that in 40 of 217 cases (18.4 percent), prescribers escalated antibiotics to an anti-pseudomonal agent when a NLF was reported by the laboratory.

Conclusion: Our findings demonstrate the preliminary reporting of NLF is not an effective predictor for Pseudomonas infections. In over 85 percent of our cases, a preliminary NLF designation was not Pseudomonas, evident by the low sensitivity, specificity, and PPV. Moreover, escalating antibiotics after a NLF report does not seem warranted based on this test alone. We believe this study demonstrates there is little value in using a preliminary NLF designation as a single tool to predict Pseudomonas infections, and prescribers should use this test in conjunction with patient specific variables and clinical judgment to guide antimicrobial therapy.

Submission Category: Infectious Diseases

Session-Board Number: 6-112

Poster Title: Rate of positive cultures necessitating definitive therapy in patients receiving empiric vancomycin

Primary Author: Dustin Waters, Intermountain Healthcare; **Email:** dustin.waters@imail.org

Additional Author (s):
Josh Caraccio

Purpose: Vancomycin is a commonly prescribed empiric antibiotic mainly used in cases where methicillin-resistant Staphylococcus aureus (MRSA) infection is suspected. It is unknown how many patients treated empirically with vancomycin actually have a positive culture for an organism that would require vancomycin therapy. The purpose of this study was to determine the rate of culture-positive MRSA infection or other organism requiring vancomycin therapy. Another aim of this study was to determine if facilities having a dedicated infectious diseases (ID) pharmacist was associated with reductions in the amount of vancomycin used for greater than 48 hours in non-culture positive patients.

Methods: All patients receiving empiric intravenous (IV) vancomycin from January 1, 2014 to March 31, 2014 within a 22-hospital health system were evaluated to determine the rate of positive cultures necessitating continued vancomycin therapy. Patients were included if they received IV vancomycin for any period of time. Patients were excluded if they received oral vancomycin, or if they were admitted to the pediatric or orthopedic specialty hospital within the health-system. Patient-specific microbiologic results were then evaluated via chart review to determine if the isolated bacteria would warrant continued therapy with vancomycin. The primary outcome variable was the rate of positive cultures that would necessitate definitive vancomycin therapy. Conditions or isolated bacteria that were considered appropriate for continued vancomycin therapy included MRSA, methicillin-susceptible Staphylococcus aureus with a documented allergy to multiple bet-lactam antibiotics, methicillin-resistant coagulase negative Staphylococci, Enterococcus spp. resistant to ampicillin, or in which the patient had a documented penicillin allergy, and other bacteria for which vancomycin would be considered the drug of choice. In addition, vancomycin therapy lasting greater than 48 hours in those with negative cultures, or with bacteria for which vancomycin would not be indicated was compared between facilities with and without dedicated ID clinical pharmacists. The study was approved

by the institutional review board at Intermountain Healthcare and granted a waiver of informed consent.

Results: A total of 1,662 patients received IV vancomycin during the study period. Of these patients, 186 (11.2 percent) had a positive culture for a bacteria which would necessitate use of vancomycin. Of the 1,476 patients who did not have a positive culture, 572 of these, or 38.8 percent, received vancomycin for less than 48 hours. The majority (61.2 percent) of patients without a positive culture requiring vancomycin therapy received vancomycin for longer than 48 hours. In comparing hospitals with and without dedicated ID pharmacists, 56.8 percent of vancomycin use in non-culture positive patients continued beyond 48 hours in hospitals with ID pharmacists and 68.8 percent of vancomycin use continued beyond 48 hours in hospitals without ID pharmacists (p less than 0.001).

Conclusion: Vancomycin is widely used as an empiric antibiotic as coverage for MRSA or other gram-positive infections. The results of this study indicate that the rate of culture-positive organisms that would require vancomycin therapy is low relative to the rate at which vancomycin is used empirically. Additionally, institutions that employed dedicated ID pharmacists used vancomycin beyond 48 hours in culture-negative patients significantly less often than did institutions who did not employ ID pharmacists. This study provides support for antimicrobial stewardship activities in reducing vancomycin use, as well as providing evidence vancomycin is over-utilized relative to the rate of culture-proven infection.

Submission Category: Infectious Diseases

Session-Board Number: 6-113

Poster Title: Re-implementation of an antimicrobial stewardship program results in a first-year savings of about 900,000 dollars

Primary Author: Warren Wood, St Mary Medical Center; **Email:** warren.wood@stjoe.org

Additional Author (s):
Matthew Chandler
Nicole Reynolds
Bobby Izadi
Winna Asuming

Purpose: Antimicrobial stewardship programs (ASP) aim to optimize antimicrobial utilization through a variety of interventions and education. In many cases, these initiatives can lead to lower medication costs. This report examines the impact of an antimicrobial stewardship program on medication costs in the first year at a hospital that recently changed their pharmacy department administrative director and clinical manager.

Methods: After an analysis of medication utilization for the past 12 months, the antimicrobial stewardship program was re-implemented with new medical staff members in January 2015. The analysis indicated that 4 antimicrobials were being misused: ertapenem, tigecycline, ceftaroline, and linezolid. Antibiogram data for the previous 3 years were reviewed along with the utilization data and a medical staff newsletter was developed and distributed. Medication utilization evaluations for the target agents were performed and reported back to the ASP. The committee reviewed the MUE data along with the antibiogram data and voted to remove ertapenem, tigecycline, and ceftaroline from the formulary and modified the usage criteria for linezolid. To assist in the transition from these agents to ones that were effective and less costly, we developed conversion flowcharts and published them as another medical staff newsletter. They were also used by our staff pharmacists as an aid in making the conversions.

Results: Spending on antimicrobials accounted for 31.9 percent of total inpatient drug spend in fiscal-year 2015 (Jul14-Jun15), for fiscal-year 2016 (Jul15-Jun16) that percentage dropped to 21.9 percent. Acquisition costs for all antimicrobials decreased by 988,926 dollars. We also tracked total antimicrobial-treatment-days on a per patient-day basis (to adjust for volume) and we noticed a decrease of 4 percent. For the targeted antimicrobials we realized the following:

tigecycline ; 85.3 percent decrease in treatment-days, ertapenem; 88.5 percent decrease in treatment-days, ceftaroline; 91.4 percent decrease in treatment-days; and linezolid; 81.3 percent increase in treatment-days. The increase for linezolid was due to the conversion of the gram positive agents.

Conclusion: Re-implementation of the antimicrobial stewardship program by new pharmacy management resulted in a savings of 988,926 dollars during the first year of the program. We are continuing to track sensitivity trends and the occurrence of multi-drug resistant organisms to make sure these do not increase.

Submission Category: Infectious Diseases

Session-Board Number: 6-114

Poster Title: Effect of drug shortage mitigation strategies on time to ampicillin/sulbactam administration

Primary Author: Andrew Zullo, Lifespan--Rhode Island Hospital; **Email:** andrew_zullo@brown.edu

Additional Author (s):
James Beaulieu
Christine Berard-Collins

Purpose: Drug shortages impact health systems' ability to provide consistent supplies of critical antimicrobials like ampicillin/sulbactam. Mitigation strategies are often implemented to conserve remaining supplies of drugs. The unintended consequences of these strategies, such as delays in therapy, remain unknown. Such information is necessary to inform future efforts by health systems to improve the management of drug shortages, especially those affecting antimicrobial drug products. Our objective was therefore to evaluate the effect of drug shortage mitigation strategies on time to administration of ampicillin/sulbactam. We hypothesized that drug shortage mitigation strategies would result in significant delays in ampicillin/sulbactam administration.

Methods: We conducted a retrospective cohort study of 804 adult patients who received at least one dose of ampicillin/sulbactam during an inpatient hospital stay between April 14, 2015 and January 13, 2016. The pre-shortage/pre-implementation baseline was April 14, 2015 to June 16, 2015. The mitigation strategy phase-in period was June 17, 2015 to August 26, 2015. The full implementation of the mitigation strategy was August 27, 2015 to January 13, 2016. The mitigation strategy included email alerts to hospital staff, increased scrutiny of clinical necessity by pharmacy staff, removal of ampicillin/sulbactam from patient care units, and consolidation of ampicillin/sulbactam supplies to the central pharmacy. Ampicillin/sulbactam use was assessed using electronic health record data. Time to first administration was calculated as the difference in minutes between pharmacist order approval and nurse administration. Kaplan-Meier curves and mixed effects Cox proportional hazards regression models with a random intercept for patient and a Weibull distribution were used to compare the times stratified by mitigation strategy implementation period (i.e., pre-shortage, phase-in, full implementation). Models were also stratified by patient care unit type (e.g., emergency,

pediatric, intensive care, general medical) and estimates were tested for linear trend using Wald tests. All estimates are represented as hazard ratios (HR) with 95 percent confidence intervals (CI).

Results: The cohort contributed a total of 165,985 minutes of follow-up time between pharmacist order verification and nurse administration of ampicillin/sulbactam. The overall mean follow-up time was 148 minutes, the median was 107 minutes, and the range was 1 to 1,314 minutes. Compared to pre-shortage baseline, there was no overall difference in time to administration of ampicillin/sulbactam in the mitigation strategy phase-in (HR 1.03, 95 percent CI 0.86-1.22, p-value 0.75) or full implementation periods (HR 1.03, 95 percent CI 0.89-1.21, p-value 0.67). There was a significant trend toward longer times to ampicillin/sulbactam administration in emergency department (ED) units compared to non-ED units across shortage mitigation strategy periods (pre-shortage HR 3.39, 95 percent CI 2.17-5.29, p-value less than 0.001; phase-in HR 3.56, 95 percent CI 2.48-5.10, p-value less than 0.001; full implementation HR 3.99, 95 percent CI 2.88-5.53, p-value less than 0.001; p-value for linear trend less than 0.001). Similarly, there was a trend toward longer times to administration in general medical units across mitigation strategy periods (pre-shortage HR 0.71, 95 percent CI 0.52-0.98, p-value 0.04; phase-in HR 0.71, 95 percent CI 0.54-0.95, p-value 0.02; full implementation HR 0.82, 95 percent CI 0.67-1.02, p-value 0.08; p-value for linear trend less than 0.01).

Conclusion: The ampicillin/sulbactam shortage and associated mitigation strategies had no overall effect on time to ampicillin/sulbactam administration, suggesting that mitigation strategies to conserve drug do not result in overall significant delays in care. However, drug shortage mitigation strategies did appear to increase time to administration of ampicillin/sulbactam in emergency department and general medical units over time. Therefore, health system pharmacists and management should evaluate the effect of drug shortage mitigation strategies within individual care units and areas.

Submission Category: Leadership

Session-Board Number: 6-115

Poster Title: Impact of a structured residency preparation program on match results

Primary Author: Vicky Shah, Wilkes University Nesbitt School of Pharmacy; **Email:** vicky.shah@wilkes.edu

Additional Author (s):
Thomas Franko
Erica Hoot
Nicole Pezzino

Purpose: The purpose of the research is to determine if two new sessions added to an already existing residency preparation series improved overall match rates for pharmacy resident candidates. Previously established programs consisted of an introductory meeting followed by a second session which covers CV review and an overall look at interviews without a practice session. The demand for pharmacy residents has increased drastically over the past few years while the number of residency spots available has not increased to match the need. It is very important for us to provide these services and assist our students to better prepare them for post-graduate training.

Methods: Two new sessions were added to the established residency preparation series, a mock showcase to prepare students for the American Society of Health System Pharmacists (ASHP) Midyear Conference and an Interview 101 program designed to educate students on skills to be used before, during and after the interview process. The mock showcase, staged the week prior to Midyear, focused on navigating the fair, approaching prospective sites, conducting a “thirty second elevator speech” and reception etiquette. The Interview 101 program, held after Midyear, focused on appropriate verbal and non-verbal communication as well as etiquette for the interview process. Students were then given the opportunity to practice ten minute interviews with a faculty member or current resident after which immediate feedback on performance was provided. A chi-squared analysis was conducted on final match results comparing students who attended zero, one and two of the new sessions. The overall match rate was also compared to that of the previous year when the new sessions did not exist.

Results: 31 students of the class of 2016 registered for the match, of which 7 attended both sessions, 12 attended one and 12 did not attend any. Corresponding match rates were 85%, 91% and 83% respectively ($p = 0.82$). The overall match rate for the class of 2016 as compared to the class of 2015 was 87% vs. 73% ($p = 0.21$). Student feedback showed increased feelings of confidence in both navigating the showcase and the interview process.

Conclusion: The two new sessions did not appear to have a significant improvement in match rate as compared to the previous year. Anecdotal student feedback showed improved confidence and satisfaction in preparation for obtaining a residency. Further research is needed to better determine the actual vs. perceived benefit of the new residency preparation sessions.

Submission Category: Oncology

Session-Board Number: 6-116

Poster Title: It's not just ACE-I's: angioedema caused by the combination of everolimus and losartan

Primary Author: GaEun Joung, Englewood Hospital and Medical Center; **Email:** gjoun2@gmail.com

Additional Author (s):
Arsheena Yassin
Minaxi Jhawer
Joseph Cruz
Jeff Nemeth

Purpose: Drug therapy with everolimus, an inhibitor of the mammalian Target of Rapamycin (mTOR), is known to increase the risk of developing angioedema. This adverse drug reaction (ADR) is well documented in case reports and case series spanning the medical literature, especially in patients who are also treated with angiotensin-converting enzyme inhibitors (ACE-I). Current practice calls for patients who have experienced this ADR due to everolimus and an ACE-I to be switched to an alternative antihypertensive therapy, possibly angiotensin receptor blocker (ARB), but there have been rare cases of repeat angioedema reported in a subset of organ transplant patients treated with this combination as well. We present the case of a 78 year-old woman with metastatic, low grade, neuroendocrine tumor of the distal ileum who developed angioedema after being treated with everolimus 10 mg oral (PO) daily while concurrently on losartan 100 mg PO daily. The patient has a past medical history of hypertension and stage II breast cancer, status post bilateral mastectomy and adjuvant chemotherapy. The patient was treated as an outpatient with monthly octreotide 30 mg depot injections. Despite this high dose, the patient remained symptomatic with progression of disease and everolimus 10 mg daily was added to her regimen. Five days after this addition, the patient was hospitalized for small bowel obstruction and multifocal pneumonia. The patient was medically managed and discharged in stable condition. A few days after discharge, she was again admitted for small bowel obstruction. Upon admission, the patient was kept on everolimus 10 mg daily, losartan 100 mg daily, and her octreotide switched to 100 mcg subcutaneous every eight hours. On day seven of admission, the patient was noted to have lower lip and tongue swelling, without complaints of wheezing or airway edema. This was believed to be attributed to everolimus, which was then discontinued, and the patient was

treated with diphenhydramine 25 mg PO, famotidine 40 mg PO, and methylprednisolone 80 mg intravenously. The patient's symptoms improved and she was eventually discharged on losartan 100 mg daily and transitioned to octreotide depot injections. The allergy and reaction to everolimus was documented in the computer system and was also reported to the Food and Drug Administration's MedWatch program. After carrying out a comprehensive review of the literature, this is to the authors' knowledge the first documented case of such a reaction between everolimus and an ARB in a patient being treated for cancer. While the incidence of angioedema with this combination of drugs in this population seems to be relatively low, patient education and practitioner awareness will be paramount in early identification of such reactions in order to increase the chances of a positive clinical outcome. Since doses of everolimus used in treating cancer are typically higher than those used in organ transplantation and the incidence of angioedema is thought to increase with higher doses, it is rational to account for this potential ADR/drug interaction when assessing the antihypertensive pharmacotherapy options for such patients. This case report also highlights the need to assess medication regimens in a holistic manner since research and clinical experience continue to show that ADRs do not exclusively manifest in response to a single drug exposure and can be sometimes only be triggered by a combination of therapies. According to the Naranjo probability scale, everolimus and losartan coadministration was the probable cause of the patient's adverse reaction. This patient experienced angioedema on everolimus (on day 34) and losartan (started approximately 4 months prior) which reinforces the need for increased awareness for the risk of angioedema in patients on everolimus and ARB therapy that may not be immediately present upon initiation.

Methods:

Results:

Conclusion:

Submission Category: Oncology

Session-Board Number: 6-117

Poster Title: Comparison of the rates of Clostridium difficile and bacteremia after delaying fluoroquinolone prophylaxis from day 0 to day +3 post-autologous hematopoietic stem cell transplantation

Primary Author: Karin Koseck, The Mount Sinai Hospital; **Email:** karin.koseck@mountsinai.org

Additional Author (s):
Amir Steinberg
Gina Caliendo
Joanne Meyer
Sara Kim

Purpose: Prophylactic fluoroquinolones are routinely administered after hematopoietic stem cell transplantation (HSCT) to prevent bacterial infection. Studies have identified Clostridium difficile (C. difficile) infection as a common complication after transplantation. The use of broad-spectrum antibiotics, including fluoroquinolones, may also increase the risk of C. difficile infection, particularly in immunocompromised patients. This study is designed to evaluate the effect of a delay in fluoroquinolone prophylaxis by 3 days after autologous HSCT on the rates of C. difficile infection and bacteremia.

Methods: A single-center retrospective cohort study was performed in 118 patients who received levofloxacin prophylaxis following autologous HSCT at our institution between November 2014 and October 2015. Institutional Review Board approval was obtained prior to initiation of the study. In efforts to reduce the rate of Clostridium difficile at our institution, initiation of prophylaxis was delayed from day 0 to day +3 of transplant beginning April 30, 2015. The incidence of C. difficile infection and incidence of bacteremia in patients who initiated levofloxacin on day 0 was compared to those who started prophylaxis on day +3.

Results: There was no difference in the rates of C. difficile (7.9% vs. 5.5%, P=0.593) and bacteremia (7.9% vs. 3.6%, P=0.323) in patients who initiated levofloxacin on day 0 compared to those who initiated prophylaxis on day +3.

Conclusion: Delaying the initiation of levofloxacin prophylaxis by 3 days post-autologous HSCT showed no difference in the incidence of C. difficile or bacteremia. Future studies are warranted to show feasibility of delaying antibiotic prophylaxis until neutropenia post-HSCT.

Submission Category: Oncology

Session-Board Number: 6-118

Poster Title: Development of a novel oxaliplatin desensitization protocol with smart pump compatibility

Primary Author: Nicholas Link, Cleveland Clinic Health System; **Email:** nlink@ccf.org

Additional Author (s):
Bernadette Clark
Marc Earl

Purpose: An oxaliplatin desensitization protocol consists of five individual intravenous bags. The first four bags are serial dilutions of the total dose (1:10,000, 1:1,000, 1:100, and 1:10) followed by a fifth bag containing the remaining ninety percent of the total dosage. Smart pump technology is limited by allowing a minimum concentration of 0.01mg/mL. Smart pump safety features and drug specific programming cannot be utilized with the first bag (1:10,000). The medication usage evaluation purpose was to determine oxaliplatin desensitization reaction rates, and investigate the possibility of developing a new desensitization protocol that will allow full utilization of smart pump technology.

Methods: A Health-System wide report was generated from the electronic medical records consisting of all oxaliplatin orders from 2007—2015, prescribed by the gynecologic oncology department. The gynecologic oncology department was chosen because they are the Health-System's most frequent prescriber of the oxaliplatin desensitization protocol. Patients were included in the evaluation if they received oxaliplatin via the desensitization protocol and had documented administration notes in the electronic medical record. Patients that did not receive oxaliplatin via the desensitization protocol or did not have administration notes in the electronic medical record were excluded from the evaluation. Primary endpoints included rate of oxaliplatin hypersensitivity reaction and bag number within the desensitization protocol in which the reaction occurred. Secondary endpoints included number of patients experiencing a reaction, oxaliplatin desensitization cycles administered, cycle in which reaction occurred, and history of prior carboplatin hypersensitivity reaction. Descriptive statistics were used to assess all endpoints.

Results: Thirty-seven patients met the inclusion criteria for the evaluation. A total of two hundred and fifty three cycles were administered with a reaction rate of twenty-four percent.

The fourth infusion bag was the median bag in which a reaction occurred (range: bag three to bag five). Nine patients experienced an oxaliplatin hypersensitivity reaction, with two patients experiencing multiple reactions. Patients' averaged six oxaliplatin desensitization cycles (median: four, mode: one, six). Eighty-nine percent of patients receiving an oxaliplatin desensitization protocol experienced a prior reaction to carboplatin.

Conclusion: Oxaliplatin desensitization reactions occurred in bags three to five of our desensitization protocol. Based upon these results, the institution is planning to omit bag one (1:10,000) and utilize a protocol consisting of four stages (1:1,000, 1:100, 1:10, and remainder of dosage). The change will improve the safety of administration by allowing the entire infusion to be prepared in a single intravenous infusion bag and administer the stages by titrating the infusion rate. The change will allow for smart pump selection of the appropriate drug-specific administration record for the entire desensitization administration.

Submission Category: Oncology

Session-Board Number: 6-119

Poster Title: Benefits of the novel use of a compounded oral suspension in chemotherapy and radiotherapy induced mucositis

Primary Author: Mireya Manes-Sevilla, ASSISTANT HOSPITAL PHARMACIST; **Email:** mireya.manes@salud.madrid.org

Additional Author (s):
M.B. Marzal-Alfaro
Eva González-Haba
Ana Herranz
María Sanjurjo

Purpose: Mucositis is a common complication in patients undergoing chemotherapy and radiotherapy. This adverse effect may limit patients' tolerance to therapy and, therefore, its effectiveness.
In our hospital, the Pharmacy Department compounds an anaesthetic oral suspension for mucositis (AOSM) which contains sodium bicarbonate, gentamycin, nystatin, mepivacaine and hydrocortisone. The objective of this study is identify the onco-haematological patients who can be benefit of the anaesthetic suspension for mucositis, developed by the Pharmacy Department, using her profile to use in patient during their hospitalization.

Methods: Observational, descriptive retrospective cohort study that included onco-haematological patients who presented mucositis at hospital admission or during stay in the hospital between June 2014- June 2015.
The composition of AOSM was designed by the Pharmacy Department. It is formulated with the following components: sodium bicarbonate 23.80 g, gentamicin 320 mg, nystatin 24.000.000 UI (suspension 100.000UI/ml), mepivacaine 1% 40 ml, hydrocortisone 400 mg, water laboratory to a final volume of 1.700 ml. They were repackaged in 250 ml individual bottles. A 30 day stability period, at room temperature and protected from light was assigned. The recommended dose was 5 ml per administration and the frequency of administration was depending of mucositis severity and clinical decision.
As sources of information, the Farhos ® electronic prescription program and medical records were used. An Excel ® table registered the following variables: patients' characteristics (gender, age, diagnostic); clinical variables (neutropenia, opportunistic infections); mucositis

characteristics: drug involved and severity, according to the World Health Organisation (WHO); therapy; dosage and duration of the AOSM; tolerance; additional topical treatment; analgesic and anti-microbial concomitant treatment; nutritional support and date of mucositis resolution. The data analysis was performed using the SPSS ® version 19.0 statistical program, through descriptive statistics.

Results: Seventy patients were analyzed (80% women), with an average age of 69 years (SD: 1.85). The most common diagnoses were: acute myeloid leukaemia, and head and neck cancer. At admission 32% of the patients presented neutropenia (22% of grade IV) and 57% had opportunistic infections.
Mucositis was related to chemotherapy treatment in 73% of the patients, caused by cisplatin (14%), etoposide (13%), oxaliplatine (11%), 5-fluorouracil (9%), others (53%); and to radiotherapy treatment in 27% of the patients. The severity of mucositis was: Grade I (65%), grade II (24%), grade III- IV (11%).
The most frequent dosage regimen of AOSM was three times a day (87%). The median duration of treatment was 6 days (IQR:3-12). All the patients had a good tolerance of the AOSM. In 35% of patients other mouthwashes were used.
90% of patients required analgesia: orally (12.7%), intravenously (87.3%) and 32.9% required morphine. 10% of patients required parenteral nutrition during hospital admission, all patients suspended the parenteral nutrition before the hospital discharge, but 28% required enteral nutrition at home. Also 35.7% of patients needed antimicrobials for the prevention of fungal infections.
In 50% of the patients mucositis was resolved by the 8th day (IQR: 14-3)

Conclusion: Mucositis is one of the most frequent complications of patients receiving chemotherapy based on cisplatin, etoposide, oxaliplatin, 5-fluorouracil and radiotherapy in head and neck. Their symptoms, which include pain, functional disability, and opportunistic infections, can cause reductions in dose and even suspensions of treatment that threaten the effectiveness of cancer treatment. Early treatment of this adverse effect is important. In this regard, our compounded oral suspension allows administration of a complete local treatment to treat mucositis and has been well tolerated by patients. In addition, despite establishing a systemic treatment, the suspension has been maintained to sooth pain prior to food intake and minimize the required nutritional support.

Submission Category: Oncology

Session-Board Number: 6-120

Poster Title: Nw-hydroxy-L-Arginine as a sensitive and stable indicator for determining ethnic and estrogen-receptor-specific breast cancer disease progression

Primary Author: Srinidi Mohan, UNIVERSITY OF NEW ENGLAND; **Email:** smohan@une.edu

Additional Author (s):
Kelly Frazier
Cathy Ng
Nancy Moua
Ian Greenstein

Purpose: Estrogen-negative (ER–) patients has been recognized as the more aggressive subtype, more difficult to treat, greater ethnic disparity concerns, worse prognosis, and twice the risk of mortality compared to estrogen-positive (ER+) tumors. ER– tumor is 2-3 fold more profound in women of African American (AA) than Caucasian (CA) origin. Thus there is an urgent need to identify novel indicators to monitor ER– breast cancer progression in ethnically disparate groups.

Methods: A series of ER– and ER+ primary cells of AA and CA origin, (enlisted in Table 1), along with control mammary epithelial cells cultured in medium between weeks 1 and 9, were tested for cell proliferation and cell cycle by Guave-8HT® flow cytometry (Millipore, MA) using kit assays. Inducible nitric oxide synthase (NOS2) expression in cells was determined by ELISA kit assay (Bioassay systems, CA); and cell nitric oxide as total nitrite was determined by calorimetric assay (Cayman Chemicals, IL). Nw-hydroxy-L-Arginine (NOHA) in the culture medium as well as in the cell lysate were determined (over a 10 week period), by LC-MS, with a lower limit of quantification set at 2.5-10 nM.

Results: Culture medium showed NOHA reduction of 0.85 fold for ER–[CA], and 1.9-fold for ER–[AA] from either ER+ or control after week 1; with progressive decrease over 9 weeks. At the end of 9 weeks, the total NOHA reduction for ER–[CA] was 1.67 fold, with a 9.4 fold reduction in ER–[AA] from ER+ and control culture medium n=4, $p < 0.01$). While cells showed no change in NOHA at the end of week 1, significant NOHA reduction was evident from week 3, which further got lowered by 2.4 fold in ER–[CA] and 9.0 fold in ER–[AA] by week 9 (n=4, $p < 0.01$). Cellular NOS2 expression in ER–[CA] and ER–[AA] increased by 2.3 and 3.2 folds in comparison

with control or ER+ groups, by week 9 (n=4, $p < 0.01$). The overall NOS2 activity also increased in ER–[CA] and ER–[AA] by 1.0 and 1.5 folds by week 9 (n=4, $p < 0.01$).

Conclusion: The present study provides the first evidence for NOHA as a sensitive and stable extra-tumoral indicator for ER– breast tumor prognosis in ethnically disparate population that is based on disease progression. Further in-depth studies are needed to validate NOHA as a new indicator that can monitor therapy outcome in responsive subgroups and prevent unnecessary exposure of unresponsive patients to ineffective therapy. In this way, NOHA will serve as a predictive indicator and will facilitate the development of personalized medicine.

Submission Category: Oncology

Session-Board Number: 6-121

Poster Title: Estimation of optimal monitoring points used for surveying occupational exposure to antineoplastic agents

Primary Author: Tomoko Morita, National Cancer Center Hospital East; **Email:** toogawa@east.ncc.go.jp

Additional Author (s):
Yoshiyuki Sano
Yasuhiko Ichida
Shinichiro Saito
Masakazu Yamaguchi

Purpose: Healthcare personnel have a potential risk of chronic exposure to antineoplastic agents. Multiple exposure routes may contribute to different absorption patterns of the drugs, leading to diverse timing of metabolites excreted via urine.We determined the optimal sampling points of urine to evaluate the occupational exposure of pharmacists handling antineoplastic agents.

Methods: Pharmacists mixing the antineoplastic agents at National Cancer Center Hospital East were enrolled in this study. We collected urine aliquots during 24 hour period, starting at the beginning of drug preparation. The urine volumes and excretion periods were registered. 2-Fluoro-beta-alanine (FBAL), a urine metabolite of 5-fluorouracil (5-FU), was used as an indicator for occupational exposure in this study, and it was measured by a liquid chromatography tandem mass spectrometry (LC-MS).

Results: Ten pharmacists participated in this study from September 2015 to May 2016. The average numbers of urine collection and volume were 5.7 (range: 3-10) and 966 mL (range: 610 -2370 mL). There were 3 patterns observed with FBAL extracted among 10 pharmacists. The most common pattern (n=4) showed the highest concentration immediately after mixing antineoplastic agents while remaining others (n=1 each) exhibited peak concentrations immediately before mixing the agents, and at 24 hour after the start of drug preparation. FBAL was undetectable in 4 pharmacists. The average excretion of FBAL was 3771 ng（range: 0-11003 ng/24 hour）.

Conclusion: Monitoring points immediately after mixing antineoplastic agents and 24 hour after the beginning of drug preparation were optimal for evaluating occupational exposure. We propose to conduct a multicenter study to research occupational exposure in Japan.

Submission Category: Oncology

Session-Board Number: 6-122

Poster Title: Tbo-filgrastim-induced marked leukocytois in a community hospital

Primary Author: Kerry-Ann Peters, Plantation General Hospital; **Email:** kenecian@yahoo.com

Additional Author (s):

Purpose: Tbo-filgrastim is a colony-stimulating factor indicated for severe neutropenia in patients with non-myeloid malignancies receiving chemotherapy drugs with a high potential for causing febrile neutropenia. Clinical trials results showed a 71 percent reduction (1.1 days versus 3.8 days, p< 0.0001) in the duration of severe neutropenia in the tbo-filgrastim group versus the placebo group. This case report describes the effect of tbo-filgrastim on white blood cell counts (WBC) in two patients with neutropenia. Critiques of these cases were done using the Naranjo algorithm. A 76 year old white male with a chief complaint of abdominal pain, nausea, vomiting, and intractable hiccups was admitted through the emergency department. The patient was afebrile with WBC of 33 on admission. A CT scan of abdomen performed at the time of admission revealed a large pancreatic mass, subsequent biopsy of the mass revealed large B cell lymphoma. Oncology was consulted and the patient received a cycle of CHOP (Cyclophosphamide 750 mg/m2, doxorubicin 50mg /m2, vincristine 2mg on day 1, and prednisone 100mg per day for 5 doses). CHOP was initiated on day 7 of the hospital stay, at this time the complete blood count (CBC) showed WBC 22, absolute neutrophil count 21,200. All prescribed doses of chemotherapy conformed to the CHOP protocol and the patient received a full 5 day course of prednisone. Tbo-filgrastim 480 mcg subcutaneously was administered on day 8, which was 24 hours after the initiation of chemotherapy in anticipation of chemotherapy-induced neutropenia. WBC was 24.9 on the day of tbo-filgrastim administration, the following day the WBC increased to 77.8. No further doses of tbo-filgrastim were given; the patient was discharged on day 10 with a WBC 70.4. A 75 year old black female patient with a complicated course at a nearby hospital was admitted to the long term care unit to be weaned off the ventilator. At the time of admission, the patient had ventilator dependent respiratory failure, tracheostomy, and a PEG tube. The patient had a history of cardiomyopathy, atrial fibrillation, hypertension, hyperlipidemia, chronic kidney disease, and a renal mass. On day 29 of admission the patient developed neutropenia and anemia. Her neutropenia was treated with Tbo-filgrastim 480 mcg daily for 4 doses on hospital days 97-100. On day 97 when tbo-filgrastim was started the WBC 1.6 and ANC 2,000; on the last day of administration of tbo-filgrastim the WBC 5.6. The patient WBC however continued to trend upward after the last dose of tbo-

filgrastim reaching a maximum WBC of 76.8 on day 109, which was more than one week after the last dose of tbo-filgrastim was given. The length of stay was increased due to the complicated course of ruling out infection and administering antibiotic for prophylaxis. Using the Naranjo algorithm, a score of 4 was assigned to our cases, which suggest a possible association. The limitation of establishing causality in our case reports is due to the concomitant use of steroids and multiple comorbidities in our patient population. All patients treated with tbo-filgrastim experienced markedly elevated white blood cell counts. Recognizing the fast rise in the WBC counts with tbo-filgrastim, pharmacists provide daily monitoring for all patients on colony stimulating factors to prevent adverse events and ensure the medication is discontinued at the appropriate time.

Methods:

Results:

Conclusion:

Submission Category: Oncology

Session-Board Number: 6-123

Poster Title: Interdisciplinary implementation of tacrolimus intravenous standard concentration

Primary Author: Brandon Shank, The University of Texas MD Anderson Cancer Center; **Email:** BShank@mdanderson.org

Additional Author (s):
Melissa Deaver
Alan Myers
Brent Anderegg
Michael Westmoreland

Purpose: Tacrolimus is a calcineurin inhibitor immunosuppressant used to prevent rejection in solid organ transplant recipients and graft-versus-host disease (GVHD) in allogeneic hematopoietic stem cell transplantation (HSCT) recipients. Most institutions compound patient-specific intravenous (IV) tacrolimus doses daily. Since IV tacrolimus bags are stable for only 24 hours, the prepared doses are often wasted due to frequent dose changes. The purpose of this evaluation was to quantify the reduction in waste and describe the safety of standardizing the concentration of IV tacrolimus.

Methods: A single-center, retrospective cohort study at a large academic comprehensive cancer center was performed comparing patient-specific IV tacrolimus doses (tacrolimus doses in 50 mL, 100 mL, or 250 mL of normal saline based on manufacturer's recommended concentration) to tacrolimus IV standard concentration (tacrolimus 1 mg in 250 mL of normal saline) continuous IV infusion titrated to prescribed dose. Prolonged physicochemical stability of tacrolimus IV standard concentration bags, with a beyond use date of 9 days stored under refrigeration. The cohort study was performed on two HSCT nursing units consisting of a pre-pilot phase from 12/1/2014 to 3/31/2014 during which time consisted of patients receiving patient-specific IV tacrolimus doses. The pilot phase was then instituted from 4/1/2014 to 6/30/2014, during which patients received tacrolimus IV standard concentration. The primary endpoint was reduction in tacrolimus IV bags wasted. Secondary endpoints were drug cost savings, IV infusion line supply reductions, IV line cost savings, decrease in time needed to execute dose changes, reduction in infusion pump alerts, and number of patient safety events. A Mann-Whitney test was used for continuous nonparametric variables, T-test was used for

continuous parametric variables, and Fisher's Exact test was used for nominal variables. A p-value of less than 0.05 was considered statistically significant.

Results: Compared to the pre-pilot phase, there was a 55 percent reduction in tacrolimus IV bags wasted during the pilot phase, resulting in a mean monthly total cost savings of approximately 220 dollars for pilot units. IV line use was significantly reduced by 17 percent (p equals 0.044), yielding a monthly total cost savings of about 84 dollars for pilot units. The median time needed to execute dose changes and IV pump overrides was significantly reduced (p less than 0.0001, p less than 0.0001, respectively). Only two adverse events occurred that were resolved after receiving the extended stability data and performing education.

Conclusion: A conservative estimate for hospital wide expansion could save approximately 3,000 dollars in IV lines and 8,100 dollars in wasted drug, resulting in an estimated total annual savings of about 11,100 dollars. This interdisciplinary quality improvement initiative led to increased efficiency and a reduction in waste when using this tacrolimus IV standard concentration approach. In addition, this change in practice improved patient safety by decreasing IV pump alerts with no significant adverse patient safety reports.

Submission Category: Oncology

Session-Board Number: 6-124

Poster Title: Preparing for United States Pharmacopeia (USP) 800 compliance: evaluating the effectiveness of two closed-system transfer devices (CSTDs) on preventing hazardous drug surface contamination

Primary Author: Andrew Szkiladz, Baystate Health; **Email:** andrew.szkiladz@baystatehealth.org

Additional Author (s):
Scott Gray
Erin Taylor

Purpose: In order to prepare for upcoming USP 800 CSTD compliance guidelines, we conducted an evaluation of two CSTD systems. The study was designed to evaluate how well each CSTD would fit into existing pharmacy and nursing workflows and measure the level to which each system was able to minimize environmental contamination.

Methods: A multidisciplinary group, including pharmacy, nursing, professional development and value analysis, was convened to perform a safety, compliance and cost-effectiveness analysis of the available CSTD systems. Based on the review, one product was selected to compare to our then current CSTD system, focusing on the ease of use during the compounding and administration processes. The two systems were demoed in our outpatient cancer center by pharmacy and nursing staff. The staff members provided feedback on the systems, ultimately leading to the selection of the new CSTD system based on ease of use and adaptability to workflow processes.
As part of the new CSTD system validation, we completed a surface contamination analysis using wipe kits. The first wipe sample was collected while our center used our then current CSTD system during drug compounding only. The second wipe sample was collected eight months later after we had implemented the second and new CSTD system for both compounding and administration. Surface wipe samples were taken from a shelf where chemotherapy is stored, a pharmacy drug preparation counter, the deck of the compounding aseptic containment isolator, a courier box used to transport chemotherapy, a nurse's station computer keyboard, and an IV pole used to hang chemotherapy drugs during administration. The drugs identified for analysis consisted of paclitaxel, fluorouracil, cyclophosphamide, ifosfamide, and methotrexate.

Results: We found that both CSTD systems were safe and easy to use during the compounding process, however we found that the bonded CSTD administration components with the second CSTD system added an additional layer of safety by ensuring there were no accidental disconnects. Both wipe sample analysis results showed non-detectable levels for all drugs and wipe samples tested.

Conclusion: Preparing for USP 800 with a review of CSTD systems can help a facility be one step closer to USP 800 compliance. We evaluated several CSTD systems and narrowed the evaluation down to two systems, eventually choosing to implement the second CSTD system we tested as it met the needs of our pharmacy and nursing staff. Surface wipe analysis confirmed that the CSTD, along with work practices and procedures that were implemented, was effective in minimizing hazardous drug surface contamination, noting that the work practices and procedures may have contributed to the non-detectable levels as well.

Submission Category: Oncology

Session-Board Number: 6-125

Poster Title: Operationalization of a new oncolytic viral therapy at a large health system

Primary Author: Cheryl Wood, University Hospitals of Cleveland; **Email:** cheryl.wood@uhhospitals.org

Additional Author (s):
Karen Donato
Indrani Kar

Purpose: Utilization of viral-based therapy as an investigational drug in the institutional setting is common practice. Once approved for general use, appropriate operationalization is key for safe use and administration. A novel oncolytic viral therapy was approved by the Food and Drug Administration in 2015. Talimogene laherparepvec is a genetically-modified, live, attenuated, herpes simplex virus-1 oncolytic viral medication indicated for melanoma. In order to implement a safe process, an interdisciplinary group identified the need for a standard of practice to safely provide this medication. In anticipation of future viral-based medications, a separate policy for the health system would be needed.

Methods: Once talimogene laherparepvec was requested for addition to formulary, the health system formulary process reviewed and approved the medication for use in the outpatient oncology infusion center. A paper order set and corresponding electronic medical record build were developed. The interdisciplinary workgroup further developed a standard of practice addressing physician, nursing, and pharmacy specifics for procurement, storage, preparation, prescription, dispensing, administration, and decontamination for the medication in a safe manner for both patients and staff. Additionally, education was created and disseminated to appropriate staff, where safety measures were described. A policy was further developed for the health system to address operationalization of new live viral therapies.

Results: After educating staff involved, the standard of practice was followed for the health system's first patient. Challenges were identified and addressed as an update to the standard of practice. The system policy was approved by the health system policy body.

Conclusion: A process to address viral therapies has been developed and implemented at a large health system. Substantial time and interdisciplinary cooperation are required to develop

a safe operational process for these types of medications. This project resulted in the safe implementation of a standard of practice for patients at a large health system requiring talimogene laherparepvec and a system-wide policy for the health system on the management of future viral-based medications.

Submission Category: Pain Management

Session-Board Number: 6-126

Poster Title: Evaluating intravenous acetaminophen in bariatric surgery patients

Primary Author: Michael O'Brien, University of Iowa Hospitals and Clinics; **Email:** michael-e-obrien@uiowa.edu

Additional Author (s):
Jamie Smelser

Purpose: The American Society of Anesthesiologists recommends minimizing or avoiding perioperative opioid administration by using multimodal pain management including acetaminophen (APAP). No studies have shown active comparison between IV, oral, and rectal APAP for post-operative bariatric surgery. Most trials showed some reduction in opioid use with IV APAP vs. placebo or control however, impact varied among groups with one trial showing no benefit. Trials evaluating IV APAP in bariatric surgery are limited by small sample sizes, inconsistencies in outcome measures (and results), and were either underpowered to detect a reduction in opioid-induced side effects or did not report opioid side effects.

Methods: Retrospective chart review was conducted for bariatric surgery patients receiving IV APAP at an academic tertiary referral center from February through May 2016. These patients were compared to historical controls with similar surgeries (i.e., laparoscopic sleeve gastrectomy or laparoscopic Roux-en-Y sleeve gastroplasty) from January 2014 to January 2016 and similar BMI. The primary objective was to compare opioid consumption in 24 hours post-surgery in addition to relevant clinical outcomes such as opioid related adverse effects (i.e., nausea, vomiting, constipation, over-sedation, and respiratory depression) and pain scores. The baseline, highest and lowest pain scores during each 6 hour interval were recorded for the first 24 hours post-operatively.

Results: Forty-eight patients were included in this review. Patients who received IV APAP (n=38) were compared to control patients (n=10). The patient demographics were similar; BMI (45.86 vs 45.84), average weight (126kg vs 129kg), average age (41 years vs 42 years), female gender (90% vs 90%), laparoscopic sleeve gastrectomy (50% vs 60%), and average length of surgery (115 minutes vs 126 minutes) in the IV APAP and control groups, respectively. The average oral morphine equivalent in the first 24-hours (98mg vs 108mg) and average length of stay (1.3 days vs 1.1 days) were both similar between the IV APAP and control groups, respectively. Nausea

(29% vs 40%), vomiting (8% vs 30%), over-sedation (3% vs 10%), and respiratory depression (10% vs 0%) occurred at different rates between the IV APAP and control groups, respectively. The mean pain scores for the IV APAP group were: baseline (2.38), 0-6 hours(low:2.74, high:7.23), 6-12 hours(low:3.74, high:4.77), 12-18 hours(low:3.43, high:4.11), and 18-24 hours(low:3.20, high:4.49). The mean pain scores for the control group were: baseline (3.00), 0-6 hours(low:2.40, high:6.90), 6-12 hours(low:4.10, high:4.70), 12-18 hours(low:3.89, high:5.22), and 18-24 hours(low:3.40, high:5.00). We will be collecting additional data and additional results will be reported at time of poster presentation.

Conclusion: Multimodal pain therapy in post-operative surgery is important, however the benefit of IV APAP in addition to standard therapy is controversial. This study supports the finding that IV APAP decreases opioid use in 24 hours post-surgery, but the clinical relevance is unclear. To date, this study has found no significant difference in pain score, length of stay, or oral morphine equivalent usage. There appears to be differences in rate of adverse events. These results are confounded by the small sample size. Additional patients will be reviewed.

Submission Category: Pain Management

Session-Board Number: 6-127

Poster Title: Pharmacist-led management of chronic pain in an outpatient internal medicine clinic

Primary Author: Alexandra Pietras, MedStar Georgetown University Hospital; **Email:** alexandra.m.pietras@gunet.georgetown.edu

Additional Author (s):
Amy Ives
Jonathan Puhl
Dev Chatterji

Purpose: The purpose of this study is to determine the impact of pharmacist-directed chronic pain management of outpatients at MedStar Georgetown Internal Medicine Clinic (GIM). There has been a continuing increase in opioid prescribing and opioid deaths in the past several years, receiving much media attention. The CDC's most recent statistics show that over 28,000 deaths attributed to opioid overdose in 2014, with at least half of these involving a prescription opioid. In response to the increasing national problem, GIM consulted the Pharmacy Department to help proactively update their workflow in an attempt to combat the epidemic.

Methods: This is a single-center retrospective chart review which observed data from September 2015 to March 2016. The subjects of the study were GIM patients with documented pharmacist encounters for management of chronic pain. Data was retrieved from the outpatient EMR used by the GIM clinic following approval by the Georgetown University IRB. Patients were excluded if they were younger than 18 years of age, terminally ill, or if their chronic pain was due to malignancy. Information collected included pain score (Numeric Rating Scale) at each visit, documentation of a signed pain contract, and whether appropriate discharge from the GIM pain management program occurred in patients who breached their contract. Pharmacist interventions were also collected and organized into opioid-related and non-opioid related.

Results: Thirteen patients were included for a total of 36 pharmacist encounters. All patients had a signed pain contract on file. Eight patients had documented pain scores in the EMR. Decrease in pain score from initial visit to first follow-up was observed in two patients; however both patients' pain scores were back up to baseline at subsequent visits. Five patients

maintained their baseline pain score throughout the study period. One patient had increase in pain score from baseline; however this patient was discharged from the pain program due to failed urine drug screen and receipt of controlled substance prescription from outside GIM without consent (breach of pain contract). Patients who broke their contract during the study period were discharged. The majority of the pharmacist interventions made were titrating medications, both opioid and non-opioid. Other opioid related interventions included transitioning a patient from taking acetaminophen/oxycodone combination product around the clock to taking acetaminophen around the clock with oxycodone only for breakthrough. Pharmacists also recommended initiating long acting opioids and were able to decrease the number of short-acting opioids prescribed. There were a total of 24 interventions made by pharmacists and 3 three discharges (mean interventions per patient = 2.07).

Conclusion: Review of our initial pilot demonstrates a positive impact made by pharmacists in physician workflow. The greatest impact made was assisting in identifying patients potentially abusing or diverting medications by ordering and following up on drug screens as part of the pain contract. We were unable to effectively assess prescription fill history because the District of Columbia currently lacks a prescription drug monitoring program. Minimal effect was observed on patients' pain scores, likely attributed to the subjective nature of patient-reported pain. This study can provide insight into how to improve the current GIM program and provide information to other institutions.

Submission Category: Pediatrics

Session-Board Number: 6-128

Poster Title: Pharmacist collaborative practice in the management of high-risk pediatric asthma

Primary Author: Hanna Phan, University of Arizona; **Email:** hphan@pharmacy.arizona.edu

Additional Author (s):
Mark Brown

Purpose: Given the multifaceted nature of factors affecting asthma medication adherence and asthma control, a multimodal and family-centered multidisciplinary approach that includes involvement of a pharmacist, is often necessary for optimal outcomes. An intraprofessional team developed a high-risk severe asthma clinic for children with intensive patient/caregiver education, pharmacist-driven medication management, and home care nurse services. Patients referred to this specialty clinic were those at high-risk for asthma-related complications (i.e., physician diagnosed severe persistent asthma). This project was designed to evaluate the implementation of a patient care model for the management of high-risk pediatric asthma patients utilizing pharmacist collaborative practice.

Methods: We conducted a prospective, observational study evaluating outcomes of a patient care model for the management of high-risk pediatric asthma patients (ages 6-17 years) utilizing pharmacist collaborative practice. The clinic consisted of a pharmacist, pediatric pulmonologist, and home care nurse. Primary outcomes of this study were asthma control (including asthma control questionnaire (ACQ) score, courses of systemic corticosteroids) and use of health care resources (e.g., hospitalization). Other outcomes included patient/caregiver knowledge of asthma and its treatment (team developed, asthma knowledge questionnaire (AKQ)) and quality of life (Pediatric Asthma Quality of Life Questionnaire (PAQLQ). Data collection included demographics, asthma control and step therapy as defined by NHLBI/NAEPP, AKQ scores, ACQ scores, PAQLQ scores, caregiver PAQLQ scores, identified adherence barriers, pharmacist interventions (medication management, referrals, laboratory monitoring), and spirometry values (e.g., forced expiratory volume in one second (FEV1), forced vital capacity (FVC)). Descriptive statistics including Chi-square, Fisher's Exact Test, Kruskal Wallis, and Wilcoxon Signed-Rank were used to analyze data using STATA version 12.0. The institution review board approved this project and informed consent was obtained for all subjects.

Results: We enrolled 23 subjects (median age 9 years, IQR 6) which completed a total of 65 clinic visits over the course of 14 months. Most subjects (91.3%) were prescribed step 5 therapy or higher at baseline. A majority (87%) of our subjects faced social barriers to adherence, such as family stressors (e.g., two households). Limitations in knowledge about medications and asthma in both subjects (91.3%) and caregivers (61%) were also noted. There were no significant differences between subject and caregiver activity (p=0.20) or emotional (p=0.06) limitation PAQLQ. Subjects who completed at least 2 clinic visits (N=16, 69.6%) demonstrated improved monthly rates of systemic corticosteroid (p=0.01) and emergency department use (p=0.003). ACQ score was not significantly different between pre- and post-clinic attendance (p=0.08); however asthma symptoms on waking was significantly improved pre- and post-clinic attendance (p=0.03). Statistically significant, though not necessarily clinically significant (i.e., at least 12% difference), changes in FEV1 were noted pre- (96, IQR 16.5) to post- (85, IQR 16) clinic (p=0.02). Similarly, FEV1/FVC ratio was decreased from pre- (98.4, IQR 12.4) to post- (91.2, IQR 9.1) clinic (p=0.04). Significantly more patients' asthma were classified as "well-controlled" post-clinic compared to baseline (56.3% vs. 25%, p=0.04).

Conclusion: Pharmacist collaborative practice paired with home care nursing services, as integral components of an intraprofessional clinic for children with high-risk or severe asthma, can help provide necessary intensive patient/caregiver education, complex medication management, and monitoring. This care model may help improve asthma related outcomes including asthma control and health care resource utilization. The clinical and economical impact of this care model should be further investigated in larger, long- term studies.

Submission Category: Pediatrics

Session-Board Number: 6-129

Poster Title: Use of dexamethasone for acute asthma exacerbation requiring PICU admission

Primary Author: Steve Willis, Lifespan; **Email:** swillis@lifespan.org

Additional Author (s):

Purpose: To describe the use of dexamethasone as the steroid of choice in pediatric asthma exacerbation requiring PICU admission. Previous data exists regarding the use of dexamethasone in the general hospital population, but this is the first data reported for the use in patients requiring admission to the PICU.

Methods: Retrospective chart review from 4/1/2015 to 4/1/2016, looking at all patients under 18 years of age, admitted to the PICU for asthma exacerbation or status asthmaticus, and receiving dexamethasone as the steroid component of treatment. Age, sex, weight, concomitant therapy, length of stay, readmission, and duration/dose of therapy will be collected and evaluated to determine significance.

Results: Full results TBD.

Conclusion: Pending final results.

Submission Category: Pediatrics

Session-Board Number: 6-130

Poster Title: Preventing diaper dermatitis in level II nursery-a simple and cost-effective approach

Primary Author: Mona Yu, The Methodist Hospital in Houston Medical Center; **Email:** hyu@houstonmethodist.org

Additional Author (s):
Carlette Patterson
Lisa Fischer
Wilda Chung On

Purpose: The skin of newborns is thin and fragile. It is susceptible to friction, pressure, chemical irritation, and infection. The estimated diaper dermatitis incidence had been approximately 40% and up to 60% in 2009 in our level II nursery. To reduce the incidence of diaper dermatitis, some researchers suggest the use of consistent prevention strategies. Therefore, we proposed a new skin care regimen for level II nursery and it was implemented in September 2010: change the routine diaper change practice to include the prophylactic application of a petrolatum-based topical skin barrier for each diaper change.

Methods: Healthy skin of neonates provides a protective barrier against infection by preventing prolonged contact with urine, feces, moisture, and microorganisms and also functions in thermoregulation, fat storage, and prevention of excessive fluid loss. This protective quality of neonatal skin is effective only if skin integrity is maintained. In addition to routine diaper changes whenever necessary and gentle cleansing with warm water and a soft cloth, prophylactic application of vitamin A & D ointment (active ingredient: petrolatum 93.5%) with each diaper change as a topical skin barrier was included in routine skin care for the level II nursery beginning September 2010. The electronic Level II Nursery Admission Order Set was modified that the “vitamin A & D ointment as needed for each diaper change” was pre-checked. This ensured a thick layer of petrolatum-based vitamin A & D ointment would be applied over the perineal area for each diaper change on every neonate. To evaluate the effectiveness of the intervention, we retrieved and trended the utilization of vitamin A & D ointment vs. the diaper dermatitis treatment medications cholestyramine in 42% petrolatum ointment and zinc oxide ointment from January 1, 2005 through December 31, 2015. In

addition, the incidence of diaper dermatitis over the 11 year period was also calculated and was compared before and after the implementation of the new regimen.

Results: Prior to the change of practice in September 2010, a topical skin barrier was not routinely administered for each diaper change. At the time, vitamin A & D ointment and zinc oxide-based ointment were prescribed for minor diaper rash (i.e. mild scaling, erythema), and topical cholestyramine in 42% petrolatum ointment for more severe diaper rash (i.e. skin breakdown, skin excoriation). According to our data, the estimated diaper dermatitis incidence decreased from approximately 40% and up to 60% in 2009 prior to the intervention to approximately 10% after the intervention. Our medication utilization data also showed the utilization of topical cholestyramine in 42% petrolatum ointment decreased as the utilization of vitamin A & D ointment increased. The utilization of zinc oxide-based ointment didn't show much difference before and after the intervention.

Conclusion: We observed prophylactic application of vitamin A & D ointment with each diaper change reduced the incidence of diaper dermatitis in level II nursery neonates and decreased the severity of diaper dermatitis. The average wholesale price (AWP) of vitamin A & D ointment 2-ounce tube is $3.22, and our acquisition cost is less than $1.80. This simple and cost-effective strategy of implementing prophylactic application of skin barriers can help prevent diaper dermatitis and therefore diaper dermatitis-associated complications.

Submission Category: Pharmacokinetics

Session-Board Number: 6-131

Poster Title: Recommended vancomycin dosing is insufficient to maintain adequate serum levels in pediatric patients

Primary Author: Talita Maloni, Hospital Albert Einstein; **Email:** tamaloni@hotmail.com

Additional Author (s):
Celina Haga
Fábio Ferracini
Talita Belucci
Tatiana Marins

Purpose: Vancomycin is a glycopeptide antibiotic that is widely used in pediatrics to treat infections caused by methicillin-resistant Staphylococcus aureus.
The concentration recommendations range to avoid microbial resistance to vancomycin is between 10mg/mL to 20mg/mL.
Even the large consume and knowledge about vancomycin, the use in the pediatric population is not specific as in adults.
This study evaluated the prevalence of pediatrics patients in intensive care unit that did not achieve the appropriate vancomycin serum concentrations after the administration of the recommended dosage in pediatric references (40 – 60 mg/kg/day).

Methods: Retrospective cohort study included pediatrics patients in intensive care unit from Hospital Albert Einstein, a privative general hospital focused on the treatment of highly complex disease, located in São Paulo – Brazil, to evaluate if the vancomycin serum concentrations collected in the valley were in the therapeutic range (10 – 20mg/mL) during January 1, 2008 through December 31, 2014.

Results: The cohort included 110 pediatric patients (newborns aged more than 37 weeks and more than 28 days and children and adolescents aged ≤ 18 years) that were treated with vancomycin at least 48 hours and with normal kidney function.
This study shows the average dose of 52mg/Kg/day was not sufficient to achieve the vancomycin serum concentrations recommended.

We verified that 84% (n=182/217) of the vancomycin serum concentrations collected in the valley were done according the pediatrics references, but 69% (n=76/110) of the patients presented an average serum concentrations less than 10mg/mL.

Conclusion: The average dose of 52mg/Kg/day was not sufficient to achieve the vancomycin serum concentrations recommended by pediatrics references (10 – 20mg/mL). This study suggests high doses of vancomycin to optimize the drug exposure, whereas the monitoring is done properly to ensure the pediatrics patient´s safety with effective's dosages of vancomycin.

Submission Category: Pharmacokinetics

Session-Board Number: 6-132

Poster Title: Calculation of vancomycin clearance and area under the curve using non-steady state serum concentrations

Primary Author: William Murray, Rady Children's Hospital San Diego; **Email:** wmurray8@cox.net

Additional Author (s):
Joshua Murray

Purpose: Consensus statements from the Infectious Disease Society of America and The American Society of Health-System Pharmacists have implied that the measurement of a trough level at steady-state is a surrogate for the AUC. Recent reports have implicated high trough concentrations of vancomycin as a factor increasing risk of nephrotoxicity. Recent studies suggest that targeting AUC may be a safer and more accurate way to initiate and adjust vancomycin doses. This project is designed to demonstrate how pharmacists can quickly and easily calculate patient-specific vancomycin clearance and subsequent AUC from a single trough level even without a sample obtained at steady-state.

Methods: A Microsoft Excel spreadsheet was developed using standard pharmacokinetic equations for a one-compartment infusion model. The worksheet does not require or assume that steady-state conditions be achieved. The spreadsheet allows the user to input an estimated volume of distribution and with knowledge of the doses and administration times the patient specific clearance can be calculated by an iterative method. The user can then calculate the steady-state peak and trough values for any given dose as well as the AUC. Simulations were performed to authenticate the spreadsheet's predictive values under multiple dosing regimens utilizing varying values for clearance and volume of distribution to predict steady-state peak, trough levels and the AUC. Simulations were performed using different values for clearance and volume of distribution to predict steady-state peak and trough levels and the AUC for multiple dosing regimens. A table comparing the results will be presented.

Results: Simulations using fixed doses of 15 mg/kg every 8 hours with clearances ranging from 0.04 L/kg/hr to 0.12 L/kg/hr revealed that the ratios of the AUCs to the troughs are not proportional as many pharmacists might expect. For example, a patient receiving a dose of 15 mg/kg every 8 hours with a clearance of 0.1 L/kg/hr would have an AUC of 450 with an

expected trough of 9.1 mg/L. With the same dose of 15 mg/kg every 8 hours and a clearance of 0.05 L/kg/hr the AUC would be double of 900, however the expected trough would be 26.7 mg/L almost triple that of the patient with the clearance of 0.1 L/kg/hr.
The only patient in this simulation with an estimated trough between 15-20 mg/L had a clearance of 0.07 L/kg/hr with a corresponding AUC of 643 and trough of 16.5 mg/L. A patient with a higher clearance, for example 0.1 L/kg/hr, would require a dose of about 85 mg/kg/day to achieve the same trough, but the corresponding AUC would be 850.

Conclusion: The ratio of vancomycin AUC and trough levels is not a constant value when using a fixed dose and interval while varying the clearance. The use of a simple Microsoft Excel worksheet to help calculate patient specific clearance and AUC is expected to increase pharmacist awareness that trough vancomycin levels are not necessarily surrogates for the AUC as suggested in the consensus articles on vancomycin monitoring.

Submission Category: Pharmacokinetics

Session-Board Number: 6-133

Poster Title: Drug-drug interactions studies between HCV antivirals sofosbuvir and velpatasvir and HIV antiretrovirals

Primary Author: Sarjita Naik, Gilead Sciences; **Email:** sarjita.naik@gilead.com

Additional Author (s):
Kyle Hammond
Joe Llewellyn
Anita Mathias
Erik Mogalian

Purpose: A once-daily fixed-dose combination tablet composed of sofosbuvir (SOF; nucleotide analog NS5B inhibitor) and velpatasvir (VEL; pangenotypic NS5A inhibitor) is under regulatory review for the treatment of chronic HCV infection. Phase 1 studies were conducted in healthy volunteers to evaluate potential drug-drug interactions (DDIs) between SOF/VEL and HIV antiretroviral (ARV) regimens to support coadministration in HIV/HCV co-infected patients.

Methods: These were multiple-dose, randomized, cross-over DDI studies. Subjects received SOF/VEL and ARVs EFV/FTC/TDF, RPV/FTC/TDF, DTG, RAL+FTC/TDF, EVG/COBI/FTC/TDF, DRV/r + FTC/TDF, ATV/r + FTC/TDF, LPV/r + FTC/TDF, or EVG/COBI/FTC/TAF alone and in combination. Steady-state plasma concentrations of SOF, its predominant circulating nucleoside metabolite GS-331007, VEL, and ARVs were analyzed on the last day of dosing for each treatment. Pharmacokinetic (PK) parameters were calculated and geometric least-squares means ratios and 90% confidence intervals (combination vs. alone) for SOF, GS-331007, VEL, and ARV AUCtau, Cmax and Ctau were estimated and compared against lack of PK alteration boundaries of 70-143% for all analytes. Safety assessments were conducted throughout the study.

Results: 230 of 237 enrolled subjects completed the studies; 5 subjects withdrew consent, 1 discontinued due to Grade 1 urticaria and 1 discontinued due to pregnancy. The majority of adverse events (AEs) were Grade 1 and there were no serious AEs. No clinically significant changes in the PK of SOF/VEL, except EFV, were observed when administered with HIV ARVs. Decreased VEL exposure (~53%) was observed with EFV/FTC/TDF. No clinically significant

changes in the PK of HIV ARVs, except TDF, were observed when administered with SOF/VEL. Increased TFV exposure (~40%-81%) was observed with SOF/VEL when administered as TDF.

Conclusion: Study treatments were generally well tolerated. Results from these studies demonstrate that SOF/VEL may be administered safely with RPV, RAL, DTG, EVG, COBI, DRV/r, ATV/r, and LPV/r (but not EFV) with a backbone of FTC/TDF or FTC/TAF. The safety and efficacy of SOF/VEL and ARVs was evaluated in HIV/HCV co-infected subjects in the Phase 3 ASTRAL-5 Study.

Submission Category: Pharmacokinetics

Session-Board Number: 6-134

Poster Title: Model-predicted netupitant pharmacokinetic (PK) profiles on repeated dose schedules: accumulation and safety considerations for chemotherapy-induced nausea and vomiting (CINV) prophylaxis in multiday emetogenic chemotherapy

Primary Author: Lee Schwartzberg, West Cancer Center; **Email:** lschwartzberg@westclinic.com

Additional Author (s):
Simona Parisi
Alberto Bernareggi

Purpose: NEPA is an oral fixed combination of the neurokinin-1 receptor antagonist netupitant (300 mg) and the 5-hydroxytryptamine-3 receptor antagonist palonosetron (0.5 mg). A single NEPA administration plus dexamethasone was shown to be safe and effective for CINV control with single doses of highly/moderately emetogenic chemotherapy. Anticancer chemotherapy may follow a multiple-day schedule of administration, increasing the risk for CINV. Repeated palonosetron plus dexamethasone dosing with multiday chemotherapy was safe and effective at preventing CINV. This study aimed to predict the PK profile of multiple dosing schedules of 300-mg netupitant and to develop safety considerations based on exposure.

Methods: Experimental PK data from 22 healthy adults (age 18–45 years) who received an oral single dose of NEPA under fasting conditions, participating in a phase I study (Calcagnile et al, Clin Pharmacol Drug Dev 2015), were used for model development. Netupitant plasma concentrations were measured up to 240 hours post-dose. A two-compartment PK model with first-order absorption, first-order elimination and lag time was fitted to the mean netupitant plasma concentration-time curve using the software Phoenix WinNonlin version 6.4 (Certara USA, Inc.). The model was then used to simulate the netupitant PK profiles after repeated NEPA administrations, assuming PK linearity.

Results: The two-compartment model was appropriate to describe the time course of netupitant plasma concentrations after single oral administration, as shown by goodness-of-fit parameters and diagnostic plots. The PK profiles of netupitant 300 mg after 4 oral administrations on days 1, 3, 5, and 7 (NETU-1357) or days 1, 3, 6, and 8 (NETU-1368) were simulated. For NETU-1357 and NETU-1368 the predicted peak and trough netupitant plasma concentrations increased gradually after each administration due to the long netupitant half-

life (80 h in cancer patients). The predicted fraction of steady state achieved after the fourth administration was 81.7 percent (NETU-1357) and 79.2 percent (NETU-1368). The predicted maximum serum concentration and area under the curve from time 0 to 240 h after 4 administrations increased 1.3- and 3.6-fold (NETU-1357) and 1.3- and 3.4-fold (NETU-1368), respectively, compared with the values after single administration. Predicted overall systemic exposure (AUCinf) of netupitant was lower for NETU-1357 and NETU-1368 (78,268 h·ng/mL for both) compared to previous PK studies with daily netupitant alone (Study 1: netupitant 300 mg daily, days 1–7; AUCinf 136,970 h·ng/mL; Study 2: netupitant 450 mg daily, days 1–7; AUCinf 205,453 h·ng/mL; Study 3: netupitant 200 mg daily, 8 weeks; AUCinf 730,504 h·ng/mL).

Conclusion: Model-predicted netupitant overall exposure is lower than the exposure achieved in previous phase I multiple dose netupitant studies in which the drug was shown to be safe. A convenient repeated dose NEPA administration regimen may provide a substantial benefit in the multiday chemotherapy setting. While these preliminary modeling results are promising, validation in the context of a clinical trial to evaluate the efficacy and safety of NEPA with repeated dosing is required.

Submission Category: Pharmacokinetics

Session-Board Number: 6-135

Poster Title: Development of a novel LC-MS/MS method for determination of denosumab in human serum and its clinical application to cancer patients

Primary Author: Hiroaki Shida, Hamamatsu University School of Medicine; **Email:** shida.hiroaki@gmail.com

Additional Author (s):
Takafumi Naitio
Kaito Shibata
Junichi Kawakami

Purpose: Denosumab is a human monoclonal antibody targeting receptor activator of nuclear factor kappa-B ligand which is used for the treatment of bone metastatic cancer and osteoporosis. Although denosumab has several severe adverse effects like hypocalcemia, its relationship with serum concentration remains unclear. Generally the serum concentration of therapeutic antibodies including denosumab is determined using ligand binding assay such as ELISA. However, this approach has limits with regards to reagent availability and specificity. The purpose of this study is to develop an LC-MS/MS method for determination of denosumab in human serum and to apply it to cancer patients treated with denosumab.

Methods: The surrogate peptide of denosumab was determined using Fourier transform mass spectrometer and 2D-structure database. Human serum spiked with denosumab was treated with a protein G affinity column. The extracted antibodies were mixed with stable isotope-labeled surrogate peptide as an internal standard (IS) and then treated with denaturant, dithiothreitol and iodoacetamide. The samples were digested by trypsin, and the peptides were purified with a desalting column. The extracted peptides were separated with a 2.6-micrometer particle size ODS column using a mobile phase of mixture of acetonitrile and water containing 0.1 percent acetic acid. The flow rate was 0.2 mL/min and the column temperature was 40 degrees Celsius. The detection of peptides was performed in multiple reaction monitoring transition mode using a triple quadrupole mass spectrometer with electrospray positive ionization. This validated method was applied to the cancer patients treated with denosumab. The patients' blood samples were collected just before denosumab subcutaneous administration. The study protocol was approved by the institutional ethics committee.

Results: Five peptides were found as surrogate peptide candidates and one of them (peptide A) was selected for denosumab quantification from a view point of its specificity and sensitivity. The peptide A was derived from a complement determining region of denosumab. The retention times of peptide A and IS peptide were 2.0 minutes. The calibration curve was linear and covered the concentration range of 2.5-100 micrograms per mL as denosumab. The lower limit of quantification of serum denosumab was 2.5 micrograms per mL. No peaks were observed from denosumab-free serum. The intra-day and inter-day coefficients of variation were less than 15 percent and accuracy was 85-115 percent. From these results the method met the US FDA guidance. The serum concentration of denosumab of cancer patients treated with denosumab was within the range of calibration curve of this method.

Conclusion: The present study developed a novel LC-MS/MS method for determination of denosumab concentration in human serum. This method was well validated and could be applied to serum samples of cancer patients. The present method would contribute to overcome the problems of existing ligand binding assay approach, and to reveal the relationship between denosumab serum concentration and its adverse effects.

Submission Category: Pharmacokinetics

Session-Board Number: 6-136

Poster Title: Validated LC-MS/MS method for the simultaneous determination of amlodipine and its major metabolites in human plasma and its clinical application to patients with hypertension

Primary Author: Reina Taguchi, Hamamatus University School of Medicine; **Email:** rtaguchi@hama-med.ac.jp

Additional Author (s):
Takafumi Naito
Hikaru Sato
Junichi Kawakami

Purpose: Amlodipine (AML) is a calcium channel blocker used in the treatment of hypertension and angina pectoris. AML is hepatically metabolized by cytochrome P450 3A4 via dehydrogenation of its dihydropyridine moiety to a pyridine derivative, dehydroamlodipine (DH-AML), and excreted in the urine largely as an oxidized pyrimidine analogue, O-Des[2-aminoethyl]-O-carboxymethyl dehydroamlodipine (CM-DH-AML). The relationships between the plasma concentrations of AML and its metabolites, and clinical responses remain unclear. The aim of this study was to develop a validated method for simultaneous determination of AML and its major metabolites in human plasma and to apply it to hypertension patients in clinical settings.

Methods: Deproteinized plasma specimens with acetonitrile were separated using a 3-micrometre particle size ODS column with isocratic elution using a mobile phase of 50:50 (v/v) mixture of methanol and 0.15 percent formic acid in water. The flow rate was 0.2 mL/min at the column temperature 40 degrees Celsius. The detection of each analyte was in multiple reaction monitoring transition mode using a triple quadrupole mass spectrometer with electrospray positive ionization. The m/z of the precursor and product ions for the analytes was as follows: AML, 409.2/238.2; DH-AML, 408.2/259.3; CM-DH-AML, 423.3/287.2; d4-AML (as an internal standard), 413.2/238.2. This validated method was applied to the determination of plasma samples in 18 hypertension patients treated with oral AML. The study protocol was approved by the Ethics Committee of Hamamatsu University School of Medicine.

Results: AML, DH-AML, CM-DH-AML and d4-AML were eluted at 4.9, 2.4, 9.2 and 4.9 minutes, respectively with a total run time of 11 minutes. No peaks interfering with analytes and IS were observed. The calibration curves in human plasma of AML, DH-AML and CM-DH-AML were linear over the concentration ranges of 0.5-80.0, 1.0-80.0, and 0.5-80.0 ng/mL, respectively. The lower limits of quantification of AML, DH-AML and CM-DH-AML were 0.5, 1.0, and 0.5 ng/mL, respectively. Their extraction recoveries were more than 85 percent. The intra-day and inter-day coefficients of variation and accuracy were within 15 percent and 85-115 percent for all analytes, respectively. The results obtained with this method met the standards of the international US FDA guidance. The ranges of plasma concentrations of AML, DH-AML and CM-DH-AML in patients with hypertension were 4.4-27.3, 3.0-14.0, and 3.5-35.0 ng/mL, respectively.

Conclusion: This study developed a validated method for the simultaneous determination of AML and its major metabolites in human plasma using an isocratic liquid chromatography coupled to tandem mass spectrometry. The present method with acceptable analytical performance can be helpful for evaluating the pharmacokinetics of AML and its metabolites in patients with hypertension and elucidating the inter-individual differences in the hypotensive effect of AML observed in clinical settings.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 6-137

Poster Title: Effective and economical drug supply chain security act compliance

Primary Author: Steven Robinson, Comprehensive Pharmacy Services/Charleston Area Medical Center; **Email:** steven.robinson@camc.org

Additional Author (s):
Brian Sayre
Jamie Baughan
Lisa Bray

Purpose: On November 27, 2013, the Drug Supply Chain Security Act (DSCSA) was signed into law, which outlines new definitions and requirements related to product tracing. The DSCSA frameworks critical steps to build an electronic, interoperable system by November 27, 2023, which will identify and trace certain prescription drugs as they are distributed in the United States. When this law first became known to the public, there was very little guidance for hospitals to be compliant. The purpose of this project was to examine and analyze the law to develop a compliant process.

Methods: Members of the pharmacy management team and general legal counsel of the organization conducted a thorough examination and analysis of what the DSCSA law entailed. The DSCSA law will be rolled out in phases through 2023; however, all elements of the law were examined to meet current compliance elements as well as future compliance elements. There are many “track and trace” product vendors who offer tools and technology to meet DSCSA compliance. Each vendor was vetted in various categories such as the training provided by the vendor to the staff, implementation timeline, backup systems, serialization readiness, contract agreement terms, proposed pricing, compatibility with daily operations (receiving), and other elements related to DSCSA compliance. Additionally, potential challenges and issues with daily operations were forecasted. All this information was gathered and used to determine the best way to meet compliance with efficiency and cost-effectiveness.

Results: The organization developed an internal DSCSA process that fully meets DSCSA compliance without the use of a “track and trace” product vendor. A policy and procedure was developed for standardization within the organization. All current vendors were identified to verify they met the requirements of an authorized trading partner defined by the FDA.

Processes were developed to receive T3 information from various sources. A process was developed to handle suspect and illegitimate products. A standard form and process was created to supply necessary information needed to comply with potential investigations by the FDA. The organization developed a policy to address the need to supply T3 information to outside sources. Lastly, the organization was able to save approximately $50,000 annually by not using a “track and trace” product vendor.

Conclusion: With little industry guidance, the organization was able to develop an internal process that is fully compliant with the DSCSA law. The policy and procedures that were adopted are an efficient, effective, and cost-friendly way to ensure compliance with DSCSA.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 6-138

Poster Title: Safe medication disposal guidance for patients in a hospital and clinic setting: enhancing a state requirement for dispensing

Primary Author: Deborah Sadowski, Deborah Heart and Lung Center; **Email:** sadowskid@deborah.org

Additional Author (s):

Purpose: Often unused medications remain available in medicine cabinets simply because the public is unaware of how to get rid of them. In an effort to reduce the number of unused prescription medications available for diversion, the state of New Jersey implemented a required informational offering to all consumers to assist and instruct with disposal options for these medications. P.L. 2015, c.66, which became effective on January 1, 2016, requires all New Jersey prescribers and pharmacies to provide a notice about drug take back programs to each patient receiving a controlled dangerous substance (CDS) prescription.

Methods: The new law requires prescribers who dispense medications directly to patients to furnish a notice prepared by the New Jersey Division of Consumer Affairs to each patient with any CDS prescription drug or medicine dispensed. Additionally, any pharmacies that dispense prescription drugs must distribute this same notice prepared by the Division of Consumer Affairs with any CDS prescription that is dispensed to an individual located in New Jersey. The prescriptive language designated had to be presented in a very specific manner.
Although it does not apply to patients receiving only a written prescription in hand at discharge or following an office visit, our institution felt that as a public service to all New Jersey residents, we would provide this information to them as well in order to reinforce the message for safe and timely disposal of unwanted medications. Led by the Director of Pharmacy, a multidisciplinary group comprised of the Vice President of Medical Affairs, the Vice President of Patient Care Services/Chief Nursing Officer, and the Chief Information Officer developed a multi-pronged approach to provide this information to our patients in all settings.

Results: Using the exact prescriptive language required from the state, the safe disposal notice was embedded in all discharge summaries provided to inpatients with their exit paperwork. The

same language was embedded in the outpatient visit summaries as well. Signage was posted in our clinic waiting areas instructing patients and visitors alike of the information. E-mail notification of the information is pending implementation via our patient portal for initial log-in by patient users.
Additionally, screen saver messages were created in order to share this information with staff as well as information provided on the employee portal for their review.

Conclusion: In an effort to support statewide efforts at reducing prescription drug abuse and overdose, our hospital took a voluntary stance to participate in the program mandated for dispensing entities to help provide information as a public service to our communities. Our efforts are aimed at both inpatients and outpatients through multiple delivery methods that cater to different types of learners – electronic vs. visual vs. written. We have also included this information to employees through screen savers and our employee portal as a service to staff as well.
To date, significant positive feedback has been received on these efforts.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 6-139

Poster Title: Assessing the impact of new regulations on pharmacy education and practice in Lebanon

Primary Author: Rony Zeenny, Lebanese American University - School of Pharmacy; **Email:** rony.zeenny@gmail.com

Additional Author (s):
Souheil Hallit
Georges Sili
Pascale Salameh

Purpose: There are 5 licensed Schools of Pharmacy in Lebanon, while 5 additional schools have requested licensure. In order to prevent the saturation of the market, the Order of Pharmacists drafted a legislation to limit the number of graduates per year, also known as numerus clausus. Accordingly, the aim of this study is assess pharmacists' growth in Lebanon over the past 10 years and project the possible impact of new regulation of pharmacy education system on the practice of pharmacy In Lebanon.

Methods: A retrospective cohort study was conducted at the Lebanese Order of Pharmacists to explore the staffing level of pharmacists, and pharmacies in the community during the past 10 years. The numbers were projected to the future for 35 years, through the year 2050. A literature review was performed using electronic databases of PubMed and Google Scholar. Search terms included "pharmacy", "numerus clausus", "pharmacist ratio", "pharmacies ratio" alone and in combination. Information and data needed on the yearly pharmacy graduates were collected from the 5 accredited schools of pharmacy in Lebanon and the Lebanese Order of Pharmacists. The survey tool was a data collection form to document the information. Data were updated through February 2016. A statistician managed data processing including data entry, cleaning, and analysis. Data were analyzed using SPSS (version 23). The projection for 35 years was done using ARIMA method, based on different scenarios: a. growth based on the current operating pharmacy schools, b) growth based on the impact of suggested new schools with a conservative graduation rate, c) growth based on the impact of suggested new schools with incremental graduation rate similar to the past 10 years, d) impact of the new law with a cap of 300 pharmacists licensed on yearly basis. The calculations were done taking into account the projection of pharmacists studying abroad, pharmacist's retirement rate and deaths.

Results: The results shows that the number of pharmacists in Lebanon has increased significantly during the past 10 years from 3,980 in 2006 to 7,588 in 2015 with a 2015 population density of pharmacists, presented as per 10,000 population, is 17.40. The number of pharmacies has increased from 1546 to 2897, with an average pharmacy density of 66 pharmacies per 100,000 inhabitants. Pharmacy graduates from 5 accredited Schools of Pharmacy in Lebanon has increased from 170 in 2006 to 424 in 2015. While the number of graduates from outside the country fluctuated between 59 and 109. The projection of pharmacist's growth for the next 35 years with the current schools results in totaling the number of licensed pharmacists to 27,505 with a pharmacists' density of 41.03/10,000. The addition of new pharmacy schools will worsen the numbers yielding to a total of 28,345 and 31,492 respective to whether the projection of growth was conservative or not. However, the implementation of a numerus clausus in 2017 will come into effect after 5 years and will cap the number of new graduating pharmacists to 300. Such decision will lead to decrease the density from 22.44 in 2021 back to 15.17 pharmacists/10,000 in 2050.

Conclusion: The density of Pharmacists in Lebanon is high compared to most countries around the world. The growth is directly proportional to the number of newly licensed pharmacists, graduating from accredited Lebanese universities. The projection to the future for 35 years, through the year 2050 showed catastrophic outcomes for pharmacists and the pharmacy career. Suggested measures can be the numerus clausus regulation as well as changing the pharmacy education to six years (instead of 5)

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-140

Poster Title: Development and implementation of a pharmacist-directed sports supplementation and nutrition educational outreach program

Primary Author: Cody Lovejoy, Ohio Northern University; **Email:** c-lovejoy.1@onu.edu

Additional Author (s):
Karen Kier

Purpose: One of the fastest growing markets, in terms of supplementation, is the market for sport's supplements. The market in the United States is the largest in the world grossing roughly $6.7 billion. This market targets all age ranges, but especially young athletes. With the ever increasing number and type of these products available to consumers as well as the varying information on these products, the objective of this outreach program was to assess previous knowledge of and provide education to young athletes on how to appropriately select and use these products.

Methods: The presentation was developed by a student pharmacist to provide evidence-based educational information to inform individuals on how to appropriately use and select pre-workout, creatine and protein products as well as how these products act in the body. The study was IRB approved as part of health outreach. The educational program was designed to be a thirty-minute presentation for high school and college-aged young adults. Local area high schools were contacted about presenting to their students through either a health education class or to one of their sport's teams. The presentation was given to students at 2 different area high schools on separate dates. Prior to the presentation, a survey was conducted to gather background information on age, gender, level of activity, and type of products used previously as well as questions assessing protein use, daily protein consumption requirements, and the role of the FDA in regulating supplements. De-identified data was collected in aggregate using clicker devices. After the presentation, a survey was conducted evaluating the same areas as the pre-survey to assess changes in knowledge and the viability of such a program. Alpha was established at 0.05. Data was analyzed using descriptive and inferential statistics calculated using IBM SPSS Statistics 20 software.

Results: When evaluating differences in the backgrounds of these two groups, there was a difference between the two groups as the presentation at School A was given to several isotonics classes (n=45), which consisted of students from all ages in high school both male and female with varying levels of physical activity, whereas the group presented to from School B (n=22) consisted of male student athletes that had tried multiple different types of sports supplementation products. This was reflective in the results to the pre-survey as School B students had a significantly higher ($p=0.037$) baseline knowledge of the products when compared to School A students. Although, this was not seen in the post-presentation survey results. In the question assessing protein intake based on varying physical activity, overall the students that answered correctly increased from 17.9% to 80.6% ($p=0.0014$). In the question assessing the role of protein in supplementation, overall the students that answered correctly increased from 22.4% to 74.6% ($p=0.0031$). In the question assessing the role of the FDA in regulating supplements, overall the students that answered correctly increased from 19.4% to 92.5% ($p < 0.0001$).

Conclusion: The survey results demonstrate the viability of a brief educational program highlighting key sports nutrition and supplementation information for consumers when selecting a product. The differences in baseline knowledge between the groups reinforces how the program can effectively educate consumers regardless of initial knowledge as there was no statistically significant difference between the two groups in the students that answered correctly in the post-presentation survey. A pharmacist-directed sports supplementation education program can have a significant impact on improving the knowledge base of consumers and help direct more appropriate use of these products.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-141

Poster Title: Self-management practices in Type 2 diabetic patients: a cross-sectional survey in Alexandria, Egypt

Primary Author: Reem Nagib, Ministry of Health, Alexandria, Egypt; **Email:** reem.nagib@yahoo.com

Additional Author (s):
Maha Abdul-Latif
Laila AboulAtta
Mohamed A.Mekkawy
Adel Abou-Ali

Purpose: With the rapidly growing global burden of diabetes, more interest has been directed to examining aspects of patient care beside drug therapy. Recent American and Canadian guidelines have emphasized the significance of such aspects on the overall patient care process. The purpose of this study was examining the pattern of self-monitoring of blood glucose (SMBG), foot examination, patient knowledge of complications and follow up to prevent or manage these complications early enough in type II diabetic patients in Alexandria, Egypt.

Methods: A cross sectional survey of a random sample of 100 type II diabetic patients from different areas of Alexandria City, Egypt. The data were collected by filling a standardized questionnaire. The questionnaire was designed to collect data on patient demographics ((age, sex, educational level, job, body weight, and height), and patients` awareness of; hypo- and hyper-glycemic symptoms and their response to them, daily foot care, and regular screening of potential micro-vascular complications (retinopathy, neuropathy, and diabetic foot) with physician.

Results: The questionnaire was completed and returned by 92 diabetic patients (92% of selected participants) of which 49% were males and 51% were females. The mean age of participants was 58 (SD: 7.95), and the mean weight was 87.6 (SD: 14.3). 49% of participants were college educated, 36% had lower education, and 15% were not educated.
For patient awareness of hypo- and hyper-glycemic symptoms, 67.7% of participants recognised hypoglycemic symptoms and 58.7% knew how manage them. While about 58.7%

recognised hyperglycemic symptoms and only 42.4% knew how to manage them. Only 46.7% of participants performed daily foot examination, and 7.61% did not know how to.
6.59% of participants performed fasting plasma glucose level and/or postprandial level on a daily basis, 26.37% on a weekly base, 31.87% on a monthly base, 27.4% every 3-6 months, and in 7.7% every more than 6 months. Finally, regular screening of micro-vascular diabetic complications (retinopathy, neuropathy and diabetic foot) by physician was carried out in only 22.7% of the participants.

Conclusion: The study results show that the level of patients' knowledge and response towards complications was suboptimal. We recommend an introduction of an adequate diabetes self-management education, SMBG, and individualization of medication regimens in the governorate of Alexandria.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-142

Poster Title: Impact of liposomal bupivacaine on post-operative outcomes in colorectal surgery

Primary Author: Carli Nesheiwat, Our Lady of the Lake Regional Medical Center; **Email:** cccomish@yahoo.com

Additional Author (s):
Brandi LaFrance

Purpose: The use of opioids post-operatively provides acute pain relief, but may contribute to hospitalization length of stay (LOS) through opioid-related adverse effects. Liposomal bupivacaine allows prolonged drug diffusion for local post-operative analgesia. While several studies have supported the use of liposomal bupivacaine in colectomies, the impact on post-operative outcomes at our institution was unknown.

Methods: This retrospective evaluation compared post-colectomy outcomes in patients who received conventional post-operative therapy with patients receiving conventional post-operative therapy plus liposomal bupivacaine. Patients were identified through financial reports; even numbers of patients from each group were selected in numerical order. The primary objective was hospital LOS. Secondary objectives included opioid-related costs and post-operative opioid utilization. Charted opioid doses were converted to intravenous morphine equivalents using a standard opioid equianalgesic chart.

Results: Sixty-two patients were included in each group. The addition of liposomal bupivacaine to conventional post-operative therapy reduced total hospital LOS by 1.4 days [from 6.9 to 5.5 days]. Liposomal bupivacaine contributed to drug-related costs; cost avoidance associated with LOS was not assessed. The average post-operative opioid utilization was 237 mg and 171 mg IV morphine equivalents in the conventional therapy and conventional therapy plus liposomal bupivacaine groups, respectively. Liposomal bupivacaine use reduced opioid requirements on average by 66 mg IV morphine equivalents per patient.

Conclusion: The use of liposomal bupivacaine in colectomy procedures decreased total LOS and post-operative opioid utilization. Results were presented to the institution's Pharmacy and Therapeutics Committee as well as the Colorectal Multidisciplinary Group.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-143

Poster Title: A propensity score matched analysis: the association between pre-hospital statin use and mortality in patients with diagnosis of acute respiratory failure

Primary Author: Arinze Nkemdirim Okere, Florida A&M University; **Email:** arinzechukwu.okere@famu.edu

Additional Author (s):
Colleen Renier

Purpose: Acute respiratory failure (ARF) is a condition associated with high mortality. Although the etiology of ARF is not completely understood, invitro and invivo studies suggest that it is associated with the release of proinflammatory cytokines. Because of the anti-inflammatory activity of HMG-CoA reductase inhibitors (statins), statins can be a potential therapeutic modality in the management of ARF. However, studies on the potential role of anti-inflammatory activity of statins in hospitalized acute respiratory failure (ARF) patients are limited. Therefore, the objective of this study is to examine the association between pre-hospital statin use and inpatient mortality.

Methods: This study is a single institution retrospective study of patients at least 40 years old with a discharge diagnosis of ARF from November 2007- March 2013. ARF was defined using ICD-9CM codes. ARF patients were classified as a pre-hospital statin user (statin user) if any statin was initiated ≤ 24 hours of inpatient admission. A propensity score analysis was performed using a logistic regression. To test the efficiency or discriminatory power of our propensity score model, Hosmer-Lemeshow goodness of fit test for logistic regression and the area under the receiver operating characteristics curve (AUC) were analyzed respectively. A stepwise selection process was implemented to choose those variables with the best predictive power. Variables included in the model were as follows: study period (2007- 2013), Deyo-Charlson comorbidity index (CCI), All Patients Refined Diagnosis Related Groups (APR-DRG) severity of illness (SOI), race, tobacco use, gender, HDL-C levels, heart failure, hyperlipidemia, other CVD, diabetes, myocardial infarction, PVD and COPD. Subsequently, patients were matched 1:1 (statin users to non-statin users) using greedy algorithm. Variables included in the match were ARF diagnosis (primary/secondary diagnosis), APR-DRG Medical/surgical, ventilation (yes/no), insurance type and propensity score +/- 0.05. The primary outcome of the

study was to compare inpatient mortality rates between statin and non-statin users. Inpatient mortality rate was estimated using generalized estimation equations.
This study was approved by institution review board (IRB).

Results: Following our analysis, Hosmer-Lemeshow goodness-of-fit statistics revealed $\chi 2 = 9.18$ ($p > 0.327$) indicating a strong goodness of fit and our developed model has an acceptable discriminatory ability (AUC = 0.706, $P < 0.001$). Furthermore, our propensity score model was balanced across treatment (statin users) and comparison group (non-statin users). In our final analysis, a total of 366 patients were assigned to either the statin group (n=183) or non-statin group (n=183). Our general estimation equations model identified an interaction between gender and statin status. Among statin users, the rate of inpatient mortality was lower among females (0.9%) than in males (8.3%) (OR [odds ratio] = 10.06, 95% Cl [confidence interval] = 1.25-80.72). Similarly, females on statin had a lower inpatient mortality (0.9%) than females not on statin (8.3%) (OR = 13.30, 95% Cl = 1.65 – 107.35). Additionally, females on statin had a lower risk adjusted inpatient mortality (0.9%) compared to male not on statin [11.4%] (OR = 14.21, 95% Cl = 1.73-116.84). In contrast, there was no significant difference between males who are statin users and males who are non-statin user.

Conclusion: After adjusting all covariates (including comorbid conditions), pre-hospital statin use was independently associated with decreased rate of in-patient mortality among females alone compared to males (with or without statin) or females not on statins. Therefore, females with diagnosis of ARF experiences favorable impact from statins compared to males with similar diagnosis of ARF. We suspect that the observed outcome is related to sex linked differences in the release of pro-inflammatory substance as suggested by Hefferna et. al. (2011). Therefore, gender biological differences may play an important role in the management of ARF.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-144

Poster Title: Minding the gap: perceived factors affecting primary care coordination of adults in 11 countries

Primary Author: Jonathan Penm, James L Winkle College of Pharmacy, University of Cincinnati; **Email:** jonathan.penm@uc.edu

Additional Author (s):
Neil MacKinnon
Stephen Strakowski
Jun Ying
Michelle Doty

Purpose: Care coordination has been identified as a key strategy to improve the effectiveness, safety and efficiency of the United States (US) healthcare system. Examining the risk factors that impact care coordination will allow clinicians and policy makers to make evidence-informed decisions. As such, this study aims to examine perceived risk factors which may impede primary care coordination using the 2013 Commonwealth Fund International Health Policy (IHP) survey data.

Methods: Data from the 2013 Commonwealth Fund International Health Policy (IHP) survey were analyzed. Responses came from Australia, Canada, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom (UK) and the US. Multivariate logistic regression models were used to examine associations risk factors associated with care coordination gaps and poor primary care coordination among participated countries. Poor primary care coordination was defined as subjects reporting at least three care coordination gaps, out of a maximum of five. Independent variables included in the logistic analyses including age, gender and household income; and health related characteristics including numbers of doctors seen in the last year, health status, number of medications, number of chronic conditions, regular doctor experiences, and insurance status.

Results: In total, 13,958 respondents from 11 countries were included in the analyses. Of these, 724 (5.2%) respondents reported experiencing poor primary care coordination. The US had the highest incidence of poor primary care coordination at 10% (n=137/1,395). Multivariate regression of all respondents found that subjects were less likely to experience poor primary

care coordination if their primary care physician (PCP's) often or always knew the medical history, spent sufficient time, involved more and explained things well. The analysis also showed poor primary care coordination was more likely among younger aged patients. Risk factors were in general consistent across the countries.

Conclusion: US respondents had the highest rate of poor primary care coordination among the 11 high income countries. Having an established relationship with their PCP was significantly associated with improved care coordination. Furthermore, subjects with poor care coordination appeared to be chronically ill, younger individuals.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-145

Poster Title: Survey of pharmacy leaders on the priorities for the future of the pharmacy profession in Canada

Primary Author: Jonathan Penm, James L Winkle College of Pharmacy, University of Cincinnati; **Email:** jonathan.penm@uc.edu

Additional Author (s):
Neil MacKinnon
Derek Jorgenson
Jennifer Smith

Purpose: Recent regulatory and legislative changes in Canada have also allowed pharmacists to provide an expanded scope of practice. These new services include renewing/extending prescriptions for continuity of care, changing drug dosage/formulation, making therapeutic substitutions, initiating prescription drug therapy, prescribing for minor ailments and smoking cessation, administering a drug by injection, and ordering and interpreting lab tests. As there is a large range of new services pharmacists can provide, there has been debate in the profession on which services the pharmacy profession should prioritize. As such, the aim of this study is to survey pharmacy leaders in Canada on the priorities for the future of the pharmacy profession.

Methods: An online survey was emailed to pharmacy leaders in May 2016. The Canadian Pharmacists Association (CPhA) identified pharmacy leaders based on their involvement in the profession. Pharmacy leaders included pharmacist innovators, technician innovators/champions, frontline pharmacy professionals, students, pharmacy and pharmacy technician association representatives, regulatory authorities, and educators.
The survey was pre-tested for key elements of accessibility, usability and understandability. Once the survey was finalized, it was uploaded to a web-surveying program (FluidSurveys, Ottawa, Canada). Reminders to complete the survey were sent at one and two weeks after the initial invitation.
Descriptive statistics were analyzed and priorities to advance the profession were assessed for their correlation with barriers identified in the survey using Pearson correlation coefficient. Correlations were identified if $r \geq 0.30$. “Do not know” responses were removed when calculating the correlations. All statistical analyses were computed using SPSS Statistics (version 22, IBM Corp, Armonk, NY) and p-values < 0.05 were considered statistically significant.

Results: Sixty-five responses were received for the survey, giving a response rate of 68% (65/96). Respondents included 31 pharmacists, 11 academics, 8 government/regulatory, 4 pharmacy technicians, and 3 students. Regarding respondents work setting, 20 worked in community pharmacy, 12 in education/academia, 8 in hospital pharmacy and 8 in pharmaceutical industry. The top three priority areas identified as very important/important was the integration of expanded scope into daily practice (100%), development of reimbursement framework (97%), and increased general public support for the role evolution of pharmacy professionals (95%).
The inability to bill for certain pharmacy services ($r=0.4$, $p < 0.05$) was correlated as a barrier that significantly affected the integration of expanded scope into daily practice. Furthermore, the need to develop a reimbursement framework significantly correlated with too many competing priorities in the pharmacy workplace ($r=0.4$, $p < 0.05$) and insufficient time for pharmacy staff to provide advanced services.

Conclusion: Pharmacy leaders in Canada appear to have similar views on the priorities of the profession, despite their diverse positions and work setting. Integrations of expanded scope into daily practice was unanimously considered the top priority for the pharmacy profession, but was affected by the inability for pharmacists to bill for certain pharmacy services. Development of a reimbursement framework will allow pharmacists to prioritize their services and integrate expanded scope into daily practice.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-146

Poster Title: Recombinant human thrombin use in surgery: literature review of impact on clinical outcomes and costs

Primary Author: An Pham, Mallinckrodt Pharmaceuticals; **Email:** an.pham@mallinckrodt.com

Additional Author (s):
Belinda Lovelace
George Wan
Michael Baker

Purpose: When surgical ligation of bleeding fails or is not possible, surgeons rely on a number of hemostatic aids, including topical thrombins (recombinant human thrombin [rhThrombin], pooled human plasma-derived thrombin, and animal-derived source [ADS] thrombin). Thrombin preparations have established efficacy in achieving hemostasis and are used in nearly 1 million patients each year in the United States across a broad range of surgical procedures. A review of the literature was performed to assess the impact of rhThrombin use during surgery on clinical outcomes and the potential for reductions in costs.

Methods: A literature survey was performed using BIOSIS, Embase, and Medline through May 2016 using the terms “recombinant human thrombin,” “rThrombin,” “rhThrombin,” and “Recothrom.” Articles addressing recombinant human thrombin use during surgery that evaluated costs and/or clinical outcomes such as time to hemostasis and incidence of adverse events were selected for inclusion in this review. Evaluations of sealants, adhesives, glues, and hemostats that contain rhThrombin mixed with fibrinogen and other clotting factors, were excluded. A total of 27 relevant articles were identified, comprising those describing animal models of efficacy or immunogenicity (5), prospective randomized controlled trials (3), open-label and retrospective studies (6), case studies (1), pooled analyses (3), and reviews (9).

Results: Overall, rhThrombin use in multiple surgical settings was shown to be safe, well-tolerated, and to achieve more rapid hemostasis than in patients not receiving rhThrombin. In a randomized, double-blind, placebo-controlled study, the hazard ratio of 1.3 estimated for the comparison of time to healing for rhThrombin + gelatin sponge versus placebo + gelatin sponge suggests rhThrombin has a positive impact on hemostasis. Adverse events and laboratory parameters reported in clinical trials of rhThrombin were found to be consistent with those

commonly observed in surgical patients. Like all thrombins, rhThrombin has a potential risk of thrombosis if absorbed systemically. In a Phase 3 comparison of rhThrombin and ADS thrombin, 95.4% and 95.1% patients, respectively, achieved hemostasis within 10 minutes of application (95% CI, -3.7 to 5.0). No formal economic analyses on rhThrombin were identified. However, an economic impact model of costs related to cases of immune-mediated coagulopathy (IMC) was identified from published case reports of ADS-exposed patients. Aggregate resource utilization was calculated for non-bleeding (n=14) and bleeding (n=19) cases based on established cost driver information. The estimated median total cost associated with managing an ADS thrombin-associated IMC without bleeding complications was $50,191 as compared to $110,961 in cases with bleeding complications.

Conclusion: Based upon a literature survey, rhThrombin use in multiple surgical settings was shown to be safe and well-tolerated, and was shown to result in more rapid hemostasis than in patients not receiving rhThrombin. In addition, rhThrombin may be associated with lower antibody development, and does not carry the risk of transmitting plasma-borne pathogens or prion diseases as with human plasma-derived thrombin. Whether the reductions in complications associated with use of rhThrombin during surgery directly reduce overall cost of care warrants further study.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-147

Poster Title: Impact of medication therapy management (MTM) services in federally-qualified health centers (FQHCs) on measures of chronic disease

Primary Author: Brianne Porter, The Ohio State University College of Pharmacy; **Email:** briannelp@gmail.com

Additional Author (s):
Jennifer Rodis
Magdi Awad
Jennifer Clark
Alexa Sevin

Purpose: In 2014, health centers cared for 5.3 million patients with hypertension and 2.9 million patients with diabetes. Approximately one third of patients with these chronic conditions are not controlled. Further, socioeconomic status is inversely associated with the prevalence of diabetes and hypertension. Therefore, opportunities exist to enhance the health of underserved chronic disease patients by optimizing medication use through pharmacist-provided medication therapy management (MTM). The primary purpose of this study is to evaluate changes in number of underserved patients with a hemoglobin A1c and blood pressure in control while receiving pharmacist-provided MTM at three Ohio federally qualified health centers (FQHCs).

Methods: A statewide MTM Consortium was created to document patient outcomes and expand MTM in FQHCs over a 2-phase, 5-year project. For phase 1, pilot FQHC sites were recruited as best practices within the state for varied models of pharmacist-provided MTM. Each site obtained reports from their electronic medical records to identify patients diagnosed with diabetes or hypertension, with recent uncontrolled hemoglobin A1c and/or blood pressure, no evidence of end stage renal disease or pregnancy, and who had not seen a pharmacist at the center for at least one year. Patient enrollment was continuous through the end of Phase 1; uncontrolled patients were constantly being recruited even as other patients reached 'in control' outcome measurements (A1c less than or equal to 9%, BP less than 140/90mmHg). Pharmacists provided MTM to these patients and reported data to the Consortium to demonstrate the impact on stated objectives. Data has been compiled and

analyzed using descriptive statistics to track and report project-wide progress and patient outcome measures. Phase 2 involves expansion of MTM to 7-10 additional FQHC sites.

Results: 706 unique patients with uncontrolled diabetes and hypertension have received MTM at three pilot FQHC sites across Ohio. At the end of Phase 1, 930 pharmacy visits have been conducted with 48% of diabetic patients and 65% of hypertensive patients achieving pre-specified disease markers of control (A1c less than or equal to 9, BP less than 140/90).

Conclusion: Three FQHCs in Ohio successfully impacted chronic disease outcomes through varied models of pharmacist-provided MTM services within their clinics. These services helped facilitate noteworthy progress of underserved patients with uncontrolled diabetes and hypertension to reach 'in control' disease outcomes measurements, despite continuous uncontrolled patient enrollment reducing the overall percentages. This project demonstrates the importance of pharmacist-provided MTM services within FQHCs. Future studies comparing this group to those receiving the standard of care may highlight the explicit impact of these services.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-148

Poster Title: Impact of a regional interprofessional clinical reasoning competition on health profession's student team interactions

Primary Author: Adrian Schenk, Creighton University; **Email:** adrianschenk@creighton.edu

Additional Author (s):
Ann Cabri
Katie Huyck
Katie Packard
Yongyue Qi

Purpose: Professional schools are incorporating more interprofessional collaboration throughout their curricula. The Creighton University Regional Interprofessional Clinical Reasoning Competition was created by medical and pharmacy students in 2014. This interprofessional, student-led, case competition was identified as a strong incentive for students from around the region to voluntarily collaborate as health care teams. The purpose of this study was to evaluate the effect of this activity on students' perception of team interactions. The effect of a semester-long pre-competition preparation activity (Clinical Reasoning Club) was also assessed.

Methods: This study was deemed exempt by the Creighton University IRB. In the spring of 2014, Creighton University medical and pharmacy students developed a year-round, student-led, interprofessional case studies group, the Clinical Reasoning Club. The next year, students hosted the first Regional Interprofessional Clinical Reasoning Competition. The competition, funded by Creighton University and its associated hospital network, is open to all health professions students from the US and prizes are awarded. Finalists are identified from a standardized rubric and winners are selected from a panel of Creighton faculty from various disciplines.
For the clinical reasoning competition in spring 2016, two survey instruments, the Team Skills Scale (TSS) and Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education-Revised (SPICE-R), were administered to students both prior to and after the competition to assess perceptions of working as a team. The TSS measures perception of capabilities for effective team interactions and consists of 17 questions at 5 points each for a maximum score of 85. The SPICE-R measures perceptions of appropriateness and benefits of

interprofessional education and is a 10-question instrument, with each question at 5 points for a maximum score of 50. Scores were averaged and compared pre- and post-intervention using paired student's t tests. Effects of the preparatory, team-building Clinical Reasoning Club were also assessed using generalized estimating equations (GEEs). A P-value less than 0.05 was considered statistically significant.

Results: Of the 92 students that participated in the competition (59 medical, 31 pharmacy and 2 nurse practitioner), 90 completed surveys. Students from three different universities participated. TSS scores significantly improved from 48.7+10.0 to 54.2+10.0, $P < 0.001$. SPICE-R scores significantly improved from 35.0+3.9 to 36.4+4.1, $P < 0.001$. Of the 77 Creighton University students, 37 participated in the semester-long preparatory Clinical Reasoning Club and 40 did not. For students that participated in the Clinical Reasoning Club, TSS scores significantly improved from 47.9+8.2 to 54.4+8.5, $P < 0.001$ and SPICE-R scores significantly improved from 34.3+3.8 to 37.1+3.1, $P=0.003$. For those that did not participate, TSS scores significantly improved from 48.7+10.2 to 52.6+9.4, $P= < 0.001$ and SPICE-R scores significantly improved from 35.8+3.1 to 36.1+4.2, $P=0.003$. GEE analysis indicated that for SPICE-R, but not TSS, the improvement in scores was significantly greater for students that participated in the Clinical Reasoning Club.

Conclusion: Health professions students who participated in the Interprofessional Clinical Reasoning Competition improved both perceptions of team interactions and perception of the value of interprofessional education. Improvements in SPICE-R scores, which measures appropriateness and benefits of interprofessional education, were greater in students that participated in the longitudinal preparatory club as opposed to the one time competition. This suggests that longitudinal activities may have a greater impact on shifting students' values toward the benefits of interprofessional education. Thus, there is a role for both longitudinal interprofessional activities as well as meaningful, one-time events as part of a comprehensive interprofessional education curriculum.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-149

Poster Title: Time-motion study of preparing three commercial continuous renal replacement therapy (CRRT) solutions

Primary Author: Alex Shaw, University of Michigan, College of Pharmacy; **Email:** shawar@med.umich.edu

Additional Author (s):
Weerachai Chaijamorn
John Clark
Bruce Mueller

Purpose: Phoxillum is a new, phosphate-containing continuous renal replacement therapy (CRRT) dialysate & ultrafiltrate replacement solution was FDA approved in 2015. Our tertiary care, university hospital pharmacy was adding phosphate and/or potassium to commercial CRRT solutions in the pharmacy for the majority of CRRT patients treated in our institution. The purpose of this study was to determine the time and costs associated with electrolyte supplementation into CRRT solutions with three commercially available 5 Liter products (Phoxillum, Duosol, & Prismasol). (Trade names are used in this abstract because the electrolyte content, packaging and reconstitution methods are specific to each specific brand.)

Methods: Each commercial solution varies slightly in electrolyte content, but once CRRT patients are stable, they require 4mEq/L potassium and 1-1.5 mmol/L phosphate and most bags made by the pharmacy contain these electrolyte concentrations. As purchased in our pharmacy, Duosol and Prismasol required adding phosphate and potassium to achieve similar end electrolyte content as unaltered Phoxillum.
At the time of the study a CRRT shortage occurred and our pharmacy was purchasing all three brands of solutions to meet patient demand, providing us an opportunity to conduct a time-motion study of all three products. Technicians obtained labels, opened outer casing, mixed CRRT solution chambers, added electrolytes, assign a “hang by” time, and present the compounded bag and additives and syringes to the pharmacist for verification. Pharmacists examined labels, bags, additives and syringes and initialed the final product. Pharmacist and technician time and supplies (bags, additives, syringes, needles, etc) associated with the electrolyte supplementation of Duosol and Prismasol to the equivalent of Phoxillum were determined. Through direct observation, the CRRT workflow was observed and work times

recorded during normal work hours for 35 days. The dialysate bags dispensed, the additives and supplies required were recorded. Personnel cost was based on the average yearly salary of pharmacists and technicians in the United States. The material costs were based on the average wholesale price (AWP).

Results: Observations on 165 Phoxillum bags, 157 Duosol bags, and 80 Prismasol bags were recorded. Technician compounding time for Phoxillum, Duosol, and Prismasol was 106.95 ± 29.13 (mean ± sd), 113.43 ± 43.99, and 160.38 ± 45.04 seconds respectively (ANOVA p-value < 0.0001). Pharmacist time for Phoxillum, Duosol, and Prismasol was 9.46 ± 6.82, 10.77 ± 8.35, and 14.47 ± 12.36 seconds respectively (ANOVA p-value 0.033). AWP Additive/supply costs required for Duosol ($7.68) and Prismasol ($8.81), while the Phoxillum product required no additives. The most important determinants of technician time were opening the outer casings and mixing the bag chambers. Opening the outer casings for Phoxillum and Prismasol took substantially longer than for Duosol and mixing the two CRRT solution chambers was similarly fast for Duosol and Prismasol, but the Phoxillum chamber mixing took considerably more technician time. Although no additives were necessary for the Phoxillum product, the tough outer casing and slow chamber mixing yielded times similar to the Duosol product that also required electrolyte additives.

Conclusion: Phoxillum requires less pharmacist and technician time and reduces the need to enter the bag to add phosphate, however this product costs more than the other two available products. Avoidance of having to add phosphate additives to Phoxillum may confer a patient safety advantage, but overall additive/supply and personnel cost savings may be outweighed by the costs of Phoxillum itself.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-150

Poster Title: Hyperkalemia related to treatments in heart failure patients was associated with excess days in hospital

Primary Author: David Smith, Kaiser Permanente NW; **Email:** david.h.smith@kpchr.org

Additional Author (s):
Xiuhai Yang
Micah Thorp
Nina Oestreicher
Eric Johnson

Purpose: Investigators have noted that many heart failure (HF) patients do not receive renin-angiotensin-aldosterone inhibitors (RAASi) therapies, despite strong guideline recommendations. Concern over hyperkalemia and subsequent poor outcomes, including arrhythmias and thus excess hospital admissions, is thought to be a key reason for this hesitation. However, we know little about the relation between hyperkalemia in heart failure (HF) patients and hospital use. Our study addresses this gap in knowledge by evaluating whether hyperkalemia is associated with excess hospital days in patients RAASi treated and untreated patients.

Methods: We conducted a retrospective cohort study in adult HF patients with >2 outpatient serum potassium (K) values between 2005 and 2013 at Kaiser Permanente Northwest. Patients' start of follow-up (index) was their highest K value: normal-K (3.5-5.1mmol/L), mild-K (5.2-5.4), moderate-K (5.5-5.8), or severe-K (>=5.9). We estimated the incremental effect of K values on days in hospital during 90 days of follow-up using negative binomial regression, which adjusted for age, sex, race, dyspnea, HF emergency visits and hospitalizations, diabetes, kidney function, blood pressure and a comorbidity index. We stratified by RAASi Treatment (angiotensin converting enzyme inhibitors, angiotensin receptor blockers, and aldosterone receptor antagonists), and No RAASi during the 90 days preceding patient's index date.

Results: The RAASi-Treatment subgroup included 6757 patients. The No-RAASi subgroup included 1543 patients. Unadjusted rates of inpatient days per 100 for the RAASi-Treatment

subgroup were 141 (normal-K), 203 (mild-K), 223 (moderate-K), and 379 (severe-K). Unadjusted rates of inpatient days per 100 for the No-RAASi subgroup were 171 (normal-K), 178 (mild-K), 367 (moderate-K), and 258 (severe-K). In the RAASi Treatment subgroup, patients with severe-K (n=239,3.5%) had almost twice as many hospital days (rate ratio=1.75; 95% CI, 1.19-2.66) compared to those with normal-K. In the No-RAASi subgroup, severe-K occurred less frequently (n=28, 1.8%), and the effect on hospital days was not clinically relevant (RR=0.88; 95% CI, 0.33-3.10) for Severe-K compared to Normal-K.

Conclusion: Clinicians' purported concern over treatment with RAASi agents and poor outcomes associated with hyperkalemia may be warranted. We found that patients with severe hyperkalemia had a higher adjusted rate of days in the hospital that was dependent on RAASi treatment. However, our subgroup with No Treatment and Severe-K was small and potentially underpowered; the 95% CI was compatible with a greater than 3-fold excess in hospital days. We found an excess of in-hospital days during the 90 days following a laboratory indication of severe hyperkalemia.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-151

Poster Title: Elective residency preparation course may increase student ability to acquire PGY1 pharmacy residency

Primary Author: Thomas Wadsworth, Idaho State University; **Email:** wadsthom@me.com

Additional Author (s):
Kathy Eroschenko
Glenda Carr
Cathy Oliphant

Purpose: The purpose of this study was to determine if participation in a elective residency preparation course enhanced student ability to obtain a PGY1 pharmacy residency

Methods: An electronic cross-sectional survey was sent to all 2014, 2105, and 2016 graduating pharmacy students at Idaho State University. Each student received a single link and asked if they had applied for residency. Students indicating application were then asked to complete the entire survey to determine successful matching as well as if they had taken a residency preparation elective course. The survey also determined the number of residencies applied for, number of interviews received, and levels of comfort or familiarity at each stage of the application process (CV writing, PHORCAS, Letters of Recommendation, etc.) All results were collected in a secure electronic data collection service (RedCap) and the authors were blinded to the results of the survey. Chi-square was used to test differences in acceptance rates while the unpaired students t-test was used to test differences in interview rates. IRB approval was not required for this programmatic assessment.

Results: 205 students completed the survey. 63 students indicated applying for a residency with 44 successfully acquiring a residency. 27 students took the residency readiness elective in the fall of 2013, 2014, or 2015, 20 of which applied for a residency. 85 percent of students taking the residency preparation course were successful in obtaining a residency compared to 61 percent of students who did not take the course (CHI square equals 2.4 with 1 degree of freedom, p equals 0.1213). Additionally, students taking the residency preparation course had increased interview rates (66.99 percent vs 56.2 percent, p equals 0.058). Student comfort and familiarity with the ASHP residency application process also tended to favor students who had completed the residency preparation course.

Conclusion: Although not statistically significant, results tended to favor pharmacy students completing a residency preparation course in terms of interview rates, acceptance rates, and comfort/familiarity with application process. Limitations to this student include small sample size and response bias due to students enrolled in the course responding more favorably than those where unable to enroll.

Submission Category: Preceptor Skills

Session-Board Number: 6-152

Poster Title: Assessment of student perceptions following incorporation of a recitation period into the pharmacotherapy course series

Primary Author: Kristin Peterson, University of Missouri-Kansas City School of Pharmacy; **Email:** kbpt46@mail.umkc.edu

Additional Author (s):
Eric Wombwell
Ma Chu

Purpose: In Fall 2015, a weekly 2 hour recitation period was incorporated into the pharmacotherapy course to enhance critical thinking skills by applying didactic material independently to case based scenarios. The purpose of this study is to assess the effect of incorporating a recitation period on student confidence and comfort levels in various areas of pharmacological assessment and therapy. A pre- and post-survey were conducted.

Methods: A pre-survey was administered on the first day of the pharmacotherapy class and a post-survey was administered on the last day of the pharmacotherapy class. The surveys were anonymously administered in a paper format to the students physically present. The pre-survey consisted of 12 questions, 9 of which were assessed via Likert Scale analysis. These areas included self-perceived study time, and ability to document, assess and provide feedback to peers. The post-survey was identical to the pre-survey with 3 additional questions regarding students' viewpoint of the overall experience, impact on self-perceived study habits, and inclination to continue to incorporate recitation periods in the pharmacotherapy course. Descriptive and Chi-squared analyses were used to evaluate the data.

Results: A total of 116 students were administered pre- and post-surveys. Eighty-seven percent of students recommended continuing to incorporate recitation periods in the course. Seventy-one percent of students reported an overall extremely positive or positive experience, while 8.5 percent reported an extremely negative or negative experience, and 20.5 percent reported a neutral experience. Students reporting strongly agree or agree at post-survey increased significantly from pre-survey for confidence in ability to implement critical thinking skills, 88.3 percent versus 57.1 percent respectively; confidence in assessing subjective and objective information to formulate pharmacotherapeutic plan of action, 90.6 percent versus 57.8 percent

respectively; confidence in ability to provide written justification for a pharmacotherapeutic plan of action, 86.3 percent versus 52.8 percent respectively (p less than 0.05). Regarding whether the recitation period had a positive impact on study habits, 68 percent of students reported strongly agree or agree, while 8.5 percent reported strongly disagree or disagree and 23.1 percent reported a neutral response.

Conclusion: Incorporation of a recitation period into the pharmacotherapy course had an overall positive impact on student self-perceived study habits and confidence in ability to implement critical thinking skills, assess subjective and objective information, and provide written justification for a pharmacotherapeutic plan of action. The recitation period will continue to be incorporated into future pharmacotherapy courses.

Submission Category: Preceptor Skills

Session-Board Number: 6-153

Poster Title: Student perceptions of the value they bring to rotation practice sites

Primary Author: Philip Rodgers, UNC Eshelman School of Pharmacy; **Email:** prodgers@unc.edu

Additional Author (s):
Adria Fecteau
Kim Leadon

Purpose: Institutions invest much time and effort in educating pharmacy students every year. Ideally, students should be viewed as a valuable and beneficial addition to their practice sites. At our school of pharmacy, students complete evaluations at the end of each practice experience that includes a question about their perceived value to the practice site. Responses to this question have not been previously analyzed or categorized, but such information could be useful to the school and practice sites about potential areas in which students perceive they are making an impact on patient care.

Methods: Qualitative comments were extracted from the rotation management software database to students' responses to the question “Describe the value you brought to this site (to improve patient care) as a student pharmacist.” Answers were de-identified and stored in a protected database. Of the total number of evaluations (3,104), 16% were extracted for a convenient sample of N=500 responses. All the responses were reviewed by an investigator, who determined there were 19 categories of value represented. Co-investigators helped validate those categories. Responses potentially fit into multiple categories, resulting in 783 data points for analysis. Data points and categories were analyzed overall and also with respect to rotation type. Rotation types were acute care, advanced community, advanced hospital, ambulatory care, and elective. Descriptive statistics were used. The study was approved by the institutional review board.

Results: Across all rotation types, students perceived that the value they bring to their sites most commonly was in the areas of “counseling” (15.7% of comments collected) and “providing recommendations” (14.7%). Performing physical examinations and providing education to other students were the least common areas of perceived value. An unexpected category, “having a positive attitude and bringing enthusiasm to the site” was frequently noted by students (12.1%) though its actual value to a practice site is controversial. The most common

categories varied by rotation type. The most common category in adult acute care and advanced hospital was “providing recommendations” (24.4% and 19.2% respectively). In advanced community, ambulatory care, and elective the most noted value was “counseling” (25.2%, 23%, and 13.8%, respectively). Perceptions of value were consistent regardless of which half of the APPE year was examined, with the exception that “bringing enthusiasm” was more frequently noted in the first half of the APPE year than in the last half.

Conclusion: Students primarily perceive they are valuable to practice sites by making recommendations, particularly in inpatient settings, and by counseling patients, particularly in outpatient settings. This is promising as those are two of the major roles pharmacists play in healthcare settings. The identification of “enthusiasm” as a perceived value suggests that students believed their most valuable contribution was by displaying positive attitudes. These results demonstrate that students’ self-reported perceptions of the value they bring to their practice sites are consistent with other literature reports based on perception of preceptors regarding students’ value to patient care.

Submission Category: Preceptor Skills

Session-Board Number: 6-154

Poster Title: Development of a preceptor scorecard for preceptor reappointment at an academic medical center

Primary Author: Jamila Russeau, Mayo Clinic; **Email:** russeau.jamila@mayo.edu

Additional Author (s):
Lauren Aziz

Purpose: Evaluating the qualifications of residency preceptors is an important quality assurance component within post-graduate residency programs. The American Society of Health-System Pharmacists released a guidance document in April 2016 that included information on the reappointment process for preceptors. Implementation of a standardized reappointment process was identified as a need following the release of this guidance document. The purpose of this study was to standardize the preceptor reappointment process through use of a scorecard.

Methods: All preceptors and co-preceptors for post-graduate year one residency learning experiences were required to populate an academic record including the following: education, licensure, scholarly activity, publications, professional organizations and service and leadership. A preceptor scorecard was created by a pharmacy administrative intern in conjunction with the residency program director using the guidance document from the American Society of Health-System Pharmacists. The scorecard included the following criteria: Eligibility, Responsibilities and Qualifications. Both Responsibilities and Qualifications categories contain six criteria each, and preceptors are expected to meet all six criteria. Under the two latter categories, for any unmet criteria, there is an opportunity for suggested action items to be completed prior to being reappointed as preceptor. To further standardize the scorecard, examples were provided for criteria that may be met in multiple ways. Scorecards were approved by pharmacy leadership and the residency advisory committee. The scorecard was then populated using the information provided from the academic record. For areas where criteria were not met, the preceptor was provided with specific recommendations to achieve those criteria. Scorecards were then shared with the preceptor and their supervisor for review and discussion.

Results: Scorecards were populated for 21 preceptors. The completed scorecards were then distributed to all 21 preceptors, the residency director and 3 supervisors. Results showed that 5

preceptors had deficiencies in the area of scholarly activity. Most were newly created elective learning experiences. The residency director and residency advisory committee felt that use of the scorecard was successful in identifying gaps in preceptor qualifications and that it provided for a way to further customize faculty development for individual preceptors. All of the pharmacists received specific feedback and were given the opportunity to discuss with the residency program director or supervisor. Additionally, supervisors were provided with specific information on preceptor performance that could be used in discussion at the pharmacist's annual appraisal.

Conclusion: It is the responsibility of program leadership to ensure accreditation standards and expectations are consistently being met. Use of scorecards to pinpoint specific deficiencies in scholarly activity fosters faculty development and provides more specific feedback to preceptors and their supervisors.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-155

Poster Title: Educating pharmacists on the use of human performance tools and the importance of error reporting to reduce pediatric medication errors

Primary Author: Kristin Klein, University of Michigan College of Pharmacy and Health System; **Email:** kriklein@med.umich.edu

Additional Author (s):
James Newman

Purpose: Hospitalized patients are at risk of one medication error per day. Medication errors can occur at any point in the medication use process, but are especially common in the ordering and administering processes and are often the result of human error. Pediatric patients are at higher risk of medication errors due to variability in pharmacokinetic parameters, greater opportunity for calculation errors, limited availability of suitable dosage forms, and lack of standardized concentrations. Human performance tools have been used in high-reliability organizations (HROs) to reduce operational upsets. The health-care industry can use these tools to create more resilient systems in order to reduce medication errors.

Methods: An educational program was developed to educate pharmacists and pharmacy technicians regarding the epidemiology of medication errors in pediatric patients, the importance of reporting medication errors, and the use of human performance tools that have been used in HROs to reduce errors. The content was delivered at a local health-systems pharmacy professional meeting, and at a national pediatric pharmacy professional meeting. The specific human performance tools discussed included: stop-think-act-review (STAR), verification practices (peer checking, independent and concurrent verification), three-part communication, pre-job briefs, job site reviews, and questioning attitude. During the presentations, data was collected regarding pharmacists/technicians perceptions of which steps in the medication use process are most prone to errors, medication error reporting practices at participants' institutions, and how medication errors are communicated at participants' institutions. Audience response systems were used to collect anonymous data for the majority of participants. Institutional review board (IRB) approval was sought, but the IRB determined the project did not qualify as human subjects' research.

Results: Nearly 500 pharmacists and technicians attended the presentations. The majority of attendees were pharmacists practicing in a pediatric setting. Nearly 30% of respondents reported being involved in a serious medication error that went unreported. Not surprisingly given the audience, the primary reason medication errors went unreported is because the error never reached the patient (66.2% of respondents). The other significant reason medication errors were unreported was due to fear-fear of job loss (10.5%), legal action (12.8%), or getting someone in trouble (8.2%). Reporting of near misses (errors that didn't reach the patient) occurred occasionally or rarely for 2/3 of the respondents. Medication reconciliation as a verification process occurred during any transition of care for 42.2% of respondents, but 23.2% of respondents reported that medication reconciliation only occurred upon hospital admission. Respondents identified the ordering process as the most likely place for an error to occur in the medication use process (30.9%). The primary means of communicating medication errors or lessons learned occurred through departmental meetings (46.5%) or via daily safety huddles (58.5%), respectively. Eighty-five percent of respondents reported that they would be more likely to report medication errors in the future based on the information they learned through the presentations.

Conclusion: Health-care systems can utilize human performance tools that have been implemented in HROs as a means of reducing human error as a contributor to medical errors. Pharmacists frequently catch prescribing errors before they reach the patient, but most of these near misses go unreported. Educating pharmacists on the use of human performance tools, and the importance of identifying and reporting system weaknesses in the medication use process can help to reduce medication errors.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-156

Poster Title: Medication variance reporting in telepharmacy

Primary Author: Hong Lam, Pipeline Rx; **Email:** hlam@pipelinerx.com

Additional Author (s):
Kevin Jones

Purpose: The safe use of medications is the goal for all pharmacists. Medication order processing variances are a deviation from that goal. Variances can be defined as an unplanned but preventable event that may lead to inappropriate medication use or patient harm. Identifying, reporting, analyzing and improving processes that may lead to medication variances can be difficult. The challenges increase when the pharmacist is working from a remote location. This poster will outline best practices of reporting variances in remote medication order processing (RMOP), the type of variances common in RMOP and the system implemented to prevent future events.

Methods: Reporting of medication variances occurring during RMOP can be challenging in a non-traditional practice setting. Establishing a mechanism for variance tracking is an essential step. The tracking mechanism should include a database that will allow variance data to be recorded and sorted. We created a database and posted it in a shared space that is accessible on line . Determining the essential information that must be collected regarding each reported variance, such as date/time, patient account number, drug, variance type, severity level, description of the event and the pharmacist action/recall, was also an important step. The effectiveness of the different variance reporting mechanisms was examined. The options for reporting the variances included fax, e-mail, secure link, or phone messages/calls. The severity and type of the variances were collected and analyzed to show trends and cause. The goal of medication variance reporting is to focus on system issues and not to place blame on the individual pharmacist. Telepharmacy is a relatively new practice setting for the profession of pharmacy. Medication variance reporting and monitoring can be used to assist in the design of optimal procedures and work environment for a pharmacist working in a remote location. Variances due to system set up, communication, and pharmacy policies will be examined as potential causes of the variances and resolution mechanisms will be explored.

Results: The number of variances being reported has increased from month to month since the program started in Q3 of 2015. The variances can be reported via fax, e-mail, secure link by the hospital staff or self-reported by the pharmacist. The easiest forms of variance reporting are either e-mail or faxing of the variance form to a secure fax line. The top 5 types of reported variances are policy adherence, incorrect drug dose entered/verified, incorrect drug frequency, omission, and incorrect start/stop date/time. Lessons learned from the variance monitoring program can be divided into three categories. First, system access. The remote pharmacist must have electronic access to the same systems and patient information as the on-site pharmacist in the hospital. Second, training. The remote pharmacist must demonstrate proficiency with the hospital pharmacy system and the hospital policies and procedures. Finally, communication. The remote pharmacist must have the ability to effectively communication with the hospital staff in order to minimize the risk of medication variances.

Conclusion: Medication variances represent opportunities to improve processes and systems and need to be captured and studied. This is more critical in RMOP because the pharmacists are not on-site in the hospital. Despite the creation of appropriate system access, implementation of comprehensive training and establishment of effective lines of communication, medication order processing variances will still occur. Encouraging the reporting of variances in the RMOP setting is essential. The analysis and evaluation of variance data facilitates the improvement of order processing. A systematic approach to medication variance reporting and analysis is critical in minimizing errors and improving patient safety.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-157

Poster Title: Telepharmacy: productivity and quality

Primary Author: Hong Lam, Pipeline Rx; **Email:** hlam@pipelinerx.com

Additional Author (s):
Amber Locke
Kevin Jones

Purpose: Utilization of telepharmacy enables 24/7 pharmacy services for small hospitals and work augmentation for busier and complex hospitals. Remote medication order processing (RMOP) creates different demands on a pharmacist. The desired characteristics of a telepharmacist include being able to safely multi-task while working on several software systems used in multiple hospitals. Pharmacists working remotely are more efficient in order processing than pharmacists working onsite because they are not required to complete tasks required of the on-site pharmacist . This poster will review the potential impact on quality and variance rates of increasing order processing productivity of a pharmacist working remotely.

Methods: Telepharmacist productivity was defined as the numbers of orders processed by a pharmacist per hour and the number of hospitals a pharmacist is working per month. The number of hospital systems the pharmacist was required to learn and remain proficient was also considered. Quality of work was defined by the number of variances that occurred per pharmacist per month. Clinical interventions documented by the pharmacist per month and clinical consultations with providers was also evaluated. The data was collected and measured for a period of 3 months for each of the telepharmacist.

Results: There are 86 telepharmacist in the organization that have productivity and quality data. We included data from both full time and part time pharmacists. The median orders processed per hour is 27. The highest number of orders processed is 44 orders/hour and the lowest is 8 orders/hour. The median number of hospitals that each pharmacist is servicing is 8 (highest is 18, lowest is 2). The median number of variances per pharmacist per month is 3 (highest is 20 and lowest is 0). The median number of clinical intervention documented per month is 89 (highest 564, lowest is 7). The median amount of time the pharmacists were consulted on for drug therapy by a provider was 13 per month (highest is 56, lowest is 0). According to a statistical analysis of the data, there was no direct correlation between the

number of orders processed and variance rates. We also did not find any correlation between variance rates and the number of hospitals worked or the number of pharmacy systems the pharmacist has to maintain. Finally, we did not find a correlation between the number of orders processed to the number of clinical interventions or medication consultations made.

Conclusion: One of the primary operational metrics used in telepharmacy is productivity. The intent of this project was to see if there was an increase in medication variances as the number of orders processed by the telepharmacist increases. Data showed that the pharmacists did not make more medication variances as they processed more orders. They also did not have any more variances reported as they worked more hospitals and had to maintain knowledge of more pharmacy systems and policy and procedures. In addition, the number of orders processed did not influence the amount of clinical intervention or consultation done by pharmacist.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-158

Poster Title: Accuracy of hospitalized patients' height and weight documentation and impact on drug dosing

Primary Author: Ronald Patrick Landayan, Northeastern University; **Email:** landayan.ro@husky.neu.edu

Additional Author (s):
Alice Margulis
Nicholas Quinn
Alison Lew
Michael Gonyeau

Purpose: Our primary outcome was to determine the accuracy of hospitalized patients' height and weight and impact on medication dosing and clinical outcomes.

Methods: Prospective, observational study of patients admitted to a general medicine floor at Brigham and Women's Hospital over a 20 week period. Measured heights and weights were completed by a pharmacist or pharmacy student using a standing scale and mechanical height rod stadiometer. These measurements were then compared to those listed in patients' medical records and utilized to determine any errors in weight-based or renally dosed medications. Bivariate Pearson correlations were calculated to assess the outcomes. All analyses were performed with SPSS V23 with a two-tailed alpha of 0.05 used to assess for significance. Institutional Review Board approval was obtained.

Results: Of 100 patients, 97 (43 overestimated, 54 underestimated) of recorded weights and 78 (66 overestimated, 12 underestimated) of recorded heights were inaccurate. Patient height was underestimated by 1 plus or minus 0.54 inches or overestimated by 2.1 plus or minus 1.78 inches. Patient weight was categorized according to percent error: incorrect by less than 2.5 percent (n equals 57), incorrect by 2.5-5 percent (n equals 22), incorrect by 5.1-10 percent (n equals 10), incorrect by 10.1-15 percent (n equals 5), incorrect by 15.1-20 percent (n equals 1), and incorrect by greater than 20 percent (n equals 2). Accuracy of height was influenced by age (P equals 0.029), gender (P equals 0.069), body mass index (P equals 0.326) and method of measurement (P equals 0.116). Similar results were noted with accuracy of weight with respect

to age (P equals 0.605), gender (P equals 0.564), body mass index (P equals 0.211), and original method of collection (P equals 0.461).
Ninety-two patients had inaccurately recorded creatinine clearance due to inaccurate height and/or weight, accounting for 171 renally dosed medications and 68 weight based medications. Eleven improperly weight-based doses and six improperly renally adjusted medications reached patients.

Conclusion: Inaccurate height and weight measurements led to errors in dosing of weight-based and renally adjusted medications. Patient heights and weights are frequently inaccurately recorded in their electronic health record, which can potentially lead to negative downstream consequences and clinical outcomes. Obtaining accurate height and weight measurements is critical toward ensuring that patients are placed on appropriate doses of medications.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-159

Poster Title: Improving barcode overrides in medication administration: a process improvement initiative

Primary Author: Jayne Lepage, MCPHS University; **Email:** jayne.lepage@mcphs.edu

Additional Author (s):
Teresa Tronerud

Purpose: Bedside barcoding during medication administration has demonstrated significant benefit in reducing patient injury and hospital costs. Barcode Medication Administration (BCMA) provides verification of the correct patient, medication, dose, route and time of administration. Barcode overrides in the mediation administration process negate these verifications and potentially put patients at risk for medication related injury. This process improvement initiative was designed to identify the barcode overrides occurring in a small rural hospital and to improve medication administration processes and provide pharmacy and nursing education in an effort to minimize or eliminate barcode overrides.

Methods: A multidisciplinary team including pharmacy, nursing and pharmacy university faculty was organized and a process improvement initiative utilizing the LEAN A3 methodology to determine the system failures and create standard work. An all activity report for barcode overrides identifying user (nurse) by unit, medication, override reason and patient for a four month period from 01/01/2016 to 04/30/2016 for geriatric psychiatric (BH) and medical/surgical (MS) units were analyzed. Medications and override reasons were identified and categorized as nursing issues, pharmacy issues and medication safety (near misses) issues. Results were presented to pharmacy and nursing administration with suggestions for remediation and corrective action.

Results: A total of 617 BCMA overrides were reported and analyzed, 470 for the geriatric psychiatric unit and 147 for the medical/surgical unit. The number of charted doses in the MS unit for the 4 month period was 16989 and 31989 for the BH unit. Analysis of the BCMA overrides in the MS unit identified several failures to follow previously established standard work in the charting of medications as well as monitoring parameters for multiple high risk medications. The majority of reported override reasons included bar code damaged and bar codes discarded. There were also several instances where the override reason was utilized to

inappropriately document medication administered issues. Analysis of the BCMA overrides in the BH unit yielded similar results as that of the MS unit. The override reason was inappropriately utilized to chart many monitoring parameters for high risk medications and the majority of the override reasons were bar code damaged and bar code discarded. The medications with corresponding BCMA overrides in the BH unit were more varied than in the MS unit. Several failures to follow previously established standard work in the BCMA process were also identified in the BH unit.

Conclusion: BCMA was initially implemented to improve medication safety and to avoid medication related adverse events. This process improvement activity identified steps in the BCMA process that were circumvented for a variety of reasons. Nursing education and pharmacy intervention were utilized to change these deviations in standard work practices. Additional ongoing monitoring of the barcode override reports by nursing and pharmacy administration is necessary to ensure adherence to policies and procedures for standard work in the use of bedside barcoding in the medication administration process.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-160

Poster Title: Influencing patient and provider safety and satisfaction through inclusion of an indication on new prescriptions

Primary Author: Kate Perica, University of Colorado Health; **Email:** katharine.perica@uchealth.org

Additional Author (s):
Amanda Nenaber

Purpose: The purpose of this initiative was to improve patient and provider knowledge of the indication for each prescription written for a patient. Patient knowledge of why they are using a medication is highly variable, as reported in literature, ranging from 15%-70.5%. When patients do not know the reason for taking a medication, it is difficult for the patient to appropriately manage their own medications, challenging for caregivers to appropriately support the patient, and burdensome to providers who may not be familiar with medications and resort to making assumptions about the reason a patient is taking a medication.

Methods: An identified existing EHR functionality served as the vehicle to provide medication indications. The EHR settings could be defined to require an indication on each new prescription before the prescription could be signed. The EHR automatically provides checkboxes available from FDA-approved indications for a medication and also includes an area for free text, allowing the provider to write an indication in patient friendly terminology or provide the reason for an off-label use. The indication then appears on a patient's medication bottle, discharge paperwork, and medication list in the EHR. The setting to require an indication on prescriptions could be turned on at the department level, which allowed for pilots to be initiated to test this functionality. Four pilots were conducted, including two inpatient and two outpatient areas. Providers and nurses were surveyed before pilot implementation regarding perceptions about the importance of knowing a medication's indication for use. Training materials and educational sessions were also developed for the pilot studies. Every prescription written during the first week of each pilot was audited to assess how often the provider used an available check-box and whether the selected check-box appropriately matched the patient's clinical need for the medication.

Results: Both nurse and provider perceptions pointed to an acknowledgment that knowing why a patient is using a medication can help patients, caregivers, and providers deliver better care. Eighty-one percent of nurses and providers reported they would be able to make better clinical decisions if the medication indication was known and 92% reported it would be helpful to know why medications were prescribed after hospital discharge. Sixty-six percent reported they thought patients would be more adherent to medications when they knew the indication for their medications. However, providers reported including an indication on less than 29% of new prescriptions. Audits of 1290 medications during the pilots showed that providers selected an appropriate indication >99.9% of the time. Eighty-five percent of the indications were added to the prescription sig using the available checkboxes within the EHR. Anecdotal reports after the pilot studies indicated that the requirement of an indication at time of prescribing didn't impact providers' workflow to any notable extent.

Conclusion: Due to the success of the pilots, support was obtained to require that new prescriptions written within all patient care areas of our hospital and outpatient clinics would include an indication. During the first three weeks of requiring this functionality in our patient care areas, over 35,500 patients have left our hospital and clinics with indications on their 63,000 prescriptions. With over 900,000 clinic and hospital visits annually, it is expected that this initiative will impact over 1 million prescriptions every year.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-161

Poster Title: Using a risk-analysis method to evaluate the impact of robotic dispensing on patient safety

Primary Author: Carmen Rodriguez, Hospital General Universitario Gregorio Marañón; **Email:** crgonzalez@salud.madrid.org

Additional Author (s):
Ana Herranz-Alonso
Vicente Escudero-Vilaplana
Arantza Ais-Larisgoitia
Maria Sanjurjo-Saez

Purpose: The introduction of robotic dispensing systems in Outpatient Pharmacies (OP) has increased in recent years. However, no data are available about its impact on patient safety using a prospective risk analysis. The purpose of this study is to evaluate the safety after the implementation of a robotic dispensing system in an OP, and stratification of residual risks to drive future developments.

Methods: Setting: OP of a 1300-bed tertiary teaching hospital provided with a Computerized Prescription Order Entry program and online pharmacy validation. Before the implementation of the robot, dispensing was entirely performed manually by nursing assistants using barcode technology.
Design: Comparative risk analysis of the drug dispensing process before and after the implementation of the robotic dispensing system (Rowa® Vmax), according to the Failure Modes, Effects and Criticality Analysis method.
Measurements: The failure modes were defined and their critically index (CI) calculated on the basis of the likelihood of occurrence, potential severity for patients, and detection probability. CI of manual and robotic dispensing were compared, and new measures were proposed.

Results: In pre-implementation phase, the sum of CI of 17 identified failure modes was 1,141. After the implementation of the robot, 23 failure modes were identified and the CI was reduced to 780 (a 31.64% reduction). The major safety improvements were observed for the following errors during the dispensing process: incorrect drug because of barcode control omission (-

100), omission of dispensing due to lack of stock (-90), insufficient quantity (-81), an expired drug (-52). Of the 6 failures modes exclusively detected after the implementation of the robot, only the failure to deliver the drug to the correct dispensing point achieved a significant risk (CI=48).
Improvement actions identified included: (1) monitoring during robotic dispensing on a monthly basis (drug delivered to the wrong point, interruptions of robotic dispensing and stock outs), (2) establishing periodical maintenance checks and (3) establishing a double-checking system for manual dispensing of drugs that cannot be managed by the robot.

Conclusion: A robotic dispensing system has increased the safety of the process. FMECA is a useful method for evaluating the impact of robotic implementation, and identifying further improvement strategies.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-162

Poster Title: Medication-use evaluation: exploring the extent of counterfeit medicine in households in Lebanon

Primary Author: Lydia Sholy, University of Brighton; **Email:** lsholy@yahoo.com

Additional Author (s):
Angela MacAdam
Paul Gard
Sian Williams

Purpose: Counterfeit medicines (CFM) are estimated to account for about 1 percent of prescribed medicines in the developed world, and about 10-30 percent in parts of the developing world. According to the World Health Organization, the estimated global trade in CFM is experiencing continuous growth. Until now, there are no reported studies in the literature on the extent of CFM in Lebanon. The purpose of the study was to explore the extent of CFM availability in households in Lebanon.

Methods: The medication use evaluation method was used to explore the possibility of having CFM in households. Photos of all reviewed medicines were taken, and later compared with the same packages of medicines available at a university-accredited pharmacy. The study was approved by the Committee on Human Subjects in Research at the Lebanese American University.

Results: The study took place in 150 households in various regions in Lebanon. CFM were found in 49 (32.7 percent) of the visited houses. The majority of the households visited (53 percent) were in the Mount Lebanon (ML) region, 22.7 percent in Beirut, 18.7 percent in the North, 2.7 percent in the South, and 2.7 percent in the Bekaa. Almost 92 percent of participants were considered knowledgeable about their medicines. The extent of CFM varied and the region with the highest extent was the Bekaa (12.1 percent), followed by the south (5.8 percent) and Beirut (5.7 percent). The region with the least amount of CFM was ML (3 percent).

Conclusion: This study demonstrated the reality of the situation and the magnitude that CFM may have on public health. Collaboration between stakeholders would be considered a necessity, to prevent CFM from reaching patients.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-163

Poster Title: Nature of counterfeit medicine in Lebanon

Primary Author: Lydia Sholy, University of Brighton; **Email:** lsholy@yahoo.com

Additional Author (s):
Paul Gard
Angela MacAdam
Sian Williams
Ken Rutt

Purpose: Counterfeit Medicine are deliberately and fraudulently mislabelled products with respect to identity and or source. Counterfeit medicine (CFM) pose risks for public health, and their availability makes assessing the safety and quality of medicine a necessity. There are no reported studies on the nature of CFM in Lebanon. Therefore, the purpose of the study was to determine the nature of CFM in Lebanon using five identified CFM by the Lebanese Ministry of Public Health. The CFM were; Panadol® (paracetamol); Amoxil® (amoxicillin); Viagra® (sildenafil); Cialis® (tadalafil) and Plavix® (clopidogrel).

Methods: The CFM were compared to their originals to determine if they were the same or different using physical examination and chemical analysis. The physical examination followed the recommended tool for visual inspection by the World Health Organization (WHO). The chemical analysis utilised four analytical methods; Raman, Near-Infrared, Fourier Transform Infrared spectroscopy, and Ultraviolet absorbance using their the spectra to compare with that of the original for each of the five CFM.

Results: The physical examination confirmed all five CFM as counterfeits. Three of the analytical methods identified three of the CFM as counterfeits, and one identified four as counterfeits. The nature of the counterfeits were as follows; three medicines with incorrect quantities of active ingredients, one medicine with correct quantity of active ingredient but with counterfeit packaging, and one medicine with high levels of impurities and or contaminants.

Conclusion: The findings demonstrated that three of the CFM fit the 20.2 percent of the CFM categorized by the WHO, one fit the 15.6 percent category of CFM, and one fit the 8.5 percent category of CFM. The results highlighted the threats associated with the availability of CFM, the

necessity to reactivate the national laboratory to control the influx of CFM, and the role pharmacists have to play in educating and protecting patients from using CFM.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-164

Poster Title: Enhanced process for withholding anticoagulation prior to invasive procedures

Primary Author: Jacyntha Sterling, Saint Francis Hospital; **Email:** jacynthasizer@icloud.com

Additional Author (s):
Megan Hayes

Purpose: Withholding anticoagulation is critical to the safety of patients undergoing invasive procedures. Previous approaches available in our health system's electronic medical record communicated the prescriber's intent to withhold anticoagulation, but this communication did not trigger any subsequent notifications if an anticoagulant was ordered or administered while the hold order was active. Lack of awareness of the hold order sometimes resulted in anticoagulant administration, which led to cancelled or delayed procedures. A new approach to enhance awareness of medication hold orders for inpatients was developed to improve patient safety and reduce the likelihood of delayed or cancelled procedures.

Methods: Information services and pharmacy team members from Saint Francis Health System (SFHS) in Tulsa, OK, developed a new procedural medication hold order in the electronic medical record (Epic) with input from nurses, physicians, and radiology practitioners. The order was designed to capture relevant information from the prescriber regarding which agents should be withheld and for which procedure, when to withhold before procedure, and when to resume after procedure. Alerts were developed to interrupt prescribers when entering orders for related medications and to interrupt nurses during administration of related medications. Pharmacy identified all agents that should trigger an alert upon ordering or administration. Procedural hold orders were created for the following classes that may need to be withheld for a procedure: angiotensin-converting enzyme inhibitors, anticoagulants/antiplatelets, antidiabetic agents, benzodiazepines, diuretics, metformin, and phenothiazines. The process was monitored by evaluating the alerts that were triggered at ordering and administration.

Results: The new hold order process was implemented in January 2016. Prescribers issued 170 hold orders for 141 patients during a four-week period following implementation. Primary order sources were an interventional radiology order set (66%; n=112/170 orders), orders issued without an order set (18%; n=31/170 orders), and cardiac catheterization order sets (14%; n=24/170 orders). Alerts were encountered 82 times during ordering and 971 times

during administration during the four-week follow-up period. The medication class most frequently associated with alerts was anticoagulants/antiplatelets (99%; n=1038/1053 alerts); diuretic ordering or administration triggered 1% of alerts (n=15/1053 alerts). An average of 8 alerts were encountered per patient. Most patients were associated with 0 alerts (16%; n=22/141 patients), followed by 5 alerts (13%; n=18/141 patients). Five patients were outliers with 22-52 alerts per patient. A subanalysis of these 5 patients revealed that 62% of the alerts occurred after the hold order should have been discontinued; hold order criteria had been met, but no one had discontinued the order, resulting in excessive alerts.

Conclusion: The new hold order process has enhanced the visibility of hold orders in the electronic medical record system by integrating alerts into workflow for prescribers and nurses upon ordering and administration, respectively. The enhanced process has also improved the quality of information available to health care providers regarding hold criteria. Future targets will include identifying other applications for the new hold order process and improving processes related to outpatient procedures and repetitive procedures, such as electroconvulsive therapy and hemodialysis.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-165

Poster Title: Pancreatic enzyme tablet protocol for clearing occluded enteral feeding tubes: a retrospective study

Primary Author: Janice Stumpf, University of Michigan College of Pharmacy and Health System; **Email:** jlstumpf@umich.edu

Additional Author (s):
Cheryl Bruck
Jacenta Gabriel
Heena Patel

Purpose: In a previous retrospective study, a University Health System protocol using alkalinized Creon pancreatic enzyme capsules restored patency to 48.2% of occluded enteral feeding tubes. This efficacy rate was very low compared to the 95.8% rate reported in a prospective study of now discontinued Viokase pancreatic enzyme tablets. Therefore, the enteral tube clearance protocol was revised to incorporate a newly marketed non-enteric coated Viokace tablet, despite the lack of published data for this indication. The purpose of this retrospective study was to evaluate the effectiveness of a Viokace-based alkalinized pancreatic enzyme protocol to clear occluded enteral feeding tubes in a University Health System.

Methods: The University Institutional Review Board approved this retrospective assessment of adult and pediatric patients who received Viokace tablets for clearing occluded enteral feeding tubes according to a standard protocol in the emergency department or in an inpatient setting between September 1, 2014 and August 31, 2015 . Electronic medical records were reviewed. Patients who received Viokace for a purpose (e.g., exocrine pancreatic insufficiency) other than enteral feeding tube occlusion were excluded from the study. The protocol called for one tablet of Viokace (10,440 lipase units/39,150 protease units/39,150 amylase units) to be crushed and dissolved with one sodium bicarbonate 325 mg tablet in 5 mL sterile water. The solution was then instilled into the clogged enteral feeding tube for 5 to 15 minutes and the tube subsequently flushed with warm sterile water. The alkalinized Viokace protocol was deemed effective if tube clearance was documented in the medical record or if enteral tube feedings were resumed with no note regarding tube replacement.

Results: A total of 211 patients with 284 obstructed enteral feeding tubes met the inclusion criteria during the 12-month study period. Of these, 6 patients with 7 clogs were excluded because of kinked tubes. The patient population was 55.6% male and 44.4% female, with a median age of 48 years (range, 1 day to 94 years). The most frequently occluded enteral feeding tubes were Dobhoff (43.7%), nasogastric (14.8%), nasojejunal (11.6%) and jejunostomy (11.2%) tubes. When kinked tubes were excluded from data analysis, the Viokace protocol successfully cleared the occluded enteral feeding tube in 176 of the 277 cases (63.5%). In 25 cases, the Viokace protocol was repeated after the initial administration was ineffective. The second attempt successfully cleared 10 of the 25 tubes. The Viokace protocol was administered a third time in 6 cases and resulted in tube clearance in 5 cases. Compared to data from a 2010 retrospective study of an alkalinized pancreatic enzyme protocol using Creon capsules, the Viokace-based protocol was significantly more effective at clearing occluded enteral feeding tubes ($p=0.0056$). No adverse effects were attributed to Viokace administration.

Conclusion: According to this retrospective evaluation, an alkalinized Viokace pancreatic enzyme protocol was effective in clearing 63.5% of occluded enteral feeding tubes and was significantly more effective than a previous Creon-based protocol. This difference in efficacy rates may be due to differences in the concentrations of pancreatic enzymes or sodium bicarbonate in the Viokace- and Creon-based protocols. In addition, the non-enteric coated Viokace tablet formulation is more readily dissolved and lacks the inherent stickiness of the enteric-coated granules of Creon pancreatic enzymes, potentially improving the ability to clear occluded enteral feeding tubes.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-166

Poster Title: Establishment of policies, procedures, and standard work in the provision of respiratory medications in a small rural hospital

Primary Author: Teresa Tronerud, UMass Memorial Clinton Hospital; **Email:** teresa.tronerud@umassmemorial.org

Additional Author (s):
Jayne Lepage

Purpose: Respiratory medications, though controlled by and the responsibility of the pharmacy department, are administered by respiratory therapists in the hospital setting. Policies on prescribing, transcription, storage, administration and monitoring of medications administered by nursing are routinely available and followed. The steps in the medication use process for respiratory medications are often handled differently from medications administered by nursing. Policies on the provision of respiratory medications in a small rural hospital are needed to minimize risk from missed doses and maximize patient safety.

Methods: An SBAR format was utilized for initial evaluation of the respiratory medication process. The SBAR evaluation was Situation: Respiratory medication administrations are frequently missed or late on the inpatient units. Background: A handwritten physician order for respiratory medications is scanned to the pharmacy by either the unit secretary or the nurse. Pharmacy enters the order into the medication administration charting (MAK). The RT is not aware of the new orders in MAK until the unit secretary or RN also places the respiratory order into the electronic health record (HER). Orders placed in the EHR generates the patient on the RT's provider workspace. Assessment: The respiratory order is not entered into the EHR consistently. The RT is not aware of new respiratory orders because the patient has not appeared on their census. Respiratory medications are late or missed. Recommendation: Initiate a protocol for RT to assess new or changed respiratory orders utilizing a pushed report. A multidisciplinary team including pharmacy, nursing, respiratory and pharmacy university faculty was organized and a process improvement initiative utilizing the LEAN A3 methodology to determine system failures and create standard work was applied. The number of missed doses of respiratory medications was evaluated looking at root causes. The root cause identified was a breakdown in communication of electronic medication/treatment orders to the respiratory therapist resulting in missed doses of respiratory treatments.

Results: Identified root causes lead to a standard process, check and balance system to identify all patients who have medication orders for respiratory treatment entered into the pharmacy system. This process led to creation of standard work and quality metric policies and procedures to track and document failures of the electronic orders being viewed by respiratory signaling the necessity for treatment. A new report automatically generated every 4 hours noting any new respiratory medication orders is received by the respiratory therapist routinely. The therapist validates in the patient's paper medical record the physical orders for accuracy. The physical order is compared to the EMAR in the electronic system and is validated for administration. The therapist also electronically documents in their designated area of the electronic health record the presence of the electronic order for the specific treatment, i.e. inhaler vs nebulizer and frequency, for an individual patient for as long as the order is active. This standard process along with the built in checks and balances ensures that missed doses of respiratory medications do not occur. Quality metrics will be maintained and evaluated to identify missed does and deviations from established standard work.

Conclusion: By utilizing the LEAN A3 methodology to determine system failures and create standard work the number of missed doses of respiratory medications has decreased. Routine education, remediation and monitoring by pharmacy, respiratory and nursing administration is warranted to ensure compliance with established policies, procedures and standard work. Safer medication administration practices lead to improvement in patient care and outcomes and should be an ongoing goal.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-167

Poster Title: Pharmacists in primary care clinic and outpatient pharmacy of an institution collaborate to improve patient care

Primary Author: Judy Wong, Harborview Medical Center; **Email:** judywong@uw.edu

Additional Author (s):
Greta Sweney
Denise Freund
Andrew Fung
Theresa O'Young

Purpose: Pharmacist-physician communication on inpatient rounds optimizes pharmacotherapeutic regimens but there is less focus in the ambulatory setting. At Harborview Medical Center there are outpatient pharmacies with access to clinic pharmacists. This allows clinic pharmacists to address refill discrepancies and identify the cause by acting as the liaison between the clinic and the dispensing pharmacy. The improved collaboration between pharmacies and clinics provide benefits for stakeholders in healthcare. As the pharmacy profession evolves and Medicare STARs ratings include compliance measures, there will be opportunity to bill for compliance and participate in disease state management. The project was designed to find and assess the refill discrepancies to be communicated to the clinic pharmacists to be addressed and acted upon to improve adherence.

Methods: This was a quality improvement project from August 2015 to April 2016 within Harborview Medical Center. Pharmacists from the Ninth and Jefferson Outpatient Pharmacy, the largest Harborview dispensing pharmacy, manually evaluated patient refill history and contacted clinical pharmacists in the Adult Medicine Clinic via electronic medical records when refill discrepancies were identified. Two of the eight fulltime outpatient pharmacists were consistently and actively reporting data. Clinic pharmacists made an evaluation regarding the discrepancies and the findings were discussed with the patient's physician. The discrepancies detected were categorized as patient error or system communication error. Data collection included patient information, number of days between receiving messages and being seen in clinic, when patient returned to clinic, and type of discrepancy.

Results: A total of eighty-four refill discrepancies were identified by the outpatient pharmacists. Fourteen patients had missing data regarding the type of discrepancy. Upon chart review four (4.7%) of 84 patients were adherent with medications. Fourteen (16.7%) refill discrepancies were identified as system errors due to a lapse in communication between the clinic and pharmacy regarding medication changes. Examples of these changes were dose increases or decreases or the patients transferred their prescriptions to outside pharmacies. Fifty-two (62%) of the 84 patients were found to be non-adherent with their medications. Thirty-four patients met with their healthcare providers to discuss their refill discrepancies to improve medication adherence.

Conclusion: Communication between patient's outpatient pharmacy and clinic staff, including provider and pharmacist, can help improve the health of the patient by better communicating detected discrepancies and addressing them at the next follow-up. Not only health outcomes will be impacted but healthcare dollars may be saved. The next step is to assess the improvement in patient compliance after the intervention by the provider. In addition, opportunities to optimize pharmacotherapy can be identified and patients can be scheduled to see the clinic pharmacist.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-168

Poster Title: Interrater agreement among healthcare providers in categorizing medication errors using medication-use process nodes

Primary Author: Nancy Yam, UC San Diego Health; **Email:** ntyam@ucsd.edu

Additional Author (s):
Joon Hwang
Charles Daniels
Felix Yam

Purpose: All medication events can be categorized into one of the five major medication use process nodes: prescribing, transcribing, dispensing, administering, and monitoring. Analyzing the origin or the causes of medication events based on medication use process nodes can help determine opportunities to improve medication use systems. While interrater agreement when categorizing medication events according to severity has been evaluated, the interrater agreement of categorizing medication events according to medication use process nodes has not. The purpose of this study is to evaluate the interrater agreement among healthcare providers when categorizing medication events according to specific medication use process nodes.

Methods: A single-center, survey-based study was performed to assess interrater agreement of different health care providers when categorizing medication errors. An expert panel curated a sample of 50 medication errors, representing examples from each medication use process node. The process for developing the expert panel rating included the use of a medication error categorization tool followed by a meeting to establish consensus. A survey including these medication error scenarios was then sent to physicians, nurses, and pharmacists who were asked to categorize them into the appropriate medication use process node. The accuracy of medication error categorization was evaluated by comparing participant ratings to the expert panel rating. Interrater agreement among participants was evaluated using Fleiss kappa and Cohen kappa statistics.

Results: A total of 22 participants, including 8 physicians, 8 nurses and 6 pharmacists, completed the survey. The overall interrater agreement among physicians, nurses and pharmacists was fair, at 0.36 (95% confidence interval [CI], 0.35-0.36). The interrater agreement

between pharmacists and nurses was moderate, at 0.47 (95% CI, 0.27-0.67), between physicians and nurses, moderate at 0.44 (95% CI, 0.23-0.64) and between pharmacists and physician, fair at 0.39 (95% CI, 0.22,0.56). The interrater agreement within a profession was highest with pharmacists at 0.45 (95% CI 0.42-0.49) and lowest among nurses at 0.33 (95% CI 0.29-0.36). Compared to the expert panel rating, pharmacists had the highest degree of agreement at 0.56 (95% CI 0.39-0.72) and physicians had the lowest degree of agreement at 0.42 (95% CI 0.23-0.59). Accuracy among participants was highest when categorizing medication errors related to dispensing and administration. The lowest accuracy was observed when categorizing medication errors related to prescribing and transcription.

Conclusion: Overall interrater agreement when categorizing medication errors using medication use process nodes was only fair between physicians, nurses and pharmacists. Errors related to prescribing and transcription appear to be the most difficult to categorize accurately. These findings suggest that a multidisciplinary and systematic approach is needed to accurately categorize errors using medication use process nodes. More accurate categorization of the origin of medication events is needed to develop targeted medication error reduction strategies.

Submission Category: Small and Rural Pharmacy Practice

Session-Board Number: 6-169

Poster Title: Impact of a pharmacist on a patient-centered, interdisciplinary, hospice team within a rural, independent, Planetree community hospital

Primary Author: Patrick Divoky, Alliance Community Hospital; **Email:** patrickd@achosp.org

Additional Author (s):
Debra Lehrer

Purpose: In an effort to provide quality care according to the ASHP statement on the pharmacist's role in hospice and palliative care, dedicated pharmacist time was allocated for prospective medication review and consistent participation within interdisciplinary team meetings for all patients entering hospice services. This study is a descriptive analysis of the impact the pharmacist has on medication therapy initiation, modification, and compassionate discontinuation of medications to reduce polypharmacy burden and potential adverse effects through the reduction of scheduled medications, pain control evaluations, and symptom management through additions of as-needed medications when clinically appropriate.

Methods: Currently servicing approximately 60 hospice patients within a rural community setting at any point in time, the pharmacist is responsible for prospectively analyzing the medication profiles of new and existing hospice patients and discussing all therapeutic recommendations with the interdisciplinary team. The pharmacist provides education to the hospice team about medication therapies, assists patients and caregivers understand medication instructions, provides insight into alternative dosage formulations of medications, addresses any financial concerns that arise with the patient or hospice service, assists in the safe and legal disposal of medications after death, and maintains quality standards with regulatory and licensing agencies. During each interdisciplinary team meeting, each patient is presented to the team by the patient's assigned nurse and is discussed by each member of the interdisciplinary team (nurse, physician, pharmacist, social worker, chaplain, caregiver/visitor/volunteer) with respect to the patient's current health status and clinical course, medical concerns and needs, medication recommendations, and plan of care moving forward. An assessment of each patient's pain control through detailed pain consultations, antibiotic usage and stewardship opportunities, pill burden with respect to number of scheduled medications and as-needed medications, and overall pharmacy continuity of care

outpatient prescription workflow will provide insight into the success of the program and opportunities for improvement and growth.

Results: Since the initiation of the program, 296 patient medication profiles were prospectively reviewed weekly during the patients time within the hospice service. Risk-benefit discussions occurred for each patient's individual clinical scenario. Consent from patient and physician was obtained to compassionately discontinue scheduled medications to reduce pill burden as well as the risk of medication adverse effects from developing which could reduce quality of life remaining. More than 90% of patients discontinued daily vitamins, cholesterol, anti-diabetic, and anticoagulation, and other chronic disease-state and secondary preventive medications when appropriate. Discontinued mediations ranged from 1-19 medications based on individual medication regimens. All patients' pain regimens were reviewed, simplified for ease of patient administration if applicable, and modified at each team meeting which occurred twice monthly and as needed. All antibiotics were prospectively reviewed for appropriateness and were provided with proper dosing and scheduled discontinuation dates. An updated "hospice standing orders" medication list was approved through the pharmacy and therapeutics committee which was utilized for addressing as-needed symptoms with each patient thus allowing for better nurse communication to pharmacy for more efficient prescription dispensing to provide better comfort to patients. As-needed mediations were individually ordered and utilized as often as individually needed.

Conclusion: Incorporating the pharmacist into the interdisciplinary hospice team to assist in the medication review process for all hospice patients embraces the planetree hospital mission and allows for real-time medication adjustments which reduces polypharmacy burden, provides timely, effective, and simplified pain control, promotes appropriate antibiotic usage, and assists in more efficient symptom control through use of a "hospice standing orders" intermittent as-needed medication list. The clinical pharmacist serving as the hospice point person allows for better continuity of care for each patient's clinical course as well as efficient pharmacy workflow within a rural, independent, planetree, community hospital.

Submission Category: Small and Rural Pharmacy Practice

Session-Board Number: 6-170

Poster Title: Puerto Rican rural pharmacists' knowledge, attitudes, and practices related to gender-based violence: development and face validation of a survey

Primary Author: Brenda Soto-Torres, Ponce Health Sciences University; **Email:** sototorr@gmail.com

Additional Author (s):
Miguel Marrero-Medina

Purpose: Gender-based violence has been recognized as a public health problem, has mental and physical consequences, and it is the leading cause of violent death among Puerto Rican women. Puerto Rico's population density is among the world's highest and 30% of its population live in rural areas. Although violence against women occurs across diverse geographies, rural residents experience unique challenges and pharmacists have an important role. No questionnaire was found related to rural pharmacists' knowledge, attitudes and practices regarding gender-based violence. This study designed and validated a questionnaire to assess Puerto Rican rural pharmacists' knowledge, attitudes and practices regarding gender-based violence.

Methods: This descriptive study explains the questionnaire design process, pilot study and the theoretical, technical and linguistic evaluation of issues found during its construct and face validation. A triangulate qualitative approach was used, including a panel of experts (including methodology, gender-based violence, women's advocacy, and related legal issues) and iterative interviews with rural pharmacists. The panel of experts evaluated the content validity of the scale through a content validity index and qualitative interviews. The face validity was evaluated by iterative interviews with rural pharmacists. Institutional Review Board authorization was granted by Ponce Health Sciences University.

Results: The validation process resulted in the development of a questionnaire to assess rural pharmacists' knowledge, attitudes and practices related to gender-based violence. Both the panel of experts and the interviewed rural pharmacists found the questionnaire valid and relevant to the Puerto Rican culture and language and that it reflected situations that could be encountered in their practices. Given that pharmacists are ranked consistently among the top trusted professions and that they may be among the few available health care professionals in

their communities, rural pharmacists are in a privileged position to engage in public health roles related to the prevention of gender-based violence and being resource persons for the survivors.

Conclusion: In the present, pharmacists' services include more patient-oriented public health functions. Thus, rural pharmacists' interpersonal communication plays a fundamental role in patient centered care. Under this model, rural pharmacists have a major role in gender-based violence detection and intervention, but there have been challenges in identifying whether they perceive it as a public health problem in the island. The instrument developed in this study can be used to describe the profile of rural pharmacists that face gender-based violence among their patients and to develop interventions to prepare them on how to deal with the issue with sensitivity and cultural competence.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 6-171

Poster Title: The impact of implementing clinical pharmacy services in an emergency department

Primary Author: Matthew Ford, Clovis Community Medical Center; **Email:** mford@communitymedical.org

Additional Author (s):
Hamid Ahmed

Purpose: Clinical pharmacy services (CPS) provided in the Emergency Department (ED) has been shown to increase patient safety, reduce errors and overall costs.1-3. These services have been perceived positively by physician and nursing staff.4-5. In the fast-paced ED, it is important to maintain the flow of patients while delivering quality care. The purpose of this poster is to evaluate the impact of an onsite ED pharmacist on prospective order verification and evaluate the interventions made by the ED pharmacist.

Methods: Clovis Community Medical Center (CCMC) is licensed 208 bed hospital. The ED Department averages 5,250 visits per month. In February 2016, a pilot program of onsite CPS was initiated in ED. Consensus was reached with physicians and nursing for this pilot and it was decided the pharmacist be available during peak times (1500 to 0130). One full time pharmacist was located at a nursing station in the ED for about 40 hours per week. The pharmacist would be responsible for prospective medication order review, formal clinical consults, providing drug information, attending codes, and assisting with medication reconciliation process (MR). The ED pharmacist documented these activities as interventions in the electronic medical record (EMR). When the ED pharmacist is not available the central pharmacy would continue to provide these services with the exception of attending codes and MR.
To assess the ED pharmacist's impact a comparison of two quarters was performed. The data for first quarter of the ED pharmacy services from February 2016 through April 2016 (pilot period) was compared with the previous quarter with central pharmacy processing all ED orders from November 2015 through January 2016 (control period). Order verification times and pharmacist interventions (I-vents) are evaluated as markers of the ED pharmacist's impact.

Results: During the pilot period the number of orders processed for the emergency department was 23,032 and the average order verification time was 3.63 minutes overall. Orders are submitted as either “routine” or “STAT.” Average verification time for routine orders was 4.45 minutes and 2.81 minutes for STAT orders. During the control period there were 26,924 orders and the overall average order verification time was 4.09 minutes, 5.05 minutes for routine and 3.12 minutes for STAT orders. Using a 95 percent confidence interval the difference in overall average times was statistically significant with a p value of 0.01. The difference in the routine and STAT order verification time was statistically significant.
The total number of pharmacy department I-vents during the pilot period was 6,956 and since I-vents are mainly associated with a medication order, this represents 30 percent of all orders had a pharmacy I-vent. During the control period there was 6,797 I-vents, equating to 25 percent of all orders. During the pilot period pharmacy interventions were increased by 5 percent compared to the control period. The increase in I-vents is evidence of increased pharmacy involvement in the ED.

Conclusion: The overall turnaround times for order verification in ED were significantly improved in all categories in this pilot of an ED pharmacist. Pharmacy interventions were increased by 5 percent. In our pilot of ED pharmacist clinical services we improved efficiency and improved pharmacy involvement. This pilot provides us an opportunity to further analyze the data. Future directions include categorizing and analyzing the interventions, and examining the medication reconciliation process. We believe our pilot program supports the addition of a pharmacist to the emergency department team to improve patient safety, efficiency and potentially decrease costs.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 6-172

Poster Title: Implementation of comprehensive pharmacy services in a community teaching hospital emergency department

Primary Author: Chelsea McSwain, Holy Cross Hospital; **Email:** chelsea.mcswain@holycrosshealth.org

Additional Author (s):

Purpose: The 55-bed emergency department (ED) sees approximately 90,000 patients per year and treats a wide range of patient populations, including pediatrics and geriatrics. The pharmacy department utilizes a decentralized model, with pharmacists covering all major areas of the 443-bed hospital. Until August 2014, the emergency department was excluded from this model. Risk management identified the emergency department as a high-risk environment, and worked with pharmacy leadership to collect baseline adverse event data. The goals of the ED pharmacist initiative were to reduce potential and actual medication errors and adverse drug events, and to provide comprehensive pharmacy services to the emergency department.

Methods: A needs assessment was conducted to determine the best strategy for implementation of an emergency department pharmacist position. Results of the needs assessment were shared with senior leadership, and the position was successfully approved as a result of collaboration between pharmacy, nursing, physicians, risk management, and human resources. The pharmacy department approved necessary FTEs and funding was secured. A scope of practice was developed in accordance with the results of the needs assessment and departmental services in other units throughout the hospital.
A dedicated decentralized pharmacist position was created to provide comprehensive pharmacy services in the emergency department. Pharmacist services include adult and pediatric code response, code STEMI/stroke team response, drug information consults, prospective medication order review, and other clinical consults. Using the scope of practice as a guide, the two dedicated ED pharmacists collaborated to determine a generalized workflow and identify areas of need within the department. Initial areas of focus included automated dispensing cabinet inventory, prospective order review of high-risk medications and pediatric dosing double checks, and medication expediting. Service expansion has included presence in all adult and pediatric codes, medication consults, patient counseling, and complicated medication reconciliation.

Results: Pharmacists are expected to document all clinical interventions performed in the emergency department. From implementation to the end of March 2016, two dedicated ED pharmacists have documented over 9700 interventions, which correlate with a total estimated cost savings of over $1,100,000. The most common intervention types include senior polypharmacy reviews, antimicrobial streamlining, dose adjustments, new therapy recommendations, drug information consults, and code response.
Results from the needs assessment survey demonstrated a need for pharmacy services in the emergency department. Initially, 82.1% of respondents indicated a value to having a pharmacist in the ED, and 92.5% of staff expected the ED pharmacist to prevent or reduce potential medication errors. The survey was re-distributed in June 2015 to compare the results to the baseline responses. Results showed an increase from 82.1% to 100% of respondents indicating a value to havinga pharmacist in the ED and 100% of respondents indicated preventing/reducing potential medication errors as a benefit. Awareness of pharmacy services and presence in the emergency room has significantly increased since implementation (76.4% vs. 91.4%). ED pharmacists are recognized for preventing potential medication errors and participation in the management of medical emergencies, including code response.

Conclusion: Implementation of a decentralized emergency department pharmacist service provides specialized services to a high-risk area of the hospital that previously did not have a pharmacy presence. ED pharmacists have developed customized tools and resources for nursing staff and provide educational services department-wide. Pharmacists collaborate with physicians and nursing staff on a daily basis to optimize patient care and have been incorporated into the interdisciplinary team. Pharmacy services have reduced medication errors and prevented adverse drug events. Future directions include expanding hours of coverage to provide continuity of care in the emergency department.

Submission Category: Emergency Medicine/ Emergency Department/ Emergency Preparedness

Session-Board Number: 6-173

Poster Title: Impact of an emergency room clinical staff pharmacist in a tertiary hospital in Puerto Rico

Primary Author: Lilliana Ortiz-Acevedo, Comprehensive Pharmacy Services; **Email:** lilliana.ortiz-acevedo@cpspharm.com

Additional Author (s):

Purpose: The practice of emergency medicine is new for pharmacists in Puerto Rico and hospitals do not routinely dedicate a full time clinical pharmacist in their emergency rooms (ER). Due to the high daily census in the ER, the concern about safe use of medications, the desire to ensure that protocols and clinical pathways are started correctly in the ER, and the need to decrease costs, the administration of a Puerto Rican tertiary hospital approved a full-time ER clinical staff pharmacist position in 2014. This report describes the impact of the ER pharmacist during the first nineteen months of service.

Methods: In August 2014, one clinical staff pharmacist was assigned to the ER of a tertiary hospital in Puerto Rico with an ER average daily census of 150 visits. The pharmacist was provided an office within the ER and worked weekdays from 7:00 A.M. to 4:00 P.M. In the beginning, the pharmacist verified ER orders and dispensed medications, which where ways to identify issues and get them addressed immediately. The pharmacist then began to expand clinical services by giving drug education to ER staff, providing treatment recommendations, developing disease management protocols for ER use, and recording daily interventions in the electronic medical record (EMR). The teaching component was expanded in August 2015 with the creation of an advanced practicum on emergency medicine for fourth year pharmacy students. An informal survey conducted in January 2016 was approved by the office of Quality Management in the hospital to recollect ER staff perceptions of the ER pharmacist. To demonstrate the impact of the pharmaceutical services, the ER pharmacist interventions from the first of September 2014 to the end of March 2016 were retrieved from the pharmacy interventions module in the EMR to assess types and trends. The data was then analyzed to determine direct and indirect cost savings based on intervention type. These costs were established and provided by the corporate office and calculated based on research studies.

Results: The ER pharmacist collaborated in the development of new ER protocols for acute coronary syndromes, cerebrovascular accidents, and diabetic ketoacidosis. Four pharmacy students completed the rotation in emergency medicine and performed drug utilization reviews for pain management, acute coronary syndromes, and diabetes management medications. The results from these reviews were presented on the Pharmacy and Therapeutics Committee with strategies to improve patient care. According to the perceptions survey completed by the ER staff (n equals 25), 92 percent agreed that compared with previous years, the pharmaceutical services provided in the ER had improved due to the efforts of the ER clinical pharmacist, 88 percent agreed that the presence of the ER pharmacist improved quality of care in the ER, and 100 percent considered the ER pharmacist an integral part of the ER team. A total of 3,959 interventions were documented by the ER pharmacist during the first nineteen months of service. The amount of interventions increased month after month and the most frequent were monitoring of laboratory tests for anticoagulants and electrolytes (39.7 percent), renal adjustments for famotidine and antibiotics (15.5 percent), and therapeutic interchanges for vancomycin and pantoprazole drips (10.7 percent). Overall, the interventions represented cost savings of $623,604.39.

Conclusion: The ER clinical pharmacist proved to be an education resource, ensured safe and effective use of medications, demonstrated to be an integral factor in cost containment, and was perceived as a valuable addition to the ER team. While the ER pharmacist keeps earning confidence and trust as a valuable and capable health professional, the role of the ER pharmacist will continue to expand. The impact of this innovative service is a benefit for the hospital and the data from this report justifies the creation of additional clinical pharmacist positions in this and other emergency rooms throughout Puerto Rico.

Submission Category:

Session-Board Number: 6-174

Poster Title: Pharmacist career ladder

Primary Author: Karen Babb, CHI Memorial; **Email:** karen_babb@memorial.org

Additional Author (s):

Purpose:

Methods:

Results:

Conclusion:

Submission Category:

Session-Board Number: 6-175

Poster Title: MCA: management controlled anesthesia: the growing pains of space planning for an expanding department

Primary Author: James Besier, University Hospitals/Rainbow Babies & Children's Hospital; **Email:** jlbesier@gmail.com

Additional Author (s):
Ashley Wester

Purpose:

Methods:

Results:

Conclusion:

Submission Category:

Session-Board Number: 6-177

Poster Title: Evaluation of community tech-check-tech as a strategy for pharmacy practice advancement

Primary Author: Rachael Fleagle, UW Health; **Email:** rachael.fleagle@gmail.com

Additional Author (s):
Joe Cesarz

Purpose:

Methods:

Results:

Conclusion:

Submission Category: Oncology

Session-Board Number: 6-178

Poster Title: Evaluating the Accuracy and Precision of Chemotherapy Preparations –Interim Analysis of a Multicenter Project

Primary Author: Stephanie Salch, UNC Eshelman School of Pharmacy; **Email:** ssalch@live.unc.edu

Additional Author (s):
Moe Shwin
Lam Nguyen
Stephen Eckel

Purpose: Small errors in preparing chemotherapy may result in unintended consequences due to the narrow therapeutic index of these medications. Inaccurate dosing could lead to toxic adverse events, ineffective treatment, drug wastage, and increased costs. Thus, it is important to create systems and processes to ensure each chemotherapy preparation is accurate and precise. Recent published data evaluating the accuracy of the volumetric method demonstrated a lack of precision during the preparation. To further explore the accuracy of volumetric preparations, our study utilized the gravimetric method of preparation to verify the accuracy and precision of the volumetric method at 5 different hospitals.

Methods: A prospective, non-intervention, multi-site study was conducted in order to generate baseline estimates of accuracy and precision in the medication preparation process. Five different hospitals in the United States participated with each hospital collecting data to capture a minimum of 1,500 doses. Data was collected through the following process. An electronic balance was placed and calibrated in one hood. Once the medication was ready to be prepared, the empty syringe was weighed. The dose was prepared in the usual manner. After the pharmacist checked that the dose was correct (i.e. ready to be dispensed), the full weight of the syringe was documented and recorded. The accuracy and precision of each preparation was evaluated using the recorded data points and the specific gravity of the respective medication.

Results: An interim analysis is being presented from all sites. A total of 4,500 doses were prepared, representing 60 different medications. These were recorded over a 14 month period. A total of 300 preparations were dispensed to the patient in a syringe and the rest in an IV bag.

The top 5 medications in number were cytarabine, cyclophosphamide, etoposide, vincristine, and paclitaxel. The mean percent volume difference was 0.39%, median percent volume difference was 0.16% with a standard deviation of 9.39%. The accuracy of doses was 96.04% within ± 10% of the ordered dose and 91.33% within ± 5% of the ordered dose. The 3 doses with the greatest variation from zero were -227.77%, 132.22%, and 117.96%. There were only 73 of 4,500 doses that were perfectly accurate with no deviation from the prescribed dose.

Conclusion: While the majority of preparations were within the acceptable range of either ± 5% or ± 10%, there continues to be medications that fall outside of this range. Current processes using volumetric preparation are not reliable enough to ensure accuracy of each dose for every patient. Because of the medication type being evaluated, the opportunity for significant over- or under-treatment of an individual's disease state exists. Data collection is ongoing, so the potential for different variation can exist following completion. Further review of opportunities to improve precision and accuracy in the IV preparation process needs to be prioritized.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-179

Poster Title: Hospitalization costs and associated factors among maternity stays involving low-risk and high-risk childbirths in the united states

Primary Author: Justin Yu, Bayer HealthCare Pharmaceuticals Inc.; **Email:** justin208350@gmail.com

Additional Author (s):
Richard Lynen
Wenlong Lin
Jay Lin
Amy Law

Purpose: Recent studies have identified large variations in hospitalization costs associated with childbirth, and although hospital costs for maternity stays involving low-risk childbirths have been assessed, costs for high-risk childbirths remain uncharacterized. This study aimed to assess the costs of childbirth among US hospitals and to stratify such costs by risk groups. This study also aimed to identify potential factors associated with such hospital costs for low vs. high-risk childbirth groups.

Methods: All hospitalizations for childbirth among women ages 15 to 44 years in the Premier Perspective Hospital Database between 2010 and 2014 were identified. Risk category for each childbirth was defined by the age of the subject and/or the presence of specific maternal comorbidities and obstetric risk factors. High-risk deliveries included women ages 16 to 34 years with any of 23 maternal comorbidities or any of 15 obstetric risk factors on discharge records as well as women who were less than age 16 or older than age 34 regardless of the presence or absence of maternal comorbidities and obstetric risk factors. Hospital childbirth costs were determined and stratified by low-risk and high-risk groups. Factors associated with costs for each risk group were evaluated by multiple regression. A sensitivity regression analysis using generalized linear models was also evaluated.

Results: 2,367,195 hospitalizations for childbirth were identified, among which 64% (n= 1,513,938) were identified as high-risk. Vaginal birth was the most common delivery method (n=1,596,757; 68%). 15% of women were over the age of 34 years (35-39 years: 12%, n= 285,280; 40-44 years: 3%, n= 63,288). Of the patients with C-sections, a higher percentage were

categorized as high-risk vs. low-risk (88% vs. 12%; $p < 0.0001$). Among patients with a hospital length of stay (LOS) ≥4-days, a higher percentage were high-risk vs. low-risk (81% vs. 20%; $p < 0.0001$). The mean costs for high-risk vs. low-risk hospitalizations were $6,145 (median=$5,760; standard deviation (SD)=$2,262) and $5,397 (median=$5,001; SD=$2,016), respectively ($p < 0.0001$). Among high-risk deliveries, factors significantly associated with hospitalization costs included delivery type (C-section vs. vaginal birth), longer LOS (2, 3, 4, 5+ days vs. 1 day), hospital location (rural vs. urban), calendar year of hospitalization year, payer types (Medicaid vs. commercial), age, teaching status (no vs. yes), hospital bed size, the presence of serious maternal morbidity (yes vs. no) and geographical region. Similar factors were found to be significantly associated with hospitalization costs among low-risk deliveries. Sensitivity regression results were consistent with the multivariable linear regression results.

Conclusion: In this large scale real-world evaluation of hospital costs associated with childbirth, the majority (64%) of childbirth deliveries were considered high-risk. Characteristics such as delivery type, LOS, geographical region, teaching status, serious maternal morbidity and hospital location were shown to significantly impact hospital costs of childbirth.

Submission Category: Clinical Services Management

Session-Board Number: 6-180

Poster Title: Impact of the appointment-based model on medication-taking behavior and health outcomes: a systematic review

Primary Author: Elaine Nguyen, University of Connecticut/Hartford Hospital; **Email:** elaine.nguyen@hhchealth.org

Additional Author (s):
Sarah Kessler
Diana Sobieraj

Purpose: Medication non-adherence has been attributed to a significant degree of morbidity, mortality and healthcare costs in the United States. There are many variables associated with non-adherence and multi-faceted interventions are recommended. The appointment-based model (ABM) is a community pharmacy-based intervention targeting medication adherence and is driven by the process of proactive prescription synchronization. We aimed to systematically review evidence on the impact of the ABM on medication-taking behavior, clinical and economic outcomes, health resource utilization, and the preferences of patients and providers.

Methods: We conducted a systematic literature search of Medline and Scopus from database inception through December 28, 2015 using terminology to describe medication synchronization, the appointment-based model or community pharmacy services. The bibliographic database search was augmented with a search in Google Scholar as well as backwards citation tracking of included studies. Two investigators independently screened the title/abstract of each identified citation and subsequently reviewed the full-text manuscript for final inclusion into the review. Studies were included if they were original investigations evaluating the impact of the ABM on at least one outcome of interest and published in the peer-reviewed literature as a full-text manuscript in the English-language. For purposes of this review, we applied the previously established definition of ABM which focuses on three core elements: prescription synchronization, a scheduled monthly appointment and a pre-appointment call. Outcomes of interest included medication-taking behavior, clinical and economic outcomes, health resource utilization, and patient or provider satisfaction. Using a standardized data collection form, two investigators independently collected pertinent study data and evaluated study risk of bias. Data was synthesized qualitatively.

Results: Our search yielded 3,192 citations. After screening and full-text assessment, four observational studies and one randomized trial were included in our review. Risk of bias was low for all studies with the exception of the randomized trial which had several domains rated with a high-risk of bias. Studies evaluated chronic medication users with intervention periods ranging from 3 to 12 months. In all but the trial, patients self-selected into the ABM service. Both genders were well represented (female range: 50.1 to 63.7 percent) and the average age of enrolled subjects ranged from the fourth to seventh decade. Most studies were performed in the Midwestern United States and primarily within chain pharmacies. Objective measures of medication-taking behavior (i.e., proportion of days covered, medication possession ratio and persistence) were consistently improved in patients enrolled in the ABM versus control, indicating participation in the ABM is associated with improved adherence and decreased likelihood of non-persistence. Limited data regarding clinical and economic outcomes, health resource utilization, and patient or provider satisfaction exist and thus the impact of the ABM on such outcomes is uncertain.

Conclusion: The ABM provides a unique, patient-centered service to improve medication adherence amongst patients taking chronic medications. Future research is needed to determine the impact of the ABM on clinical and economic outcomes, health resource utilization and patient and provider satisfaction.

Submission Category: Leadership

Session-Board Number: 6-181

Poster Title: Designing a systematic approach to involve Pharm D. students with chronic disease state management in a camp setting using a service learning model

Primary Author: Christopher Jacobson, Loma Linda University; **Email:** cjacobson@llu.edu

Additional Author (s):
Nancy Kawahara

Purpose: The profession of pharmacy is undergoing change with many states giving pharmacists provider status that will increase their roles and responsibilities. Pharmacy education assumes primary responsibility for preparing students to accept the challenges associated with these expanded roles for pharmacists. As a result it is paramount that students receive both didactic and hands-on opportunities to demonstrate their ability to perform the skills and functions associated with these expanded roles for pharmacists. Involvement in chronic disease state management is an area where the profession has already demonstrated the value a pharmacist brings to the care of patients.

Methods: Students are eligible to apply for camp after they have completed the endocrine module of therapeutics. The student must submit an application stating their interest in participating at camp and the experience they hope to gain. Students that are selected from the applicant pool are then required to attend an eight-hour training day. Once training has been completed students participate in 1 week of diabetes camp and complete a written reflection about their experience. While at camp students participate as active members of the medical staff. They work on an interdisciplinary team to provide care to campers. Duties include: assisting campers with dosing insulin for meals, completing both midnight rounds and 3 a.m. checks, as well as staffing the medical center. Students who complete one week of diabetes camp are then eligible to return the following summer and serve as a peer mentor. Peer mentors must submit an application expressing the impact that diabetes camp had on their life and their desire to return as a mentor for new students. Peer mentor responsibilities include: assisting with the selection of the next group of students, teaching the 8 hour training session, spending two weeks at diabetes camp, and helping with management of the camp medical center.

Results: The impact of participating at diabetes camp on the lives of students is very profound. Upon return there are a few common themes that preside in all of the students' reflections. These reflections demonstrate how students have developed both interprofessional and patient provider relationships and improved their self-awareness. One of the biggest epiphanies that students make is how critical "whole person care" is for successful disease state management. They come to appreciate the flaws associated with treating a patient "by the numbers". Students learn the value of forming a strong bond of trust within the patient provider relationship and the impact that trust or lack thereof has on patient outcomes. Students are grateful for the opportunity to put into practice the information that they have obtained from time in the classroom. They gain the skills necessary to successfully work with an interdisciplinary team through their work at camp with nursing students, physician assistants, medical students, medical residents, endocrine fellows, and attending physicians.

Conclusion: Emersion in a camp setting provides a valuable experience for Pharm.D students that allows the integration of material learned during didactic lecture with real world experience Pharm.D students gain increased awareness of the burden of living with a chronic disease and the importance of a positive patient-provider relationship for delivery of high quality patient care.

Submission Category: Geriatrics

Session-Board Number: 6-182

Poster Title: Proton pump inhibitor use in older adults: Risks assessed by an interprofessional fall prevention team.

Primary Author: Lazara Cabrera Ricabal, Nova Southeastern University, College of Pharmacy; **Email:** charycabrera@hotmail.com

Additional Author (s):
Joshua Caballero
Michelle Gagnon Blodgett

Purpose: Proton pump inhibitors (PPIs) are associated with bone thinning which may cause or worsen osteoporosis and predispose patients to falls and fractures. The 2015 Beers Criteria recommends avoiding scheduled PPIs for more than eight weeks to prevent bone demineralization and fractures in older adults. While some studies show an association between PPIs and an increased risk for osteoporosis, falls, and fractures, other data state otherwise. Therefore, the primary aim of this study was to evaluate PPI use and differences in osteoporosis diagnosis, falls, and fractures in our older adult population. The secondary aim was to evaluate osteoporosis treatment.

Methods: Our university's interprofessional fall prevention clinic consists of healthcare providers working together to assess patients with a history of falls and/or balance problems. After Institutional Review Board approval, retrospective data from our interprofessional fall prevention clinic between 2011-2015 were collected. Inclusion criteria included patients 65 years of age or older evaluated at our fall prevention clinic. Exclusion included patients younger than 65 years of age. Osteoporosis diagnosis, number of falls with and without fractures, and current medications were evaluated. Descriptive statistics and Mantel Haenszel Chi-Square tests ($p < 0.05$) were used to analyze the data.

Results: Data from ninety-eight patients 65 years of age or older were evaluated. Sixty-nine percent of patients were female with an average age of 77.4 years (+/- 9.5). Sixty-seven percent of patients reported at least one fall with an average of 1.5 (+/- 1.4) falls. Forty-two percent reported osteoporosis from which 19 percent experienced at least one fall with fracture and 29 percent of those were on a PPI. The use of PPIs did not demonstrate an increased risk for osteoporosis (RR= 0.620; 95 percent CI 0.301, 1.141, p=0.096). Although PPI use in patients with

osteoporosis showed a 24 percent relative risk increase in falls with fractures, the increase was not statistically significant (RR= 1.24; 95 percent CI 0.174, 5.856, p=0.774). When PPIs were used in patients without osteoporosis, there did not appear to be a risk in falls with fractures (RR= 0.000; 95 percent CI 0.000, 3.292, p= 0.152). Additionally, only 26 percent of patients with osteoporosis who experienced at least one fall were appropriately treated with a bisphosphonate plus calcium and/or vitamin D. Fifteen percent were not treated optimally (e.g., bisphosphonate without calcium and/or vitamin D supplementation) and 13 percent were not receiving any osteoporosis therapy or supplementation.

Conclusion: Our data showed PPI use did not have an increased risk for osteoporosis in older adults or an increased risk in falls with fractures among older adults without osteoporosis. The non-statistically significant increase risk in falls with fractures among those with osteoporosis may be explained with the results demonstrating over 25 percent of patients were not properly treated for osteoporosis while on PPIs. Limitations include limited sample size and unknown length of PPI therapy or osteoporosis diagnosis. However, our study elucidated the need for having patients on proper osteoporosis therapy when a PPI is prescribed.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-183

Poster Title: Perceptions of medical science liaisons: challenges and strategies for initiating and managing key opinion leader (KOL) relationships

Primary Author: Melanie Shelton, Med Communications, Inc; **Email:** melanie.shelton@medcomminc.com

Additional Author (s):
Tasfia Ahmed

Purpose: Medical science liaisons are employees of medical device, managed care, biotechnology, or pharmaceutical companies. The significance of the medical science liaison role lies within their ability to build and foster scientific-based relationships with key opinion leaders. Perceptions of medical science liaison talents necessary to build those relationships have rarely been reported. Furthermore, medical science liaison views of challenges associated with opinion leader relationships have not been reported in a post-Sunshine Act era. This survey-based assessment of medical science liaisons within the United States will explore the perceptions of peaks and troughs of a key opinion leader-medical science liaison relationship.

Methods: This study has been submitted to the University of Tennessee Health Science Center's Institutional Review Board for approval. A 21-question, electronic survey will be developed and posted on www.surveymonkey.com, a Web-based survey host site, for 60 days. Links to the online survey will be sent out via a LinkedIn social media group to medical science liaisons. Approximately 3,000 medical science liaisons within the pharmaceutical industry will have access to this survey. During the time this survey is available, periodic reminder notifications will be sent. Data recorded will include: medical science liaison position, medical science liaison therapeutic area of interest, most important strategies for engaging key opinion leaders, and most difficult challenges faced when engaging key opinion leaders. The identity of medical science liaison respondents will be confidential and blinded from the investigator. Data reported will be stratified by therapeutic area of interest.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-184

Poster Title: Dispensing dilemmas: Pharmacy students' decision-making in gray areas of practice

Primary Author: KariLynn Dowling, ETSU Gatton College of Pharmacy; **Email:** dowlingk1@etsu.edu

Additional Author (s):
Nicholas Hagemeier
Cortney Mospan

Purpose: Ethical or legal dilemmas frequently create gray areas in practice as pharmacists attempt to balance identifying and preventing potential drug abuse and diversion with providing evidence-based, quality patient care. The objective of this study was to use the theory of planned behavior (TPB) to examine the extent to which pharmacy students' attitudes, perceived social norms, and perceived behavioral control beliefs explain prescription drug abuse and addiction-related dispensing behaviors.

Methods: Third-year pharmacy students (n=83) were provided with five written case scenarios describing common dispensing gray areas in practice related to prescription drug abuse. Scenarios included (1) a long-term buprenorphine maintenance prescription without evidence of tapering or counseling, (2) prescriptions from a pain clinic, (3) early refill of a narcotic for an out-of-town patient, (4) over-the-counter (OTC) sales of pseudoephedrine and (5) OTC sales of syringes. Students completed a brief TPB-based questionnaire for each case. Seven-point rating scales were used to evaluate attitudes regarding dispensing (i.e., bad-good, unprofessional-professional, illegal-legal) and level of agreement (strongly disagree-strongly agree) with subjective norm and behavioral control statements. In addition to TPB items, the questionnaires assessed 1) if the student would dispense the medication in the given scenario, and 2) how many times out of 10 similar scenarios the student would dispense the medication. Descriptive statistics were calculated for all survey items using SPSS version 22. Items representing each TPB construct were examined for internal consistency reliability. Two- to three-item composite scores were calculated for attitudes and subjective norms constructs by taking the average of the responses. Linear regression analysis was performed to examine the extent to which composite scores and individual behavioral control items explain mean intent

to dispense in similar scenarios. Independent sample T-tests were used to examine differences in behavioral intention across student gender and pharmacy work experience.

Results: Wide variation in the decision to dispense was noted across all scenarios. Whereas 12 percent of respondents indicated they would dispense buprenorphine in the given scenario, 56 percent of respondents indicated they would sell syringes without a prescription in the given scenario. The mean intent to dispense in similar scenarios ranged from 2.2 (SD=3.1) to 5.8 (SD=3.7) times out of 10 for the buprenorphine and syringe scenarios, respectively. For all case scenarios, mean intent to dispense in similar scenarios was explained by composite attitude scores (P less than or equal to 0.008). For every 0.334 increase in the buprenorphine dispensing attitude score, students will dispense buprenorphine one more time out of ten. Similarly, a 0.659 attitude score increase results in one more sale of syringes without a prescription. In the case scenario regarding early refill of a narcotic for an out-of-town patient, there was a statistically significant difference in male (3.64) versus female (1.78) students' intent to dispense in similar scenarios (P=0.015). No statistically significant differences in behavioral intention were observed based on students' previous pharmacy work experience.

Conclusion: Student attitudes consistently predicted intent to dispense across the five perceivably difficult practice scenarios. These findings can be applied to development of interventions in pharmacy education that influence students' dispensing decisions. Further study is warranted to determine if TBP constructs similarly explain the dispensing behavior of practicing pharmacists.

Submission Category: Infectious Diseases

Session-Board Number: 6-185

Poster Title: Outcomes and safety of utilizing patient-specific pharmacokinetics for vancomycin therapeutic dosing and monitoring: A retrospective study

Primary Author: James Truong, Loma Linda University Medical Center; **Email:** jamestruong@llu.edu

Additional Author (s):
Shawn Smith
Steven Forland

Purpose: Vancomycin trough levels are used by clinicians to monitor treatment efficacy and toxicity. There were two studies that suggested the use of a vancomycin protocol for therapeutic dosing and monitoring to improve efficacy and minimize toxicity. Neither of these studies used patient-specific pharmacokinetics in their protocols. To our knowledge, there are no studies that utilize patient-specific vancomycin pharmacokinetic parameters to make dosing recommendations. In our retrospective study, we will compare the efficacy and safety of patient-specific pharmacokinetic methods to traditional methods for dosing and monitoring vancomycin.

Methods: This retrospective study will be submitted to the Institutional Review Board for approval. At our hospital, vancomycin per pharmacy (VPP) was implemented in February 2016 as an opt-in service utilizing patient-specific pharmacokinetics to dose and monitor patients. An electronic report will be generated from EPIC of all patients who had an active vancomycin order from February to August 2016. This report will be used to screen for patients meeting selection criteria. Patients who were 18 to 89 years of age, were on vancomycin for greater than 24 hours, and had an appropriately timed trough will be included. Patients included in the VPP group must have been started on the VPP-consult service within 48 hours of vancomycin initiation. Patients will be excluded from the VPP group in the event that no initial levels were collected for pharmacokinetic calculations. The primary efficacy endpoint will be goal trough attainment by 48 hours after vancomycin initiation. Secondary efficacy endpoints will include average days to goal trough and average duration of vancomycin therapy. Safety endpoints will include troughs greater than 20 mg/L and incidence nephrotoxicity.

Results: N/A

Conclusion: N/A

Submission Category: Small and Rural Pharmacy Practice

Session-Board Number: 6-186

Poster Title: Adherence to current pneumococcal vaccine guidelines in four federally qualifed health centers (FQHC) in Indiana

Primary Author: Norman Fenn, Purdue University; **Email:** nfenn@purdue.edu

Additional Author (s):
Bin Deng
Kimberly Plake

Purpose: The Advisory Committee on Immunization Practices (ACIP) changed the recommendations for pneumococcal vaccinations in 2014, and issued an updated recommendation on the interval between PCV13 and PPSV23 vaccines in 2015. One of the quality improvement initiatives of the North Central Nursing Clinics (NCNC) this year is evaluating patient and provider adherence to the pneumococcal recommendation changes. The purpose of this study is to assess adherence to these new ACIP pneumococcal guidelines within the four FQHCs in Indiana, as well as evaluate reported patient and provider barriers to the guidelines.

Methods: This study will be submitted to the Institutional Review Board (IRB) for approval. Patients will be identified through the Centricity electronic health record (EHR) for the NCNC from January-December 2016. Data to be collected include demographic information (name, age, gender); if the vaccine was offered and administered to or rejected by the patient; reasons for vaccine rejection; the type of vaccine given (PCV13 or PPSV23); and the patient's primary provider. Patients will be included if they were offered the pneumococcal vaccine during at least one visit in 2016 and are at least 65 years of age. Patients who are < 65 years, were not offered the pneumococcal vaccine at any visit in 2016, or were not seen by a clinic provider during 2016 will be excluded.

Results: N/A

Conclusion: N/A

Submission Category: Cardiology/ Anticoagulation

Session-Board Number: 6-187

Poster Title: Impact of Medication Interactions on Clinical Outcomes with Concomitant Rivaroxaban Therapy

Primary Author: Joseph Goble, Baylor Scott & White Health; **Email:** goble.joseph@gmail.com

Additional Author (s):
Paul Godley
Jeffrey Michel
Laurel Copeland
Kiumars Zolfaghari

Purpose: Previous literature has established an increased risk of bleeding in rivaroxaban patients with concomitant use of non-steroidal anti-inflammatory drugs (NSAIDs) or platelet aggregation inhibitors (PAIs). These studies acknowledge a theoretical risk of concomitant CYP3A4/P-gp inhibitor/inducer use with rivaroxaban; however, risk evaluation was not completed due to lack of population size. This study aims to characterize any association between the concomitant use of CYP3A4/P-gp inhibitors and inducers and the risk of bleeding events and venous thromboembolism (VTE) in patients managed on rivaroxaban.

Methods: This retrospective cohort study will examine Scott & White Health Plan's (SWHP) archival prescription and medical claims, and Baylor Scott & White electronic medical records from January 2012 through December 2015. SWHP members will be included in the study if they meet the following criteria: (a) prescription claims for rivaroxaban for at least 90 consecutive days, and at least one interacting concomitant medication of interest (CYP3A4/P-gp inhibitors and inducers, PAI, or NSAID) and (b) medical claim for VTE or bleeding event occurring at least 7 days after prescription date of interacting concomitant medication. Dependent variables are VTE and bleeding event. Covariates include: patient age, gender, and comorbidity (i.e., past-year diagnosis of hypertension, hypercholesterolemia, diabetes mellitus, atrial fibrillation, coronary artery disease, myocardial infarction, stroke, and chronic kidney disease). Chi-square tests will be used to evaluate the difference in the proportion of patients with VTE and bleeding events in the group that had concomitant interacting medications versus the group that did not. Multiple logistic regression will assess this association for outcomes adjusting for clinical and demographic covariates. A P-value < 0.05 will be used as the criterion

significance level. Analyses will be performed using SAS software. This study is in review by the Baylor Scott & White Institutional Review Board.

Results: N/A

Conclusion: N/A

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-188

Poster Title: Physical compatibility of ZTI-01 (fosfomycin for injection) with select intravenous drugs during simulated Y-site administration

Primary Author: Marguerite Monogue, Hartford Hospital; **Email:** marguerite.monogue@hhchealth.org

Additional Author (s):
Joseph Kuti
David Nicolau

Purpose: Fosfomycin is a phosphonic acid derivative antibiotic that demonstrates in vitro potency against multi-drug resistant (MDR) bacteria. An oral formulation is available in the US, but an intravenous formulation, currently in development, would be a welcomed addition to the antibiotic armamentarium as the prevalence of MDR bacteria escalates.
Given the frequency of concurrent intravenous medication administration in hospitalized patients, the objective of this study is to determine the physical compatibility of ZTI-01 (fosfomycin for injection) in normal saline or 5% dextrose during simulated Y-site administration with 36 intravenous antimicrobials and 61 non-antimicrobials by visual observation, turbidity measurement, and pH assessment.

Methods: To simulate Y-site administration in a 1:1 ratio, a 5 mL sample of fosfomycin 30 mg/mL will be combined with a 5 mL sample of each of the secondary intravenous solutions in a colorless, 15-mL, borosilicate glass, screw-cap culture tube with polypropylene caps. Each of the sample solutions will be passed through a 0.22-micrometer filter in a filter syringe as it is introduced into the culture tube. Solutions will be inspected visually against white and black background for clarity, color and Tyndall beam test immediately after mixing, 15 minutes after mixing, and then 60 and 120 minutes after mixing. The turbidity of each sample will be measured using a laboratory-grade turbidimeter in 10 mL borosilicate glass tubes according to turbidimeter instructions. Determinations will be made for samples at 15, 60, and 120 minutes after mixing. Physical stability will be defined as a change in measured turbidity greater or equal to 0.5 nephelometric turbidity units (NTU). Sample pH will be determined for each mixture in the 10 mL borosilicate tube with a pH meter prior to mixing (fosfomycin control), at 15 minutes,

1 hour, and 2 hours after mixing. pH changes will be utilized to explain any incompatibilities that may be observed via tyndall effect and turbidity measurement.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-189

Poster Title: Clinical Validation of a Rheumatoid Arthritis Algorithm at a Health Plan located in Central Texas

Primary Author: Stephanie Yu, Baylor Scott & White Health; **Email:** stephanie.h.yu@gmail.com

Additional Author (s):
Karen Rascati
Paul Godley
Laurel Copeland
I-Chia Liao

Purpose: An algorithm developed by Curtis et al. estimated the effectiveness of biologics used to treat rheumatoid arthritis based on medical and pharmacy claims. The algorithm determines the responsiveness to biologic medication based on six criteria evaluating adherence, switch, and medication increase or add-ons. However, the robustness of the algorithm has only been tested against the Disease Activity Score (DAS) 28-joint patient-reported outcome within a Veteran's health Administration population (94% men). Although there are no thresholds to compare the algorithm against clinical measures, the predictive accuracy of the algorithm may be assessed by adherence and discontinuation, two components of the algorithm.

Methods: A retrospective review of prescription and medical claim records from 2010-2015 will be conducted. The date when the first biologic medication is filled after an oral DMARD (with no use of the biologic for at least 6 months prior) will be referred to as the index date. Inclusion criteria: Patients with CRP/ESR measurements from blood tests and joint involvement measures at least six months prior and up to 30 days after index prescription date. Design: Percentage of patients with non-adherence, adherence, and discontinuation of DMARDs will be compared against inflammatory markers, joint count, comorbidities, medication dosing frequency, SQ vs. IV injection, concurrent DMARD use, and number of medications. Primary study endpoints: 1) Determine percent of patients satisfying all 6 criteria of the therapy response algorithm 2) Determine the cost per effectively treated patient for each biologic as defined by the algorithm, 3) Determine CRP/ESR levels, joint count, infection incidence, MI incidence, IS incidence, and all-cause and RA-related healthcare costs that differ between patients with or without adherence. Baseline characteristics of patients with or without adherence will be compared using t tests for continuous variables and chi-square tests for categorical variables. Generalized

logistic models adjusted for clinical and demographic covariates will be used to compare annualized medical utilization, costs, and post-index MI or IS. In review by the Baylor Scott & White Institutional Review Board.

Results: N/A

Conclusion: N/A

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-190

Poster Title: Evaluation of the growing opportunities for pharmacists within commercial PharmD industry fellowships

Primary Author: Malay Naik, Rutgers University; **Email:** mnaik.91@gmail.com

Additional Author (s):
Pranvi Parekh
Dhanushya Raja
Sarah Ullman
Michael Toscani

Purpose: In recent years, there has been a visible growth in both the interest and availability of pharmaceutical industry fellowship programs across various commercial functions. Historically, pharmacists have played less of a role in commercial functions compared to other functions such as Medical Affairs. However, as the desire to pursue these commercial positions increases, there is an interest in understanding the growth of these opportunities and types of fellowship positions available. The objective of this analysis is to identify these growth trends and capture the progression of commercial fellowship experience over 4 years within available post-doctoral fellowship programs.

Methods: This analysis takes a look at all commercial fellowship positions currently offered and all those that have been offered for the past 3 years across the available post-doctoral industry fellowship programs. The evaluation will assess the growth trends for the number of commercial positions by specific commercial category (e.g. marketing, market access, business development and licensing, market research, etc.). In addition, this evaluation will assess the criteria required for application to each position. This information will be pulled from public sources (e.g. internet searches, web sites, published brochures). Fellowship program recruitment information is generally posted online annually between September and November of each year. Each fellowship position will be examined to identify similarities in required candidate qualifications and then to identify common elements across the available commercial roles. Descriptive statistics will be used to understand the growth in the overall number of commercial fellowship positions, as well as the percentage of total fellowships available to PharmD graduates that are on the commercial side of the pharmaceutical industry.

Results: N/A

Conclusion: N/A

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-191

Poster Title: Sterile compounding review in U.S. based colleges/schools study

Primary Author: Kaitlyn Dana, Purdue University; **Email:** kdana@purdue.edu

Additional Author (s):
John Hertig
Leigh Briscoe-Dwyer
Catherine Scott

Purpose: The "Instruction on Compounded Sterile Preparations at U.S. Schools of Pharmacy" study published in 2007 by the American Journal of Health-System Pharmacy evaluated sterile compounding education provided in colleges/schools of pharmacy. Laws, regulations, and public awareness have changed in the 10 years since publication of these data. Therefore, the purpose of this study is to assess current sterile compounding education in United States pharmacy college/school curriculum as a follow-up study. The objectives are to evaluate and compare course characteristics of sterile compounding instruction provided by U.S. colleges/schools of pharmacy and distinguish how the data compares to the 2007 study.

Methods: This study was submitted to the Institutional Review Board for exempt review. An electronic survey using Qualtrics software (Provo, UT) will be sent out to all U.S. based colleges/schools of pharmacy (136 accredited, full or candidate status and 3 pre-candidate status) including U.S. territories (Guam, Puerto Rico, and the U.S. Virgin Islands). The survey will be sent to all deans and lab coordinators (identified by the American Association of Colleges of Pharmacy database) at each college/school. The survey will include questions to collect both demographic information and details pertaining to sterile compounding instruction. All data will be recorded and maintained confidentially. Results will include only completed responses and one survey submission per college/school. Investigators will complete a comparison of the course structure, compounding environment, training techniques, and perceived preparedness across U.S. pharmacy programs. Investigators will calculate the percentage of programs covering the survey topics in their current curriculums (lecture compared with laboratory assessments). Also, investigators will determine if any college/school demographic characteristics correlate with extent of sterile compounding education. The investigators will use the data to evaluate the current status of sterile compounding education in the U.S. and compare this data to previous 2007 results.

Results: N/A

Conclusion: N/A

Submission Category: Small and Rural Pharmacy Practice

Session-Board Number: 6-192

Poster Title: Role of the pharmacist in global health: a cross-sectional survey of residents and fellows in a postgraduate training program

Primary Author: Abisola Tepede, Novartis Institutes of BioMedical Research/MCPHS University; **Email:** abisola.tepede@novartis.com

Additional Author (s):
Jonathan Spector
Sherri Schwaninger
Dinesh Yogaratnam

Purpose: Pharmacists from the United States can play an important role in Global Health (GH) by using their unique skills to address medication-related challenges in developing countries. Little is known about the prevalence, scope, or depth of training opportunities for pharmacists or pharmacy students on providing GH services in countries or settings with limited resources. The objective of this study is to describe the attitudes, perspectives, and experiences of current pharmacy residents and fellows with regards to global health.

Methods: This study will be submitted to the Massachusetts College of Pharmacy and Health Sciences University (MCPHS-U) Institutional Review Board (IRB) for approval. An anonymous Qualtrics electronic survey will be administered to all PharmD residents and fellows enrolled in the MCPHS-University Postgraduate Training over a one-month period. The total population that will be surveyed is estimated at 70 with the aim of 60% response rate. Data will be captured through 20 closed-response questions in five broad areas: participant demographics, knowledge, curriculum, experiences, and perspectives. Questions will assess for information including the description of previous or current global health opportunities, the length of time spent within these opportunities, the additional global health trainings offered in the curriculum and the willingness to participate in future global health opportunities. It is expected that this study will increase understanding of the scope, breadth, and prevalence of GH training among postgraduate pharmacists.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-193

Poster Title: Implementation of an interactive program to teach medical terminology: a pilot evaluation

Primary Author: Elizabeth McNamara, MCPHS University/Novartis; **Email:** lizaks100@gmail.com

Additional Author (s):
Noah Stachulski
Valerie Coppenrath

Purpose: It is crucial for Doctor of Pharmacy students to understand medical terminology, as reflected in Center for the Advancement of Pharmacy Education outcomes 3.6.1 and 3.6.9. The Medical Language Lab is an interactive medical terminology teaching and assessment platform developed by F.A. Davis. However, searches of MEDLINE and ERIC databases conducted in May 2016 found no articles describing the use of the Medical Language Lab in Doctor of Pharmacy students. This study examined if use of the Medical Language Lab by healthcare students increased medical terminology performance, with the goal of justifying further trial in a Doctor of Pharmacy curriculum.

Methods: Ten MCPHS University Diagnostic Medical Sonography students were enrolled in an elective medical terminology course utilizing the Medical Language Lab and the associated textbook. Over ten weeks, they completed all 18 modules of the program. Each module included reading a chapter in a textbook and completing Critical Listening, Response, and Practice exercises in the online program. Exercise scores were automatically recorded. Pre- and post-tests were also administered in the online program. Each contained 90 questions and addressed concepts taught throughout the program. Students were also invited to participate in an eight-question online survey after course participation. Participants provided informed consent prior to taking the survey. The purpose of the survey was to determine their self-described baseline levels of experience with online courses and medical terminology, and to gather feedback on their perceptions of the course. Students' exercise scores were described, pre- and post-test scores were compared, and survey results were analyzed using Microsoft Excel. Four of the eight survey questions asked respondents to select one of five ordinal responses from "strongly disagree" to "strongly agree". These were assigned a value from 1 (for

"strongly disagree") to 5 (for "strongly agree") for the purposes of the analysis. This study was reviewed by the MCPHS University Institutional Review Board and deemed "exempt."

Results: All ten students completed all exercises and tests; seven of ten completed the survey. Of the seven surveyed, all had taken an online class prior, and most (4/7) described their baseline competence in medical terminology as "intermediate." Students spent an average of 9.8 hours in the online program (range 0.3-16.0 hours). The overall exercise score average was 91.5 percent. The pre-test average was 72.0 percent, and the post-test average was 76.6 percent (difference in pre-test and post-test averages: 4.6 percent). Six students demonstrated improvement in post-test scores compared to pre-test scores; the average improvement among these students was 16.8 percent. Per survey feedback, the most valuable feature of the software was the Practice Exercises (5/7 responses) and the least valuable feature was Pronunciation Guide (3/7 responses). Median values for the four ordinal survey questions were as follows: "program had a user-friendly interface" - 5, "program increased time I spent on course" - 5, "option to practice before submitting exercises for grading enhanced my learning" - 4, and "program enhanced my learning compared to the textbook and tests alone" - 5.

Conclusion: Average performance increased slightly after course completion. Increases were greater among those who displayed any improvement. This may relate to grading structure – pre/post test results were not incorporated into grades, limiting students' incentive to perform. Tests were also administered online, so students may have utilized external resources. Furthermore, students reported that the software was user-friendly and enhanced their learning. These results support the further evaluation of online platforms as tools to improve the medical terminology performance of healthcare students, including Doctor of Pharmacy candidates. Future evaluations should incentivize students to put effort into the post-test and utilize in-person testing.

Submission Category: General Clinical Practice

Session-Board Number: 6-194

Poster Title: The association between patients' understanding of their medications and discharge plan with 30-day readmission in liver cirrhosis patients

Primary Author: Samah Alshehri, University of Arizona; **Email:** moo7_ph@windowslive.com

Additional Author (s):
Archita Desai
Marcella Hokonen Hokonen
Azadeh Fotouhie

Purpose: The aim of this project is to assess liver cirrhosis patients' understanding of their medications and discharge plans including follow-up visits, to find the association between liver cirrhosis patients' understanding to their medications and discharge plans and the 30-day readmission to the hospital, and to inform and guide post-discharge intervention that can reduce readmissions in liver cirrhosis patients.

Methods: This is a prospective study with a chart review component. In addition, patients who meet our inclusion criteria will be consented and surveyed prior to discharge. We identified the patient ICD-9 and 10 codes for chronic liver disease and liver cirrhosis complications diagnosis. Patients will be followed for 90 days to access readmission and mortality rates.
Adults 18 year or older who got admitted with chronic liver disease and or liver cirrhosis complications and will be discharged home were included. Subject excluded if they got admitted for schedule or elective procedure, diagnosed with dementia, pregnant, discharged to home hospice, with liver transplant prior or during the index hospitalization, not willing to participate in the survey, or with severe cognitive impairment without a caregiver who can fill the survey.
Data collected from the chart review includes demographics, status of transplant, etiology of liver disease, labs in admission and discharge, length of stay, co-morbid status, reason of the admission, number of medications at discharge, re-admission within 30,60 and 90 days, and mortality in 90 days. In addition, medication adherence and adherence barriers, patient knowledge regarding key medications in liver cirrhosis, and patient knowledge about the discharge plan and contacting information were collected from the survey.

Results: In progress

Conclusion: In progress

Submission Category: Oncology

Session-Board Number: 6-195

Poster Title: Reduced platinum salts desensitization protocols and their impact in an oncology pharmacy unit.

Primary Author: Jose Revuelta, Gregorio Marañon General University Hospital; **Email:** joseluis.revuelta@salud.madrid.org

Additional Author (s):
Eva González-Haba
Carmen Rodríguez
Ana Herranz
María Sanjurjo

Purpose: Desensitization protocols to platinum salts are used in patients with history of previous hypersensitivity reactions to induce tolerance. The traditionally used Brigham's-and-Women's-Hospital protocol includes the administration of three solutions at escalating rates in 12 steps. A modified 16-step protocol with 4 bags is recommended for high risk patients. A simplified version of these protocols has been used in our centre: 2 bags for the 12-step protocol and 3 bags for the 16-step protocol. Objective: to describe and compare the utilization of the standard and simplified platins desensitization protocols in our hospital, their impact on pharmacy workload and their clinical results.

Methods: We conducted an observational retrospective study. All adult patients that received platinum desensitization protocols between 2013 and 2015 were included in the study. Demographic (sex, age) and pharmacotherapeutic (tumor location, drugs used, previous courses, desensitization cycles, protocol used and number of bags) variables were collected from electronic medical orders and clinical records

Results: Fifty-eight patients were treated [median age 63 (range 35-81) years, 32% men]. Tumor locations were: colon and rectum (42%), ovary (31%), lungs (9%), pancreas (6%), biliary tract (6%), cervix (4%), stomach (2%) and head and neck (1%). Oxaliplatin was the drug requiring a greater number of desensitizations [175 (60%)], followed by carboplatin [79 (29%)] and cisplatin [40 (14%)]. In three patients (9%) desensitization protocols to two or more different platins were needed. Patients had received a median of 5 (IQR=3-8) cycles before requiring desensitization. The Pharmacy Department compounded 771 bags, accounting for

294 desensitizations (71 in 2013, 95 in 2014 and 128 in 2015). The utilization of reduced protocols has steadily increased over these years (49% in 2013, 72% in 2014 and 85% in 2015). The most commonly used protocols were the reduced 12-step protocol (52%) and the reduced 16-step protocol (18%). The standard 12-step protocol (13%) and 16-step protocol (2%) were reserved for patients with severe reactions. In a small proportion of desensitizations (15%), individualized protocols were used. According to medical records, all desensitizations were successfully administered. Similar effectiveness is reported by the clinicians for the traditional and simplified protocols, although statistical comparison of the results is pending.

Conclusion: There has been a constant increase in the use of desensitization protocols for the administration of platinum salts in patients with history of hypersensitivity reactions. The reduced protocols used in our Hospital lead to significant savings in terms of compounded bags, and seem to offer good clinical results in the majority of patients. Although these protocols have replaced those more complex, individualization of the administration is still key in these high risk procedures. Further studies would be necessary to confirm their impact on long term outcomes.

Submission Category: Infectious Diseases

Session-Board Number: 6-196

Poster Title: Clinical management and effectiveness of new direct-acting antivirals based therapies in HIV-HCV coinfected patients

Primary Author: Alberto Llorente Romeo, Hospital Universitario Central de Asturias; **Email:** alloromeo@gmail.com

Additional Author (s):
Alba Martínez Torrón
María Carmen Rosado María
Ana Iglesias Carbajo
María Teresa Iglesias García

Purpose: To evaluate the effectiveness of new direct-acting antivirals (DAAs) in HIV-HCV co-infected population. To review antiretroviral drugs (ARVs) switches in order to avoid drug-drug interactions, before starting treatment for HCV infection.

Methods: Observational and retrospective study. We included patients diagnosed with HIV and HCV, which were treated with ledipasvir/sofosbuvir (LDV/SOF), ritonavir boosted paritaprevir/ombitasvir, dasabuvir (3D) or daclatasvir + sofosbuvir (DCV + SOF) since April 1, 2015-April 31, 2016. The variable of effectiveness was measure as rate of sustained viral response at 12 weeks after the end of therapy (SVR12). Collected data: age, gender, genotype, grade of fibrosis (METAVIR score), presence of cirrhosis liver, HCV RNA baseline, virologic response at four weeks and at the end of therapy. HCV treatment history was also revised: naive, previous treatment with interferon and ribavirin (RBV), or triple therapy.
A total of 56 subjects with co-infection HIV-HCV were studied; 75% (n=42) were male. Median age was 50 years (34-64). HCV genotypes (GTs) were: GT1a (56%; n=31), GT1b (16%; n=9), GT3 (14%; n=8), and GT4 (14%; n=8). A total of 84% patients received treatment with LDV/SOF (± RBV), 14% received DCV + SOF (± RBV) and 5% received 3D (± RBV). The percentage of patients with grade of fibrosis F3-F4 was 86% and 66% (n=35) had cirrhosis. Ribavirin was used in combination with DAAs in 32% of subjects; 46% (n=26) were naive patients, where as 52% had been previously treated with interferon + RBV and only one patient had been treated with boceprevir and telaprevir.

Results: Mean HCV RNA baseline was 2.616.219 UI/mL. At four weeks of treatment, RNA was obtained in 52 patients, of which 75% showed undetectable HCV RNA. Overall, 54 patients (96%) had a sustained virologic response at 12 weeks after the end of therapy, including rates of 95% in patients with HCV GT1, 8/8 in those with GT3 and 8/8 in those with GT4.
Among those who did not achieved SVR12, one patient discontinued LED/SOF because of adverse events and one patient died of lung cancer. One patient discontinued treatment early at week 8 due to sepsis, even so achieved SVR12. In 14% (n=8) of patients at least one antiretroviral drug switch was performed to allow compatibility of DAAs. In 4 of those subjects, nucleoside reverse transcriptase inhibitor (NRTI) tenofovir (disoproxil fumarate) switched to abacavir. A total of 100% switched to an integrase inhibitor based regimen. Drug-drug interactions were found: tenofovir (with ritonavir-boosted regimen) when given LDV/SOF (n=3), tenofovir (in efavirenz-containing regimen) with LDV/SOF (n=2), ritonavir-boosted protease inhibitors with DCV (n=2) and etravirine with DCV (n=1). In one patient, tenofovir was stopped after starting treatment with LDV/SOF, due to decrease in creatinine clearance.

Conclusion: Effectiveness outcomes in the clinical setting were similar to the clinical trials. As compared to the first generation of HCV protease inhibitors (boceprevir and telaprevir), new DAAs require fewer changes in ARVs. To keep ARVs is observed, thus adapting HCV therapy. LDV/SOF can be used with most antiretrovirals, so is the preferred combination for genotype 1 and genotype 4, due to 3D has a potencial for significant drug interactions (metabolized by, and inhibitors of CYP enzymes 3A4 and 2C8). In HIV patients with tenofovir, LDV/SOF should be used with caution and monitor renal function is need. In patients with genotype 3 the combination of SOF + DCV is presented as the most effective, even though the profile of interactions of DCV. The inhibitors of the integrase could be a group therapeutic of choice for HIV-HCV co-infected population.

Submission Category: Oncology

Session-Board Number: 6-197

Poster Title: Dose Rounding of Temozolomide Concomitant with Radiotherapy

Primary Author: Beatriz Monje, Hospital General Universitario Gregorio Marañón; **Email:** beatriz.monje@salud.madrid.org

Additional Author (s):
Eva González-Haba
Belén Marzál
Carmen Rodríguez-González
María Sanjurjo-Sáez

Purpose: The objective of this study was to analyze the standard dose adjustment of temozolomide (75mg/m2) was performed based on the different capsules available in the market. Furthermore, we assessed the possible association between the administered dose and haematological toxicity.

Methods: A longitudinal, retrospective, observational study in teaching hospital was conducted. Patients 18 to 85 years of age with histologically confirmed glioblastoma treated with radiotherapy plus continuous daily temozolomide between January 2013 and December 2015 were included.
Data were obtained from the patient medical records and the electronic prescription software. We collected demographics (age, gender and BSA), chemotherapeutics (temozolomide exact dose/m2, adjusted dose in capsules and number of capsules/day) and analytical data (neutrophil and platelet count). Toxicity grading of neutropenia and thrombocytopenia was performed using the Common Terminology Criteria (NCI-CTC v 4.0) for Adverse Events version 4.0.
Statistical analyses were performed using STATA. The association between dose/m2 and haematological toxicity was studied using Wilcoxon Signed Rank test.

Results: Sixty-seven patients, 44 men and 23 women, with GBM and a mean age of 58 years (SD= 11) were treated with temozolomide (75mg/m2) plus radiotherapy.
Thirty-five (52.2%) patients received lower dose of standard (75mg/m2) and 32 (47.8%) patients received equal o higher dose, based on the recommended adjustment.

In the majority of the patients (59.7%), the temozolomide regimen required more than 2 capsules of different dose: 3 capsules/day (26.8%), 4 capsules/day (23.9%) and 5 capsules/day (9.0%) patients. Only 9 (13.4%) patients received a capsule/day of temozolomide during the treatment.
Two (3.0%) cases of grade 3-4 thrombopenia and 7 (10.5%) cases of grade 3-4 neutropenia were reported. Any grade of neutropenia and thrombopenia was experimented by 15 (22.4%) and 10 (14.9%) patients, respectively.
In our study, the range of temozolomide dosage was 72,65-77,42mg/m2. No association was found between the administered dose and the haematological toxicity, grade3-4 neutropenia (p=0.0783) and grade 3—4 thrombopenia (p=0.9789).
Therefore, a new approach of temozolomide rounding (±5.0%) could be considered to reduce the number of capsules/day. This method of dosage offers different advantages without healthcare quality being affected: improving the adherence, optimizing the preparation and reducing mediation errors.

Conclusion: Temozolomide safety profile was consistent with published literature. No association was found between the adjusted dose and the haematological toxicity. Rounding the dose (±5.0%) to reduce the number of capsules per day could be an improvement of adherence and safety.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-198

Poster Title: Influence of standarized reporting instruments and protocol repositories development on methodological quality of systematic reviews and meta-analysis on psoriasis.

Primary Author: Beatriz Isla, Department of Pharmacy,; **Email:** beatriz.isla.sspa@juntadeandalucia.es

Additional Author (s):
Juan Alberto Ruano
Inmaculada Reyes
Francisco Gómez
Antonio Velez

Purpose: Systematic reviews (SRs) and Meta-analysis (MAs) have become the standard approach in assessing and summarizing applied health research. AMSTAR (A MeaSurement Tool to Assess the methodological quality of systematic Reviews) is a reliable and valid measurement tool to assess the risk of bias of these studies by analyzing their methodological quality.
To assess the influence of standarized reporting instruments on methodological quality of systematic reviews and meta-analysis on skin psoriasis.

Methods: A systematic search and quality assessment were performed using AMSTAR tool. Protocol was registred in PROSPERO under (CRD 42016041611 ID). MEDLINE, EMBASE, and the Cochrane Database was searched. Only review articles that applied systematic methods of identification, selection and analysis of psoriasis studies were included. Two authors assessed SRs and MAs quality using the same data abstraction forms and the 11-point AMSTAR criteria. Disagrements were resolved by a third investigator and reviews were classified based on AMSTAR score as of low quality (0-4), medium quality (5-8) or high quality (9-11). A potential influence of publishing report guidelines or protocol repositories (CONSORT, QUORUM, MOOSE, STROBE, PRISMA, PROSPERO, PRISMA-P) on methodological quality evolution of SR and MAs in psoriasis during last 15 years was assessed. Other factors such as journal field or study design or objective were evaluated too. Statistical analysis and data visualization was performed using the R programming language.

Results: Articles that met eligibility criteria (n=220) were published from 1999 to 2016 and reviewed different aspects related with skin psoriasis (58.6% 'treatments', 21.3%

'comorbidities', 14.5% 'pathogeny', '5.4% 'diagnosis', and 1.3% 'economics'). They were classified of high (17,2%), medium (55%), and low methodological quality (27,7%) following the AMSTAR criteria. Since year 2000 up to 2016, a tendency of decreasing the median of AMSTAR score for low quality reviews is in contrast with an increase of the score for those studies classified as of moderate methodology quality. No time course changes were found for high quality reviews.

Conclusion: The number of SRs published in the psoriasis field has increased substantially but methodological quality remains suboptimal. SRs authors and editors should adhere to well established methodological standards to enhance the impact of their research efforts.

Submission Category: Preceptor Skills

Session-Board Number: 6-199

Poster Title: Assessing pharmacy student growth and learning in an industry-based advanced pharmacy practice experience (APPE) in pharmacovigilance

Primary Author: Tina Chhabra, Biogen/MCPHS; **Email:** tina.chhabra@biogen.com

Additional Author (s):
Michael Ryan
Theresa Foster
Shawn Burke
Patricia Valencia

Purpose: In the Accreditation Council for Pharmacy Education (ACPE) Standards and Guidelines for the Professional Program in Pharmacy leading to the Doctor of Pharmacy Degree, adverse event identification and reporting is listed as an activity that students should participate in during required advanced pharmacy practice experiences (APPEs). The reporting and assessment of adverse events is often addressed in industry-based pharmacovigilance APPEs during the last year of pharmacy school. The objective of this study is to create a survey to assess pharmacy student growth and learning during an industry based APPE that focuses on pharmacovigilance.

Methods: This study will be submitted to the IRB for approval. All students on APPE in the Pharmacovigilance department at Biogen will be chosen to participate. The survey will be created and then validated. The survey will be two pronged: the first section will assess general industry knowledge, and the second will assess pharmacovigilance-specific knowledge. Questions will be created by preceptors, fellows, and students to ensure a continuum of knowledge is addressed. The survey will be validated by establishing face validity through undergoing review by subject matter and question construction experts. It will then be administered to an APPE student. The results and feedback from that student will be analyzed and included in the final iteration of the survey. The survey will be given to the next six students at the beginning of their APPE and at the end. The results will be evaluated to assess student learning and growth over the course of the rotation as well as be used as a tool to provide feedback on student performance and optimizing rotational experiences.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-200

Poster Title: Descriptive analysis of changes in chronic disease pharmacotherapy of enrollees in the Patients, Pharmacists, Partnerships (P3) Program

Primary Author: Martin Calabrese, University of Maryland School of Pharmacy; **Email:** mcalabr3@gmail.com

Additional Author (s):
ThucQuyen Vu
Fadia Shaya
Catherine Cooke
Magaly Rodriguez de Bittner

Purpose: Medications, along with lifestyle management, are the cornerstone of managing chronic disease such as diabetes and reducing cardiovascular risk. In the Maryland P3 (Patients, Pharmacists Partnerships) Program, specially trained pharmacist coaches apply a model of care that includes Comprehensive Medication Therapy Management (CMTM) services to improve medication-related outcomes for employees, retirees, and dependents. Face-to-face encounters between the enrollee and the pharmacist occur monthly for the first three months, and then quarterly thereafter, with medication use documented electronically for each encounter. The objective of this study is to characterize changes in medication use for enrollees in the P3 program.

Methods: A computerized query of the documentation software will identify enrollees in the Maryland and Virginia areas and provide medication lists at each encounter. Patients from two employers with the largest number of participants will be included if they at least 18 years at entry into the program, have diabetes, or hypertension, and have a documented medication list at any time-point. A descriptive analysis of medication lists will be performed to identify changes in the medication list at 6-months, 12-months, and 18-months, compared to the initial encounter. The assessment of medication changes will focus on classes used to manage diabetes and cardiovascular risk reduction, including antihyperglycemics, antihypertensives, lipid-lowering therapies, anti-platelet/anticoagulants and agents used to manage neuropathic pain. Demographic information including sex, race, and age will be considered.

Results: N/A

Conclusion: N/A

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-201

Poster Title: Methodological appraisal of systematic reviews and meta-analysis on psoriasis.

Primary Author: Juan Ruano, Department of Dermatology.; **Email:** juanruanoruiz@mac.com

Additional Author (s):
Beatriz Isla
Pablo Montejano
Francisco Gómez
Antonio Vélez

Purpose: The exponential growth of publishing and the variable quality of evidence in scientific field such as in psoriasis may put knowledge and decision-making processes at risk. Systematic reviews (SRs) and Meta-analysis (MAs) have become the standard approach in assessing and summarizing applied health research. AMSTAR (A MeaSurement Tool to Assess the methodological quality of systematic Reviews) is a reliable and valid measurement tool to assess the risk of bias of these studies by analyzing their methodological quality.
Objetive: To assess the influence of article metadata and bibliometric indexes on methodological quality of systematic reviews and meta-analysis of studies on psoriasis.

Methods: A systematic search and quality assessment were performed using AMSTAR tool. Protocol was registred in PROSPERO under (CRD 42016041611 ID). MEDLINE, EMBASE, and the Cochrane Database was searched. Only review articles that applied systematic methods of identification, selection and analysis of psoriasis studies were included. Two authors assessed SRs and MAs quality using the same data abstraction forms and the 11-point AMSTAR criteria. Disagrements were resolved by a third investigator and reviews were classified based on AMSTAR score as of low quality (0-4), medium quality (5-8) or high quality (9-11). Metadata concerning the study (authors, institutions, number of pages, 'time from submission to accept', country, funding, conflict of interest, key words) and the journal (several bibliometric indexes from SRJ Scimago, and Thomson and Routers) were extracted. Multivariate ordinal logistic regression model was obtained. Statistical analysis and data visualization were performed using the R programming language.

Results: Articles that met eligibility criteria (n=220), published from 1999 to 2016, were classified as of high (17.2%), medium (55%), or low methodological quality (27.7%) following

the AMSTAR criteria. Lower compliance rates were found for 'Q5 ('list of studies provided', 11.3%), Q10 ('publication bias assessed'', 27.8%), Q4 ('status of publication included', 39.5%), and Q1 ('a priori design provided', 41%) AMSTAR items. Factors such as meta-analysis included (odds ratio, 6.21; 95% CI, 2.78 to 14.85), funding by academic institutions (odds ratio, 2.89; 95% CI, 1.11 to 7.89), article influence score (odds ratio, 2.13; 95% CI, 1.05 to 6.67), 5-year impact ffactor (odds ratio, 1.34; 95% CI, 1.02 to 1.14), article page count (odds ratio, 1.08; 95% CI, 1.02 to 1.15), and number of authors with conflict of interest (odds ratio, 0.91; 95% CI, 1.02 to 1.15) significantly predicted higher quality in the final model.

Conclusion: The nature of funding sources and the grade of independence author disclosures to perform systematic reviews may compromise their quality, increasing the risk of metodological bias. By enhancing the efforts to systematically report clearly any funding source or author disclosure in the articles, authors and editors may aid readers to assess the quality of these reviews and to interpret evidence obtained in these articles.

Submission Category: Pharmacy Law/ Regulatory/ Accreditation

Session-Board Number: 6-202

Poster Title: Assessing the need for a centralized pharmaceutical industry fellowship database and impact on student awareness of industry

Primary Author: Randall Johnson, Med Communications; **Email:** rljohnson918@gmail.com

Additional Author (s):

Purpose: Currently, pharmaceutical industry fellowships are not under the guidance of an accrediting body, such as how PGY-1 & 2 residencies are governed by the American Society of Health System Pharmacists (ASHP). The internet is a viable resource for students to discover more information about these programs. However, there is no official directory or database for industry fellowships. The aim of this study is to increase pharmacy student awareness of industry fellowships. It may also open discussion for the creation of a centralized directory or platform to streamline student's access to explore and apply to these programs.

Methods: This study has been submitted to the institutional review board for approval. An e-survey will be distributed to third and fourth-year students at University of Tennessee College of Pharmacy and Purdue University College of Pharmacy. The survey is designed to assess student awareness and opinions on industry fellowships and their existing or potential methods in finding out more information about post-graduate programs. All data will be collected via Survey Monkey, a secure online survey service. Other than classification and pharmacy school of attendance, responses will contain no identifying information. The student does not have to be interested in or actively pursuing fellowship or residency to complete the survey. The survey collection period (October – December) aims to capture a snapshot of student opinion during the active post-graduate program research and application process. Data evaluation will focus on degree of awareness and opinions on industry fellowships as well as identifying and quantifying what sources are used (or would potentially be used) in finding out about post-graduate opportunities. It will also examine student attitudes on accreditation of industry fellowships and their exposure to industry topics during their time in pharmacy school. The survey of students at schools of pharmacy in differing regions will allow for the stratification of results and will note similarities or disparities between knowledge and behaviors in two different regions of the United States.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-203

Poster Title: Assessing the Value of Biopharmaceutical Industry Fellowships

Primary Author: Nicholas Heath, MCPHS University; **Email:** nicholas.heath@takeda.com

Additional Author (s):
Anthony Abbruscato
Amee Mistry

Purpose: The number of Postdoctoral Biopharmaceutical Industry fellowships has grown rapidly over the past few decades. The MCPHS University program, started in 2003, has graduated over 90 alumni. The goal of this research is to assess the value of a fellowship program as it relates to post-fellowship job placement, personal development, and career trajectory.

Methods: This study was submitted to and approved by the Institutional Review Board at MCPHS University. A 28-question survey was distributed to 88 alumni of MCPHS University Biopharmaceutical Industry Fellowship using Qualtrics Insight Platform on August 23rd, 2016 and the response period ended on September 9th, 2016. There were a total of 49 responses, of which 48 consented and 1 declined. Those who provided partial responses may be excluded from analysis at the discretion of the investigators. The following information was collected: fellowship sponsor company, fellowship functional area, retention by sponsor company, first position post-fellowship, initial salary range, current position, current salary range, and expected years of experience needed per job description. Analysis of the data is ongoing and all data will be kept anonymous throughout the process. Preliminary data outputs will include: retention vs. job offers post-fellowship, career growth (i.e. change in salary, number of years experience required, change of position), and cross-functional career movement post-fellowship. The data are only representative of MCPHS Biopharmaceutical Industry Fellowship Program alumni and cannot be extrapolated to other programs.

Results: N/A

Conclusion: N/A

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-204

Poster Title: Factors considered in formulary management decisions in a variety of practice settings

Primary Author: Jamie Sundin, University of Missouri - Kansas City; **Email:** sundinj@umkc.edu

Additional Author (s):
Patrick Bryant
Morgan Sperry
Heather Pace

Purpose: As medication prices continue to rise, formulary committees play an increasing role in helping healthcare organizations to control their costs. However, while a great deal of research has been devoted to examining the impacts of formulary decisions, little has been done to evaluate what factors influence these formulary decisions. The primary objective of this study is to determine what factors are used when making formulary decisions and whether those factors differ depending upon the healthcare setting as well as the responder's profession.

Methods: This study will be submitted to the Institutional Review Board for approval. An electronic survey will be created and sent to both the voting and non-voting members of the formulary boards for a pharmacy benefit management organization, an academic teaching hospital, a community hospital, and a state prescription assistance program. The survey will have two sections, the first of which will be regarding the formulary committee itself and the second about the formulary decision process. Specifically, the first section will cover the number of voting and non-voting members of the committee, the background of the survey responder (i.e. nurse, pharmacist, physician, administrator, member of the public, other), the backgrounds of the other members of the committee, and what professions should be represented on the committee that currently aren't. The section regarding the formulary decision process will encompass what factors impact formulary decisions (i.e. cost, efficacy, safety, other agents already on formulary, recommendations from guidelines, requests from non-committee members, projected use by organization, other), how much the selected factors impact formulary decisions, what factors aren't currently considered during the process and should be, and the responder's level of satisfaction with the current formulary process. The responses from the survey will be compared between the practice settings as well as the different professions.

Results: N/A

Conclusion: N/A

Submission Category: Administrative Practice/ Financial Management / Human Resources

Session-Board Number: 6-205

Poster Title: Improving efficiency of the medication return system via process modification

Primary Author: Younkyoung Shin, Kangbuk Samsung Hospital; **Email:** yks.shin@samsung.com

Additional Author (s):
Jakyun Lee
Wuri Cho
Eunsook Kwon
Junhyung Lee

Purpose: Clinical pharmacies accept significant number of unused returned medications from ward. In year 2013, 180,000 medications were returned back to pharmacy stock and it escalated up to 267,000(733/day) medications in 2015. The dramatic increase of unused medicines at the ward caused overall increase in pharmacy work load.
Kangbuk Samsung Hospital(KBSMC) pharmacy does not have a system to detect canceled medication orders before distributing the medications to the ward. Oftentimes, pharmacists delivered the medication without knowing that the order has been canceled. Therefore, a system for minimization of unnecessary medication delivery was necessary to reduce delivery work burden and returning medications.

Methods: KBSMC pharmacy changed collecting data(medication) into the system before delivering for IV fluids, and added a screening process before delivering oral medication. For IV fluids KBSMC changed the system for collecting medication orders from per patient to per ward. For oral medications KBSMC added a screening process which detects canceled medication orders before sending out the medications from central pharmacy. Pharmacists implemented a system to identify canceled or unwanted orders list by Electronic Medical Record (EMR) and unnecessary medications were not delivered.
After the implementation of the new system, the reduced work burden from baseline was measured with the following parameters: percentage of unwanted items before delivery, amount of time spent in returning unwanted items back to the central pharmacy stock, and satisfaction among relevant departments after the implementation.
The satisfaction level was surveyed among pharmacists, delivery staff members, and nurses.

Results: After the implementation of the new system, the detected number of canceled or unwanted medications increased from 27.9% to 97% for IV fluids and 0.31% to 15.05% for oral medications. Pharmacist's work load decreased after the implementation from 8.0 hours to 3.9 hours. According to the satisfaction survey, employees of relevant departments were more satisfied after the intervention; pharmacists 78.6%, nurses 53.4%, and delivery staff 89.2%.

Conclusion: Improvement of medication delivery system for IV fluids and oral medication by using pharmacy EMR was effective. Total time spent on returned medication has decreased and employees more satisfied with the new system. In addition, mutual trust was built among co-workers employees (pharmacists, nurses, delivery staff and computing division staff members) based on improved communication and understanding after implementation of this process.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-206

Poster Title: Nonmedical use of prescription stimulants among community college students in Tennessee

Primary Author: Rajkumar Sevak, Gatton College of Pharmacy, Department of Pharmacy Practice, East Tennessee State University; **Email:** rajsevak@gmail.com

Additional Author (s):
Kelly Foster
Arsham Alamian
Robert Pack
Nicholas Hagemeier

Purpose: Nonmedical use of stimulant medications (NMUS) among college students is an important and growing problem. The annual prevalence of NMUS among four-year college students has nearly doubled since 2008 and exceeds NMUS in non-college peers. Community college students are an understudied population regarding NMUS. Given noted NMUS differences in 4-year students and non-college peers, one cannot assume community college students' cognitions, perceptions, and behaviors mirror either peer cohort. We conducted a web-based survey across 10 community colleges in Tennessee (TN) to assess correlates and consequences of NMUS.

Methods: We developed an initial version of the 60-item survey questionnaire using previously validated, theoretically based survey items and other items developed by the research team. The survey instrument was then reviewed and assessed for content validity by our research team, and thereafter pilot tested with East Tennessee State University undergraduate students for range measures, item order, and best practices for survey construction. The final 55-item survey instrument was designed using web-based survey software (i.e., Qualtrics).
Ten of 13 community colleges in TN granted approval for their students to participate in the study (N=53096). A modified Tailored Design Method approach was utilized to maximize response rate across four email contacts, and monetary incentives were offered to encourage participation in the study. Regulatory authorities (e.g., institutional review boards, institutional offices) from East Tennessee State University and participating community colleges approved the conduct of this study. Data were analyzed using SPSS (version 22). Descriptive statistics were calculated to evaluate prevalence, source, motives and consequences of NMUS. Student's

t-tests and chi-square tests were conducted to compare nonmedical stimulant users and non-users across a number of variables. Results were considered significant for $p < 0.05$.

Results: A total of 3113 students completed the survey (response-rate = 5.8%), of which 302 (9.7%) were past-year nonmedical stimulant users. A significantly greater proportion of users were diagnosed with a mental health condition (22.2%) than non-users (9.6%). Compared to non-users, significantly greater proportions of users reported using tobacco products, such as cigarettes (34.5% vs. 14%), e-cigarettes (12.5% vs. 4%), and vapors (18.4% vs. 6.7%). Users further reported using more types of illicit drugs (1.9 ± 0.1), more alcoholic drinks per week (2.9±0.3), and more occasions of binge drinking per month (1.8±0.2) than non-users (1.1±0.02, 1.3±0.07, 0.7±0.04, respectively).
Only 14.2% of users (n=43 from 302) reported having prescriptions for prescription stimulants. Common sources of prescription stimulants were friends (62.9%), family members (12.3%), and street suppliers (9.9%). Commonly endorsed reasons for NMUS were 'to improve academic performance' (63.9%), 'to have more energy' (49.7 %), 'to relieve tension' (22.2%), and 'to feel good or get high' (16.6 %). Adverse effects resulting from NMUS included: lack of appetite (45.4%), difficulty sleeping (38.4 %), and racing heart (31.1%). Unlike the published findings from 4-year college students, low GPA, male gender, Caucasian race and membership in fraternity organizations were not associated with NMUS in community colleges.

Conclusion: The present study provides useful information on characteristics of users and patterns and consequences of NMUS in community colleges students. NMUS appears to be associated with illicit substance use, binge drinking and disrupted mental health in community college students in TN. Friends are the most common source and desire to enhance academic performance is the most salient motive for NMUS. Despite facing adverse consequences, college students continued using stimulants nonmedically. These findings underscore the need for development of public health programs that target prevention of NMUS in community colleges.

Submission Category: Ambulatory Care

Session-Board Number: 6-207

Poster Title: Root-cause analysis to develop preventing avoidable admissions among assisted living elders (PA4LE) intervention

Primary Author: Sawsan Kurdi, The University of Arizona; **Email:** sawsan.m.kurdi@gmail.com

Additional Author (s):
Samah Alshehri
Jeannie Lee

Purpose: Saint Luke Home (SLH) is the only nondenominational, nonprofit academic assisted living center (ALC) for low-income seniors and in need of supervisory level assistance in Tucson, Arizona. Many of the elders' incidents, which include: emergency medical service (EMS) calls, emergency department (ED) visits and hospital admissions, are medication related. The purpose of the Preventing Avoidable Admissions Among Assisted Living Elders (PA4LE) program is to prevent such incidents from avoidable causes and decrease the use of high-risk medications among elders at the SLH. As a quality improvement process in developing the PA4LE program, a root-cause analysis was conducted.

Methods: The root-cause analysis was conducted from March 2015 to March 2016 by reviewing elders' incidence report, SLH chart and talking with the staff. The number and causes of incidences for each elder were collected by two pharmacist undergoing fellowship training. The institutional review board approved the prospective, interventional study in which PA4LE program will be delivered to SLH elders who are high-risk, as defined by having previous incidence report, EMS calls, ED visits, and/or hospitalization for avoidable causes. The intervention, PA4LE program developed through the root-cause analysis, will be implemented by pharmacists, a behavioral health nurse practitioner and SLH staff. The pharmacist intervention will consist of bi-weekly home or clinic visits (elder preference), educational sessions, and staff training. The outcomes, including number of EMS calls, ED visits and hospitalization, along with number of Beers Criteria medications, will be measured at baseline, at each follow up visit, and study end date (12 months after the start date).

Results: N/A

Conclusion: N/a

Submission Category: Oncology

Session-Board Number: 6-208

Poster Title: Influence of cytarabine metabolic pathway polymorphisms in effectiveness and toxicity of acute myeloid leukemia induction treatment

Primary Author: Juan Eduardo Megías Vericat, Hospital Universitario y Politécnico La Fe, Servicio de Farmacia- Área del Medicamento. Unidad de Farmacogenética- Instituto Investigación Sanitaria La Fe, Valencia, Spain; **Email:** megias_jua@gva.es

Additional Author (s):
Pau Montesinos
Virginia Bosó
Salvador F Aliño
José Luis Poveda

Purpose: Cytarabine is considered the most effective chemotherapeutic agent in acute myeloid leukemia (AML) treatment. Several studies suggest that single nucleotide polymorphisms (SNPs) in genes involving metabolic pathway of cytarabine could influence in treatment outcomes, although their clinical relevance remains undetermined.

Methods: The SNPs of cytarabine pathway (DCK:rs2306744, rs11544786, rs4694362; CDA:rs2072671, rs3215400, rs532545, rs602950; NT5C2:rs11598702; RRM1:rs9937; NME1:rs2302254) were evaluated in 225 adult patients at initial diagnosis from AML using a mass spectrometry–based multiplex genotyping assay (Sequenom®). All patients received induction chemotherapy consisting of idarubicin plus cytarabine (PETHEMA 99, 2007 and 2010 trials).
Efficacy of first induction cycle was evaluated comparing complete remission (CR) vs. partial remission (PR) or resistance (patients dying during induction excluded); and overall survival (OS), event-free survival (EFS), disease-free survival (DFS) and relapse-free survival (RFS) at 5 years. Induction death was defined as patients dying during induction against CR, excluding these patients with PR or resistance. Based on WHO grading scale, toxicities were grouped as binary variables (grades 0-1 vs. 2-4; or 0 vs. 1-4), assigning the maximum grade of all the specific toxicities within that group (evaluated in all patients). Genotypes were studied with co-dominant model. Association between variables was assessed using logistic regression adjusting for age, gender, cytogenetic risk, ECOG, leukocyte and platelet count, hemoglobin, creatinine,

bilirubin, albumin and LDH level at diagnosis (R® version 3.1.2). Kaplan-Meier method and Cox proportional were employed to survival estimates estimates with the same covariates.

Results: The median age of patients was 51.1 years (16-78 years). The variant allele of DCK SNP rs2306744, enzyme that catalyzes the limiting first phosphorylation in activation of cytarabine, showed higher CR (OR:6.2; 95%CI:1.3-30.2; P=0.024), and higher mucositis (OR:2.8; 95%CI 1.02-7.8; P=0.046).
CDA is the main inactivating enzyme of cytarabine. The variant allele of rs602950 was related to higher CR (OR:3.0; 95%CI:1.02-8.8; P=0.045), OS (HR:1.7; 95%CI:1.03-2.6; P=0.039) and EFS at 5 years (HR:0.4; 95%CI:0.2-0.7; P=0.014). However, heterozygous genotype of CDA rs2072671 was associated to lower OS (HR:2.2; 95%CI:1.2-4.1; P=0.015), EFS (HR:1.9; 95%CI:1.01-3.4; P=0.045), DFS (HR:3.8; 95%CI:1.2-12.4; P=0.027) and RFS at 5 years (HR:9.1; 95%CI:1.2-68.6; P=0.032), and heterozygous genotype of CDA rs3215400 to lower DFS (HR:2.9; 95%CI:1.4-6.3; P=0.006) and RFS at 5 years (HR:3.3; 95%CI:1.1-9.9; P=0.033). In addition, variant alleles of CDA rs532545 and rs602950 were related to skin toxicity (OR:2.0; 95%IC 1.1-3.9; P=0.031; OR:2.8; 95%IC 1.01-7.8; P=0.049, respectively).
Variant allele of RRM1 (rs9937), enzyme associated with cytarabine sensitivity, was associated to lower OS (HR:2.0; 95%CI:1.1-3.5; P=0.021) and RFS at 5 years (HR:3.8; 95%CI:1.02-14.3; P=0.047), and higher induction death (OR:0.2; 95%IC 0.03-0.9, P= 0.034). Variant allele of NT5C2 (rs11598702), responsible of nucleotide pools balance, showed higher hepatotoxicity (OR: 4.1; 95%IC 1.1-14.5; P=0.032).

Conclusion: This study reveals the influence in Ara C efficacy of DCK, CDA and RRM1 polymorphisms in AML adult patients, previously suggested in other studies. In addition, novel associations between SNPs in metabolic Ara C genes and toxicities were detected. Further studies with larger population are needed to validate these associations.
The study was approved by the local Clinical Research Ethics Committee of Hospital Universitari i Politècnic La Fe and on behalf of the PETHEMA cooperative group and Instituto Investigación Sanitaria La Fe. This study was supported in part by research funding from the “Instituto Carlos III” grant “PIE13/00046”, “Instituto Investigación Sanitaria La Fe” (2013/0331), and and the Cooperative Research Thematic Network (RTICC), Grant RD12/0036/014 (ISCIII & ERDF).
Samples have been managed by the Biobanco La Fe, licensed as required by the Royal Decree 1716/2011 of 18 November (Ref .: PT13 / 0010/0026).

Submission Category: Oncology

Session-Board Number: 6-209

Poster Title: First-line chemotherapy, triplets versus doublets, in HER2 negative advanced gastric cancer: analysis of 970 patients from a national registry.

Primary Author: Felipe Alvarez manceñido, Hospital Universitario Central de Asturias, Oviedo. Spain; **Email:** felipealvarezm@yahoo.es

Additional Author (s):
Alberto Rodriguez Palomo
Isabel Zapico Garcia
Ismael Macias
Paula Jimenez-Fonseca

Purpose: There is currently no consensus as to first-line chemotherapy for patients with advanced gastric cancer (AGC) ineligible to receive trastuzumab. The classical regimens, with 5-fluorouracil, cisplatin, with or without epirubicin show modest benefits in survival in comparison to single agents. Schemes that incorporate new fluoropyrimidines(capecitabine or S-1), new platinum(oxaliplatin), docetaxel, and irinotecan have been developed combining two (doublet) or three (triplet) drugs. Thus, up to 10 polychemotherapy schemes can be considered appropriate in clinical practice.
The objective of this study is to evaluate and compare the effectiveness and toxicity of triplets versus doublets chemotherapy as first-line chemotherapy.

Methods: The patients come from a national registry of AGC belonging to 28 centers and were treated between 2008 and 2016. The registry comprises adult patients (≥18 years) with pathologically confirmed, unresectable or metastatic gastric, gastroesophageal junction (GEJ) or distal esophageal adenocarcinoma, who received at least one cycle of polychemotherapy as first-line treatment. AGC that showed no HER2 overexpression were selected for this study. Regimens compared were chemotherapy doublets consisting on platinum (oxaliplatin or cisplatin) and a fluoropyrimidine (capecitabine or 5-fluorouracil) versus triplets by adding anthracyclines (epirubicin) or taxanes (docetaxel) to the former ones.
Covariates potentially involved in choosing doublets or triplets, were selected: age, Eastern Cooperative Group Performance Status performance status (ECOG-PS), number of comorbidities before starting chemotherapy, the presence of chronic heart disease; tumor

stage (locally advanced unresectable or metastatic), site of the primary tumor, number of metastases, metastatic sites, baseline carcinoembryonic antigen (CEA) value, surgery of the primary tumor, the presence of acute serious complications at the diagnosis, Lauren classification, presence of signet ring cells and histological grade.
Cox proportional hazards regression, propensity Score Matching (PSM) and coarsened Score Matching (CEM) were used for comparing the effects of the alternative regimens.
This study met Good Clinical Practice guidelines and Declaration of Helsinki and was approved by the Ethics Review Board at each of the participating institutions. All patients provided written informed consent.

Results: Of the 970 patients enrolled, 41.3% (n =401) received triplets and 58.7% (n =565) received doublets. Binary logistic regression showed that variables associated with the use of triplets were: not have chronic heart disease, good PS (ECOG 0-1), young age, locally advanced unresectable versus metastatic stage, extrahepatic versus liver alone metastases, Lauren diffuse tumors with signet ring cells and elevated basal CEA (≥10 ng/dL).
In the Cox model, the use of triplets was associated with better overall survival, Hazard Ratio (HR) 0.84 (95% confidence interval (CI), 0.72 to 0.98), p =0.035 when adjusted for confounders. After application of the PSM, the sample contained 340 couples (n =680). A significant increase in survival was observed: 11.14 (95% CI, 9.60 to 12.68) versus 9.60 months (95% CI, 8.44 to 10.75), for triplets, HR 0.77 (95% CI, 0.66 to 0.92), (log-rank test adjusted for groups PSM, p =0.004). The trend is similar after CEM: 10.75 months (95% CI, 9.31-12.18) versus 8.87 (95% CI, 7.85-9.90), respectively, HR 0.77 (95% CI, 0.65 to 0.92). Triplet therapy is feasible and drug dose densities in triplet regimens exceed 85%. Triplets were related to more severe overall toxicity, especially hematological, hepatic, and mucosal adverse events.

Conclusion: Although considering the inherent methodological limitations of a retrospective study that examines a heterogeneous set of chemotherapy regimens, we have found that triplets are feasible in daily practice and are associated with a discreet benefit in efficacy at the expense of a moderate increase in toxicity.

Submission Category: Oncology

Session-Board Number: 6-210

Poster Title: Genetic variants in ERCC1 and ERCC2 are associated with increased risk of neurotoxicity and neutropenia in taxane-treated breast cancer patients

Primary Author: Virginia Boso, Hospital Universitari i Politecnic la Fe; **Email:** virbori@gmail.com

Additional Author (s):
Ana Santaballa
Juan Eduardo Megias
Salvador Alino
jose Luis Poveda

Purpose: Neurotoxicity and myelosuppression are the main toxicities of taxanes. They affect patients' quality of life and limit the treatment. Besides the action on □-tubulin, oxidative stress has been proposed as a mechanism involved in chemotherapy-induced toxicity. The aim of this study is to assess the association between single nucleotide polymorphisms (SNPs) in genes coding for proteins involved in the generation of reactive oxygen species (ROS), DNA repair mechanisms and antioxidant response with neurotoxicity and myelosuppression in breast cancer (BC) patients treated with taxanes.

Methods: Adult women with histologically confirmed BC treated with taxanes were included. Patients with severe liver disease or renal failure prior to treatment, state of gestation or performance status (PS) score of two or higher were excluded.
Toxicities were evaluated in each cycle and classified according to the National Cancer Institute (NCI) Common Toxicity Criteria (CTCAE) version 4.0 by the treating physician in the visits previous to each chemotherapy cycle.
SNPs in ERCC1 (rs11615, rs3212986), ERCC2 (rs13181, rs1799793), GSTM3 (rs1799735), NOS3 (rs1799983, rs2070744), RRM1 (rs1042858, rs9937) and SOD2 (rs4880) were analysed. DNA samples were genotyped by a researcher blind to the clinical data with Sequenom Mass ARRAY matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry (MS) system (Sequenom MassARRAY,Inc, San Diego, CA).
Toxicities were grouped as a binary variable (grade 0-1 vs grade 2-4). Association between variables was assesed by logistic regression (adjusting for age, performance status, chemotherapy squeme and metastatic disease), and also by Elastic Net regression, including the same covariates (IBM® SPSS® Statistics v.19; R® v. 3.1.2 (glmnetv. 2-2.1). The local Clinical

Research Ethics Committee approved the study and all patients provided written informed consent prior to the inclusion.

Results: 101 docetaxel-treated patients [mean age 51.0 years (95%CI=48.9-53.1)] and 58 paclitaxel-treated patients [mean age 58.3 years (95%CI=54.8-61.1)] were included.
ERCC2 rs13181 was associated with neurotoxicity in docetaxel-treated patients [2.2% TT/GT vs 22.2% GG; OR=12.7 (95%CI=1.6-104.4; p=0.028)], where GG genotype is associated with reduced DNA repair capacity.
ERCC1 rs3212986 was associated with neurotoxicity in paclitaxel-treated patients (14.7% GG vs 41.7% GT/TT; OR=4.2 (95%CI=1.2-14.7; p=0.022), where T allele is associated with reduced DNA repair capacity. And also SOD2 rs4880 (33.3% TT/TC vs 0.0% CC; p=0.002), variant with lower enzyme activity.
Elastic Net regression including both treatment groups (n=159) selected ERCC1 rs3212986 GT, NOS3 rs1799983 GT, SOD2 rs4880 TT and paclitaxel scheme as risk factors of neurotoxicity and ERCC2 rs13181 TT as protective factor.
Three SNPs were associated with neutropenia in docetaxel-treated patients: ERCC2 rs13181 [15.2% TT vs 3.7% TG/GG; OR=0.19 (95%CI=0.04–1.01), p=0.031]; NOS3 rs2070744 [16.2% TT vs. 3.2% CT/CC); OR=0.20 (95%CI=0.04–1.03), p=0.038]; GSTM3 rs1799735 [7.1% AGG.AGG/AGG.DEL vs. 66.7% DEL/DEL; OR=20.1 (95%CI=1.6–257.9)]. All patients received prophylaxis with filgrastim.
No associations were found with neutropenia in paclitaxel group.
Elastic Net regression selected GSTM3 rs1799735 DEL/DEL as risk factor of neutropenia in docetaxel-treated patients and NOS3 rs2070744 TT as protective factor.

Conclusion: Neurotoxicity in docetaxel-treated patients was associated with ERCC2 rs13181 G allele (previously associated with reduced DNA repair capacity) and in paclitaxel-treated patients with ERCC1 rs3212986 T allele (reduced DNA repair capacity) and SOD2 rs4880 T allele (lower superoxide dismutase activity).
Neutropenia in docetaxel-treated patients was associated with NOS3 rs2070744 TT (higher expression of eNOS) and GSTM3 rs1799735 DEL (decreased GST expression).
In conclusion, genetic variants associated with reduced DNA repair capacity and detoxification are associated with an increased risk of neurotoxicity and neutropenia in BC patients treated with taxanes. Further studies are needed to validate these associations.

Submission Category: Quality Assurance/ Medication Safety

Session-Board Number: 6-211

Poster Title: The evaluation of safety and efficacy of a hybrid 4-factor prothrombin complex concentrate (4FPCC) dosing protocol

Primary Author: Victoria Do, Saint Vincent Hospital/MCPHS University; **Email:** victoria.do@stvincenthospital.com

Additional Author (s):
Jennifer Lee
Joseph Sawicki
Uyen Nguyen

Purpose: Activated 4-factor prothrombin complex concentrate (4FPCC), is indicated for the urgent reversal of acquired coagulation factor deficiency induced by vitamin K antagonist therapy in adult patients with acute major bleeding or the need for an urgent surgery/invasive procedure. While there are studies which review the benefits to fixed dosing versus variable dosing, the ideal dosing method of 4FPCC is unknown. Our institution implemented a hybrid 4FPCC dosing protocol in June 2016, utilizing the benefits of both fixed and variable dosing. The purpose of this study was to evaluate the safety and efficacy of a hybrid dosing method of 4FPCC.

Methods: The hybrid 4FPCC dosing protocol allows the pharmacist to select the number of vials needed for the dose based on the patient's weight category. The FDA approved dosing guidelines recommend dosing to be determined based on weight with an available INR. However, at our institution INR is not always readily available when the 4FPCC dose is needed. Therefore, two options were made possible for prescribers to choose from depending on the availability of the INR. Dosing option 1 is based on the FDA approved dosing guidelines and used when INR is available. Dosing option 2 is used when INR is not available and an empiric dose of 4FPCC is given.
A retrospective review of patients who received 4FPCC between July 2016 to October 2016 was performed to evaluate the safety and efficacy of a hybrid 4FPCC dosing protocol. The primary efficacy endpoints were the rates of successful reversal of INR to a target of less than 1.5 and the ability to achieve clinical stability. The secondary efficacy endpoint includes the percentage above or below the calculated dose of Factor IX. The primary safety endpoints were the

incidence of thrombotic events or continuous bleeding up to 7 days after the administration of 4FPCC. Baseline demographic and clinical data were collected and analyzed.

Results: N/A

Conclusion: N/A

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-212

Poster Title: Effectiveness and safety of omalizumab in the treatment of chronic urticaria

Primary Author: Cristina Ortega Navarro, General University Hospital Gregorio Marañon; **Email:** cristina.ortega@salud.madrid.org

Additional Author (s):
Arantza Ais Larisgoitia
Carmen Rodriguez Gonzalez
Ana Herranz Alonso
Maria Sanjurjo Saez

Purpose: Chronic urticaria can be considered a serious disease when symptoms (development of wheals and associated intense pruritus) persist for longer than six months. The latest guidelines recommend H1-antihistamines at conventional dose as first line treatment. In absense of response, increasing dose up to fourfold is indicated. However, many patients do not respond to antihistamines adequately and chronic urticaria can affect their quality of life significantly. The aim of the study was to evaluate the effectiveness and safety of omalizumab in the treatment of steroid-dependent antihistamine-refractory chronic urticaria.

Methods: A retrospective observational study was performed including patients treated with omalizumab for refractory chronic urticaria from June 2013 to December 2015. Complete response was considered when patients remained asymptomatic with omalizumab only, partial response when disease symptoms remited with omalizumab and H1-antihistamines at licensed doses and no response if symptoms persisted despite treatment with omalizumab. Demographic (age, gender) and clinical data (diagnosis, therapies used before and during treatment with omalizumab, omalizumab dosage and frecuency, duration of treatment and adverse effects) were collected from the patients´ clinical records and the dispensing records of the specialty pharmacy. The study was presented to the ethics comittee.

Results: Nine patients, with an average age of 41 (SD=15) years, were treated with omalizumab for refractory chronic urticaria. Out of those nine patients, seven (77,8%) were female and two (22,2%) male. Eight (88,9%) patients were diagnosed with chronic spontaneous urticaria and one (11,9%) with cholinergic urticaria. Median duration of treatment was 22 (3-27) months. Prior to omalizumab, all patients recieved H1-antihistamines up to fourfold licensed doses and

ranitidine, eight (88,9%) also included montelukast and three (33,3%) other drugs like cyclosporine or dapsone. Furthermore, six (66,7%) patients recieved a course of oral corticosteroids to treat an acute exacerbation. Six (66,7%) patients showed complete response to omalizumab, two (22,2%) presented partial response and one (11,1%) showed no response. Looking further at the eight (88,9%) responders, three (33,3%) responded to omalizumab within the first week and five (55,6%) within three months. One year after starting omalizumab treatment, seven (77%) patients were receiving an extended omalizumab dosage interval with symptoms remission. Three (33,3%) patients reported mild adverse events: two (22,2%) skin disorders (erythema and hives) and one (11,1%) asthenia.

Conclusion: Omalizumab is an effective and safe drug for the treatment of refractory chronic urticaria. However, it is necessary to define an individualized omalizumab extended dose regimen according to clinical response and an interruption of the treatment should be considered if full remission of symptoms.

Submission Category: Infectious Diseases

Session-Board Number: 6-214

Poster Title: Impact of antifungal therapy de-escalation on clinical outcomes among elderly patients with candidemia

Primary Author: Kierra Dotson, University of Houston College of Pharmacy; **Email:** kierradotson10@gmail.com

Additional Author (s):
Amelia Sofjan
Dhara Shah
Nicholas Beyda
Kevin Garey

Purpose: The mortality rate in hospitalized patients with candidemia exceed 40%, with rates especially high in elderly patients with multiple comorbidities. Current guidelines recommend antifungal de-escalation after initial intravenous therapy when clinically appropriate; however whether timing of de-escalation affect clinical outcomes is poorly studied. The purpose of this study was to assess if de-escalation of antifungal therapy impacts clinical outcomes in elderly patients with candidemia.

Methods: This institutional review board approved study was conducted as a retrospective chart review of adult patients admitted from January 2015 – December 2015 at a large university-affiliated tertiary care hospital. Adult patients (>18 years) with candidemia who received an echinocandin were identified. Patients were stratified as elderly (>65 years) and compared to the non-elderly population (< 65 years). Data collected included demographics, past medical history, disease severity, mycological data, and duration of treatment course. Discharge and 30-day mortality was assessed for all patients. The primary outcome assessed if there is a difference in age-related mortality based on time to de-escalation of echinocandin therapy.

Results: To date, we have identified 60 patients aged 59 ± 16 (range: 20-79) years. The most common co-morbidity related to candidemia included immunosuppression (steroid use: 39%, immunosuppressant use: 17%, and chemotherapy use: 8.5%). The most frequent underlying diseases included gastrointestinal illness (39%), cancer (35.6%), and diabetes mellitus (27.1%). The most common Candida species identified included C. albicans (45%), C. glabrata (33.3%),

and C. parapsilosis (15%). All patients were treated with micafungin, in addition to fluconazole (52.5%), amphotericin B (24.1%), or voriconazole (11.9%) during the treatment course. Data for the primary outcome is still pending collection and evaluation.

Conclusion: Results of this study will add significantly to our knowledge on the appropriateness of de-escalation therapy in adult patients with candidemia.

Submission Category: Infectious Diseases

Session-Board Number: 6-215

Poster Title: Shutting the therapeutic window: correlation of vancomycin area under the curve and nephrotoxicity

Primary Author: Eric Wenzler, University of Illinois at Chicago; **Email:** wenzler@uic.edu

Additional Author (s):
Diana Nowicki

Purpose: Vancomycin trough concentrations have long been utilized for therapeutic drug monitoring despite their lack of proven association with clinical efficacy. Recently, trough concentrations, especially those >20 mg/L, have been correlated with an increased risk of nephrotoxicity. As the paradigm of vancomycin therapeutic drug monitoring shifts towards monitoring of area under the curve (AUC) values given their repeated associations with efficacy, there is a need to establish an AUC value associated with an increased risk of toxicity in order to establish a therapeutic window using these values as opposed to trough concentrations.

Methods: This was a retrospective, single-center cohort study of all hospitalized adult (>/= 18 years old) inpatients receiving vancomycin for a suspected or proven Gram positive infection from 2015-2016. Patients who had received at least 48 hours of therapy, had a baseline serum creatinine (SCr) drawn within 24 hours of admission, and had at least 1 vancomycin concentration collected within 96 hours of therapy were included. Patients were excluded if they had a baseline SCr > 2 mg/dL or were receiving renal replacement therapy (RRT) at vancomycin initiation. Steady-state 24 hour area under the curve (AUC) was calculated using both a MAP-Bayesian approach and the Rodvold method. Data obtained included patient demographics, concomitant medications including concomitant nephrotoxins, hospital location, immunosuppression, comorbidities, vancomycin dosing regimen, vancomycin concentrations, indication for vancomycin, duration of vancomycin therapy, ICU stay, mechanical ventilation, microbiology data, source of infection. The primary outcome was nephrotoxicity experienced during therapy or within 72 hours of completion of therapy defined according to the RIFLE criteria. Continuous variables were compared using the Student t test or Mann-Whitney U test as appropriate. Categorical variables were evaluated with the $\chi 2$ or Fisher's exact test. A two-tailed significance of < 0.05 will be considered statistically significant. Independent predictors of nephrotoxicity were identified via logistic regression and CART analysis was used to identify AUC breakpoints associated with an increased risk of nephrotoxicity.

Results: In progress

Conclusion: Pending results

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-216

Poster Title: Streamlining medication use evaluation of tigecycline with clinical decision support surveillance

Primary Author: Sue Ie, Wolters Kluwer Health; **Email:** sue.ie@wolterskluwer.com

Additional Author (s):
Kathryn DeSear
Justin Clark
Trent Beach

Purpose: To assess appropriate use of tigecycline by leveraging Sentri7 advanced clinical decision support surveillance (CDSS) alerts and reporting to provide consistent and efficient medication use evaluation (MUE) among different electronic health record systems (EHRs) utilized by facilities in a multi-hospital system.

Methods: In this large multi-hospital system, CDSS is utilized to notify clinicians with real-time alerts triggered by a new tigecycline order placed electronically by a prescriber. A system-wide antimicrobial stewardship task force established criteria for use (CFU) in July 2016 and implemented a mandatory MUE to compare appropriate use of tigecycline prior to and following establishment of the CFU. In order to bridge various EHRs used at the different facilities within the hospital system, the hospitals leveraged Sentri7 to extract all requested information directly from data fields within Sentri7 in a consistent and efficient manner. An advanced tigecycline MUE alert incorporated an explanation and hyperlink to the MUE form as a “suggested action.” Clinicians generated a report detailing all patients for whom the alert was triggered in the last 30 days to facilitate completion of the mandatory MUE within the pre-specified deadline of 30-days post-discharge. To analyze the impact of the CFU intervention in decreasing inappropriate use of tigecycline, we will review a report of all tigecycline MUE alerts triggered for all facilities and validate the responses by verifying the data in Sentri7.

Results: Not applicable

Conclusion: Not applicable

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-217

Poster Title: Drug utilization study: proton pump inhibitors (PPIs) used in prophylaxis of nonsteroidal anti-inflammatory (NSAID)-induced gastroduodenal ulcers in a tertiary hospital

Primary Author: Pilar Martinez Ortega, Hospital General Universitario Gregorio Maranon; **Email:** pmortega@salud.madrid.org

Additional Author (s):
Esther Duran Garcia
Raquel Garcia Sanchez
Carmen Rodriguez
Estela Garcia Martin

Purpose: The primary objective of this study was to evaluate the adequacy of prescriptions of proton pump inhibitors (PPIs) in prophylaxis of NSAID-induced gastroduodenal ulcers in adult patients in a tertiary hospital. The secondary objective was to propose different strategies of desprescription for PPIs.

Methods: An observational cross-sectional prescription-indication study was conducted for ten days in 26 medical and surgical wards at our hospital. Patients admitted in those wards were randomly included in our study, and those admitted in critical care units were excluded, because the aim of the prescription was to prevent stress ulcer or to treat upper digestive haemorragia.
Criteria for classificate prescriptions as correct or not were “Selection criteria for proton pump inhibitors” published by Madrilenian Health System in 2011.
Demographic, prescription-related, and patient relevant information were collected from prescription software progam (Prescriplant®) and digital clinical history.

Results: 252 patients were included (52,78% women). Median age was 68 years (interquartile range 55 -81,5). PPIs were prescribed in 201 patients (79,8%).
Prescription of PPIs was not adequate in 130 patients: in 4 patients, therapy with PPIs was omitted, and in 126 (62,7% from all patients with PPI prescription), prescription was not justified.120 patients (95,2%) were not being treated with and non-steroidal anti-inflammatory

at the same time, and 6 patients (4,8%) have not factor risks which recommend the use of a PPI.
Percentages of inadequate prescription were very different between wards:
75% in Cardiology, 44,4% in Gastroenterology, 63,0% in Geriatry, 79,4% in Internal Medicine, 87,5% in Neurology, 53,9% in Oncology, 77,8% in Pneumology 100% in Psychiatry, 48,5% in Vascular and General Surgery and 45% in Traumatology.
We propose some ideas to desprescribe PPIs in our hospital: the spread of these results in the involved wards, the use of software assistants which include adequate conditions for the use of IBPs, and the incorporation of new clinical rules in Higea® (validation helping progam developed in our Pharmacy Service).

Conclusion: We have discovered a high percentage of inadequate PPI prescriptions in our hospital. Most cases, it may be caused by general use as gastroprotection in polymedicated patients. Strategies must be developed to detect inappropriate PPI use, in order to avoid iatrogenesis and overcost.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-218

Poster Title: Evaluation of the quality of published non-inferiority studies in the past decade

Primary Author: Michael Hogan, Rutgers University / Janssen Scientific Affairs; **Email:** michaeldanielhogan@gmail.com

Additional Author (s):
Luigi Brunetti
Evelyn Hermes-DeSantis

Purpose: Placebo-controlled trials may not be the most ethical study design for the evaluation of each disease state or medication in today's medical environment. The need for new drugs to be approved in rare diseases and conditions where placebo may harm the patient expanded the utilization of non-inferiority studies. The objective of this study is to review the reporting quality of non-inferiority trials in CONSORT endorsed medical journals over the past ten years in three snapshots. The assessment of reporting quality will be conducted using the 2012 extension of CONSORT statement.

Methods: Non-inferiority studies from five medical journals (New England Journal of Medicine, JAMA, The Lancet, The BMJ, Clinical Oncology) will be identified using the keywords non-inferiority or noninferiority and the specific journal in MEDLINE/OVID for the years 2005, 2010, and 2015.The primary outcome will evaluate non-inferiority studies by using the extended criteria stated by the CONSORT checklist evaluation. Past studies have shown arbitrary usage of the non-inferiority margin; therefore, secondary outcomes will include the reporting of margin by definition, percentage, and disease state. In addition, to best evaluate the statistical data of non-inferiority studies, the Food and Drug Administration (FDA) guidelines suggest conducting both per protocol (PP) and intention-to-treat (ITT) analyses. Although this is not mentioned in the CONSORT extension, this will be an additional secondary endpoint.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-219

Poster Title: Outcomes of telehealth antidepressant monitoring by pharmacists in a primary care setting

Primary Author: Shubha Bhat, University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences; **Email:** shubha.bhat@ucdenver.edu

Additional Author (s):
Zeta Chow
Lauren Heath
Danielle Loeb
Katy Trinkley

Purpose: Guidelines for depression emphasize the importance of optimizing patients' antidepressant therapies, given its impact on patients' daily functioning, quality of life, and suicide risk. In addition to screening for suicidal ideation, pharmacists are equipped to assist with medication monitoring by assessing patients' adherence, response to therapy, and expectations/knowledge of therapy. As such, pharmacists could help mitigate medical liability related to suicide risk after starting or augmenting antidepressants and use their medication expertise to optimize patients' response to therapy. The objective of this study is to characterize outcomes of a pharmacist-run antidepressant telehealth service, including patient adherence, safety, and pharmacist interventions.

Methods: Patients 18 years or older with depression who were instructed by their primary care team to initiate or increase an antidepressant are identified by automated reports from the electronic health record and contacted by the pharmacist via telephone within 1-2 week(s). With every phone call, patients are asked if they made the antidepressant change as instructed by their provider, and if applicable, if they accessed specialty care. The pharmacist assesses reasons for not following their provider's instructions and screens for adverse effects and suicidal ideation. With this information, the pharmacist works with the patients' providers to identify interventions that would optimize the patient's care and therapy. Outcome measures collected include patient characteristics (e.g., age, race, Patient Health Questionnaire [PHQ-9] score), patient adherence (followed instructions), safety (adverse effects, suicidal thoughts), and pharmacist interventions (e.g., recommendations for management of adverse effects or adherence barriers, counseling of suicidal ideation resources). Descriptive statistics will be used

for continuous and categorical variables. This study has received Institutional Board Approval and data collection is ongoing.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-220

Poster Title: Learnings from Implementing a PharmD Post-Doctoral Industry Fellowship Program at a Pre-Commercial Biotechnology Company

Primary Author: Alex Wei, Alnylam Pharmaceuticals; **Email:** awei@alnylam.com

Additional Author (s):
Dayna LeSueur
Anastasia McManus
Amy Monpara
Angela Partisano

Purpose: PharmD Post-Doctoral Industry Fellowships offer pharmacists interested in pursuing careers in the pharmaceutical and biotechnology industries in-depth and on the job training within a company. These Fellowships have traditionally been with large, globally established companies that can be categorized as commercial-stage companies with multiple drugs on the market. The purpose of this report is to better understand the current landscape of companies with Fellowships and describe the lessons learned from implementing a Fellowship at Alnylam Pharmaceuticals, a pre-commercial biotechnology company.

Methods: To better understand the landscape, data on companies with Fellowships was collected using the Industry Pharmacists Organization (IPhO) Fellowship Program Database, as of August 2016, and classified as “pre-commercial”, “commercial”, or “other”. Input from key stakeholders, who include Alnylam Fellowship preceptors and leadership, involved in the implementation and development of the Fellowship and Fellows in the Alnylam Pharmaceuticals and Northeastern University PharmD Post-Doctoral Fellowship Program (Alnylam/Northeastern Fellowship Program) was collected using semi-structured interviews and a qualitative survey. All responses were qualitatively assessed and summarized.

Results: According to the IPhO database, Alnylam was the only pre-commercial company with a Fellowship. Five stakeholders and three Fellows of the Alnylam/Northeastern Fellowship participated. A perceived benefit from the implementation of a Fellowship, as identified by the key stakeholders and Fellows, was the opportunity for Fellows to be a part of a company transitioning from the early stages of development into a commercial stage company. This included the chance to work on a potential first-in-class drug utilizing new and innovative

technology, the opportunity to potentially be a contributor to the first and subsequent product launches for the company, and the chance to put in place new processes as the company expands. A challenge, identified by the stakeholders, was being able to ensure a sustainable pipeline with positive proof-of-concept studies of a pre-commercial or biotechnology company. The stakeholders also identified challenges and considerations for future pre-commercial companies to consider before implementing a Fellowship program as having at least one employee with prior Fellowship experience, either as a preceptor or former Fellow, and a pipeline with multiple investigational agents touching several therapeutic areas or disease states.

Conclusion: Currently, Fellowships at pre-commercial companies are rare and therefore, implementing a Fellowship at a pre-commercial biotechnology company brings a set of benefits and challenges. The case study of the Alnylam/Northeastern Fellowship Program can provide insight for other companies in a similar stage of development considering establishing a Fellowship.

Submission Category: Infectious Diseases

Session-Board Number: 6-221

Poster Title: Switching to dual antiretroviral therapy in a treatment experienced HIV cohort

Primary Author: Cristina Ruiz Martinez, Hospital General Universitario Gregorio Marañon;
Email: cruizmartinez@salud.madrid.org

Additional Author (s):
Carmen Rodriguez-Gonzalez
Beatriz Monje Garcia
Maria Sanjurjo-Saez

Purpose: Long-term adverse effects, expense, and difficulty of adherence to antiretroviral therapy (ART) have led to simpler maintenance therapies. Switching from a triple therapy to a dual therapy seems to be effective and safe, but few data exist in clinical practice. The purpose was to assess the effectiveness and safety of simplification to a dual therapy in experienced HIV patients.

Methods: A retrospective study including experienced HIV patients switching from triple to dual therapy between August 2009 and January 2015.
Demographic and clinical characteristics, viral load (VL), CD4+ T-cell count, CD4/CD8 ratio, fasting lipid profile, liver and renal function were recorded when dual therapy was started and at week 24. Previous ARTs, reason for change to dual therapy and adverse events leading to discontinuation of the new regimen were also evaluated.

Results: 67 patients were included, 58.2% were male with a median (IQR) age of 50(47-54). Reasons for switching to dual therapy were: presence of adverse events(44.8%), treatment simplification(26.9%), virological failure(14.9%), immunological failure(3%) and others(10.4%). The most frequent drug combinations were: a ritonavir-boosted protease inhibitor(rPI) with maraviroc (41.8%), a rPI with lamivudine(35.8%) and rPI and raltegravir(13.4%).
Regarding to the effectiveness results , patients with a viral load (VL) lower than 50 copies/ml increased from 82.1% to 94%. No virological failures was detected during treatment. Regarding the immunological response, at week 24 of follow-up CD4 cell count increase from 569 (418-743) to 581(364-785) cel/mcL and the CD4/CD8 ratio decrease from 0,61 (0,39-0,92) to 0,57 (0,39-0,84). Effectiveness results were not statistical significant.

At week 24, there was small statistical significant improvement of the hepatic function while the renal function remained the same. There was also a small statistical significant increase of total cholesterol.
Eighteen patients (26.9%) interrupted the dual therapy: 4 patients (6.0%) switched to a triple therapy due to toxicity and drug interactions. 14 patients (21.0%) switched to a different dual therapy due to toxicity (dislypemia and gastrointestinal disorders) (9.0%), drug interactions (6.0%), simplification (4.5%) and failure to achieved an undetectable VL (1.5%).

Conclusion: Switching to dual therapy for maintenance treatment is effective, safe and non-inferior to triple therapy in treatment experienced HIV patients.

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-222

Poster Title: Understanding public stigma and self-stigma in primary care patients with depression

Primary Author: Lauren Heath, University of Colorado Skaggs School of Pharmacy & Pharmaceutical Sciences and Kaiser Permanente Colorado; **Email:** lauren.heath@ucdenver.edu

Additional Author (s):
Miranda Kroehl
Danielle Loeb
Sheila Botts
Katy Trinkley

Purpose: Major depressive disorder (MDD) affects approximately one-third of primary care patients, however it is often under-diagnosed and under-treated. One factor that could contribute to poor treatment outcomes is stigma. Understanding barriers to positive treatment outcomes, such as stigma, is an important role for pharmacists and other providers who are managing MDD. The objective of this study is to characterize perceived public stigma (PPS) and self-stigma (SS) in a primary care patient population with MDD and examine the association between the presence of stigma, depression severity, and depression treatment response.

Methods: The study population includes patients from two University-based primary care clinics with MDD managed by a pharmacist-led collaborative care model. SS and PPS are measured during the first clinic visit with a pharmacist using a validated stigma questionnaire. The stigma questionnaire consists of fourteen, four-point Likert scale questions assessing SS and PPS. PPS is a measurement of patient belief that the public discriminates against individuals with depression, and SS is a measurement of the internalization of PPS resulting in devaluing and shame-filled thoughts by an individual with depression. Patient characteristics including nine-item patient health questionnaire (PHQ-9) scores (at baseline, 12-16 weeks), age, gender, race, ethnicity, Charlson comorbidity index score, antidepressant and psychotherapy treatment history, and socioeconomic status surrogates are collected from the electronic health record. Depression remission (PHQ-9 score less than 5) and/or depression response (50 percent reduction in baseline PHQ-9 score) are determined after the acute phase of treatment (12-16 weeks). Logistic regression will be used to evaluate the association between baseline SS and PPS and depression response at 12-16 weeks, with adjustment for covariates and confounders

as appropriate. Mean baseline SS and PPS subscale scores will be calculated and reported. This study has been approved by the Colorado Multiple Institutional Review Board and data collection is ongoing.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-223

Poster Title: The development and implementation of pharmacist-led medication therapy management in a collaborative care setting for high risk Medicaid beneficiaries with diabetes mellitus

Primary Author: Jennifer Aka, Howard University; **Email:** jennifer.aka@howard.edu

Additional Author (s):
La'Marcus Wingate
Mary Maneno
Earl Ettienne
Tamara McCants

Purpose: The American Diabetes Association recognizes that elevated hemoglobin A1c directly correlates with increased diabetes-related complications and mortality. Pharmacist-led medication therapy management has proven effectiveness in controlling hemoglobin A1c, and achieving both positive clinical and economic outcomes. However, there is a scarcity of research on medication therapy management in the Medicaid population. Studies have demonstrated that the Medicaid population has the highest risk of developing diabetes-related complications and disease-related death. The objective of this study is to determine the clinical and economic outcomes of implementing a pharmacist-led medication therapy management diabetes program to enhance care for high-risk Medicaid beneficiaries.

Methods: Participants that will be included in this quasi-experimental study are members of a DC Medicaid Health Plan. The Medicaid health plan members will be followed for a period of 12 months at the health plan's wellness center. The participants will be managed in a collaborative fashion by an interdisciplinary health care team. The pharmacist will integrate appointment-based medication therapy management services (this includes comprehensive medication review, medication counseling, and blood glucose meter teaching) to each participant. The inclusion criteria will include at the point of recruitment: ages 18-75; or diagnosis of type 1 or 2 diabetes with hemoglobin A1c >9; or utilizers of 4 or more prescriptions; or have had a recent 30-day readmission to the hospital. The data collected will be electronic medical records, and both prescription and hospital visit claims data. Descriptive statistics will be used to describe the population. The statistical analysis used will be the difference-in-differences approach with

a multivariate regression analysis to evaluate the impact of the pharmacist intervention on the primary outcomes, after adjusting for other covariates. The primary outcomes will be the effect on 1) hemoglobin A1c, 2) hospital readmission rate, and 3) total health care utilization.

Results: N/A

Conclusion: N/A

Submission Category: Practice Research/ Outcomes Research/ Pharmacoeconomics

Session-Board Number: 6-224

Poster Title: Lab developed risk stratification tool to optimize chronic kidney disease care in the primary care setting

Primary Author: Aya Haghamad, TriCore reference laboratories; **Email:** ayahaghamad@gmail.com

Additional Author (s):
Kathleen Swanson
Mary Vilay
Michael Crossey
Monique Dodd

Purpose: Chronic kidney disease (CKD) affects one in ten American adults, with more than 20 million individuals having some level of CKD. In the U.S., the two leading causes of CKD are diabetes and hypertension. Additionally, suboptimal management of these states further contribute to accelerated progression and loss of renal function. Primary care providers are in an ideal position to manage these patients and potentially prevent progression to end stage renal disease (ESRD). The aim of this project is to aid primary care providers in optimizing the management of patients with CKD through implementation of a targeted intervention.

Methods: This study will be submitted for Institutional Review Board approval. Patients meeting the diagnostic criteria for CKD, diabetes or hypertension, and followed by a primary care clinic will be included. Patients will be evaluated based on four phases of care; screening, identification, management, and intervention using the chronic kidney disease targeted intervention criteria. The chronic kidney disease targeted intervention was developed to incorporate the Kidney Disease Improving Global Outcome (KDIGO) guideline recommendations for the management of patients with CKD. Patients identified as having risk factors for progression of CKD and gaps in care compared to the guidelines will undergo a chart review to validate the gaps and risks identified. Data collected will include renal function tests, frequency of screening, hemoglobin A1c to assess level of diabetes control, and screening and management of complications associated with CKD such as anemia, bone and mineral disorders and cardiovascular risk. Other factors that will be assessed through a chart review include; use of angiotensin converting enzyme inhibitors or angiotensin receptor blocker therapy for the management of proteinuria and use of nephrotoxic agents such as non-steroidal anti-

inflammatory drugs. Our aim is to optimize care in patients with CKD, in the primary care setting, slow disease progression through improved monitoring, and provide guidance to the primary care provider for when referral to a specialist is needed.

Results: N/A

Conclusion: N/A

Submission Category: Infectious Diseases

Session-Board Number: 6-225

Poster Title: Evaluation of adherence to surgical antibiotic prophylaxis guideline in a tertiary hospital

Primary Author: Khalid Eljaaly, University of Arizona; **Email:** khalid-eljaaly@live.com

Additional Author (s):
Amira Alhadab
Tahani Alrahbeni
Sulaiman Alzubairy
Yousif Asiri

Purpose: A recent guideline for surgical antibiotic prophylaxis was developed jointly by the American Society of Health-System Pharmacists (ASHP), the Infectious Diseases Society of America (IDSA), the Surgical Infection Society (SIS), and the Society for Healthcare Epidemiology of America (SHEA). The purpose of this study is to evaluate adherence to this guideline in a tertiary hospital in Saudi Arabia and identify areas for improvement and lessons from clinical practice that would be of value to any hospital.

Methods: This prospective cohort study was carried out in King Fahad specialist hospital and was approved by its Institutional Review Board. This is a 640-bed tertiary governmental hospital in Dammam, Eastern Province of Saudi Arabia. Patients of 18 years of age or older who underwent surgery between April through June 2015 were eligible for inclusion in our study. Patients who underwent contaminated or dirty procedures or those were on antibiotic treatment before the surgery were excluded. The adherence to the ASHP/IDSA/SIS/SHEA guidelines was assessed in terms of giving prophylactic antibiotics when not indicated as well as withholding antibiotics when indicated. When antibiotics were used for prophylaxis, adherence was assessed for antibiotic choice, dose, duration, initiation time, and redosing. The ASHP/IDSA/SIS/SHEA guidelines recommended increasing cefazolin dose from 1 gram to 2 grams for patients weighing greater than 80 kilograms and to 3 grams for those weighing greater than 120 kilograms; however, 2 grams could be considered for simplification. Therefore, we considered the cefazolin dose as inappropriate if it was lower than 2 grams for patients weighting greater than 80 kilograms. For timing, the guidelines recommended initiating antibiotics within 10 to 60 minutes of surgical procedure, except vancomycin (within 60 to120

minutes). Data were analyzed with SPSS software, version 23. Descriptive statistics were used to summarize the data.

Results: Two-thirds of 132 surgeries were clean-contaminated (urologic, 27.3%). The most commonly administered prophylactic antibiotics were cefazolin (53.5%), followed by cefuroxime (42.5%). Vancomycin was not given to any patient. Prophylactic antibiotics were unnecessarily given in 6/8 operations, mainly due to thyroidectomy. In contrast, they were given in almost all cases that required antibiotic prophylaxis. Only half of patients received appropriate choice of antibiotic prophylaxis, which was attributed to failure to cover anaerobes (24%); using piperacillin/tazobactam for kidney transplantation (6.5%); giving cefuroxime instead of cefazolin (61%); using ceftriaxone for urologic procedures (3%). Almost all patients were redosed when required. The main antibiotics with dosing errors were cefazolin and cefuroxime. The proportions of appropriate pre-operative and post-operative antibiotic dosing were 78.8% and 73.8% for cefazolin; 69.2% and 20% for cefuroxime, respectively. For cefazolin, the cause of inappropriate cefazolin doses in 66 patients who received it was giving lower dose than recommended for patients weighing over 80 kilograms (preoperatively, 15.2%; postoperatively, 19%). For cefuroxime, the cause of inappropriate dose was giving lower than the recommended dose of 1.5 grams. Almost all patients received the antibiotics within the recommended time frame before the procedures. Only half of patients received appropriate duration of antibiotic prophylaxis.

Conclusion: We identified several issues and lessons from clinical practice that could improve adherence to best practices of surgical antibiotic prophylaxis. Hospitals can achieve better adherence by paying more attention to the prophylactic antibiotic choice, indication, dose, and duration. Therefore, implementation and enforcement of local hospital protocol are advised with periodic adherence monitoring.

Submission Category: Drug-Use Evaluation/ Drug Information

Session-Board Number: 6-226

Poster Title: Survey of medical information preferences of healthcare professionals

Primary Author: Devin Enhoffer, Rutgers University; **Email:** devin.enhoffer@astrazeneca.com

Additional Author (s):
Daniel Boulos

Purpose: PhactMI is a not-for-profit medical information organization providing healthcare professionals, health systems, payers, and consumers access to a single source of product related medical information. Today, healthcare is increasingly influenced by advances in medicine, and the need for evidence-based drug information has increased among practitioners. Many third-party drug information sources exist, however, they may not always be accurate or they are difficult to find. To address this unmet need, PhactMI aims to understand practitioner preference and tailor its site to their needs. The objective of the survey was to gain baseline data on practitioner preferences for obtaining drug information.

Methods: The PhactMI Research and Analytics Sub-Committee developed a survey to poll healthcare professionals, primarily pharmacists, about where, how, and why they access their drug information. This poll allowed the user to select which sources and mediums they prefer over others depending on their medical information need. Pharmacists from multiple settings were surveyed, including those employed in retail, hospital, academia, and managed care. A 10 question electronic survey was developed and provided to all members of the Research and Analytics team in April, 2016. They were asked to distribute the electronic survey to their pharmacist network for completion within a 4-week window.
The results of this survey were collected and analyzed before being presented to the full PhactMI board comprising of representatives from 21 pharmaceutical companies. These results provided a baseline understanding of the medical information preferences of pharmacists.

Results: The survey was completed by 238 participants, 71% of whom were pharmacists from diverse professional backgrounds. When surveyed about the first resource utilized when seeking drug information, 50% selected specific third-party sites, 47% selected online search engines, and 3% selected live interaction with a pharmaceutical manufacturer. Of the 97% of responders who preferred online resources, 69% selected search engines such as Google and

Yahoo while 31% selected PubMed and OVID. The responders who selected web-based search engines were further split by preference: 94% preferring Google, 3% Yahoo, and 3% other. Within the technology-based resources, 68% were found to prefer websites versus the 32% who preferred mobile applications. Among the third-party compendia utilized by responders, the top three resources in order of preference were Micromedex/Lexi-Comp, UpToDate, and ePocrates. The top three attributes considered by participants when selecting their preferred third-party compendia were ease of use, accessibility of access, and accuracy. Lastly, those who used these third-party compendia were seeking clarity around dosing, drug interactions, and safety. Limitations to this study include that some participants did not answer all questions and that this was not a public survey open to all healthcare professionals.

Conclusion: The results from this initial survey have provided a preview into the preferences of practicing healthcare professionals seeking drug information. Participants preferred third-party compendia that were easy to use, accessible, and accurate to gain clarity around dosing, drug interactions, and safety information. Further research with a larger sample are needed to assess the reproducibility and generalizability of this data.

Submission Category: Oncology

Session-Board Number: 6-227

Poster Title: Role of Oxaliplatin versus Cisplatin in combination with Capecitabine and Trastuzumab in HER-2 positive Advanced Gastric Cancer.

Primary Author: Alberto Rodriguez Palomo, Hospital Universitario Central de Asturias; **Email:** albertrodripalom@hotmail.com

Additional Author (s):
Felipe Alvarez Manceñido
Isabel Zapico Garcia
Ana Custodio
Alberto Carmona-Bayonas

Purpose: Gastric cancer is the fourth most commonly diagnosed cancer and the second cause of cancer-related deaths worldwide. There is currently no single well stablish chemotherapy regimen that can be considered standard of care in advanced gastric or gastroesophageal cancers (AGC). The purpose of this study was to evaluate the efficacy and safety of oxaliplatin combined with capecitabine and trastuzumab (XELOX-T), as first line chemotherapy regimen, and to compare these results with the chemotherapy regimen consisting of cisplatin plus capecitabine and trastuzumab (XP-T) in a multicenter cohort of patients with HER-2 positive AGC.

Methods: The Agamenon Spanish registry compiles AGC cases consecutively recruited at 28 centers from January 2008 to January 2016. Patients for this substudy were eligible if they were treated with capecitabine (1000mg/m2), trastuzumab (6mg/kg; loading dose 8 mg/kg) and Oxaliplatin at 130mg/m2 (XELOX-T) or Cisplatin at 70 mg/m2 (XP-T), given in combination every 3 weeks, and if their tumors showed overexpression of HER2. HER2 positivity was defined by immunohistochemistry (IHC) 3+ or IHC2+/fluorescence in situ hybridization (FISH)+. The primary endpoint was overall survival (OS). Secondary endpoints included progression-free survival (PFS), and safety. The Kaplan-Meier method was used to estimate OS and PFS. Safety was analyzed from the adverse events reported in medical histories according to the National Cancer Institute Common Terminology Criteria for Adverse Events (NCI-CTCAE) 3.0 version. This study met Good Clinical Practice guidelines and Declaration of Helsinki and was approved by the Ethics Review Board at each of the participating institutions. All patients provided written informed consent.

Results: The Agamenon registry contains data from 1119 patients, 362 of whom were treated with a chemotherapy regimen based on XELOX(n=169) or XP(n= 193). Median age(range) of this baseline population was 61.1(30- 89) years, OS 10.4 (9.5-11.7) months and PFS 6.3 (5.9 – 6.9) months.
A 26.7% of patients in the XELOX(n=45) and 32.6% in XP(n=63), had an HER2 positive tumor treated with chemotherapy plus trastuzumab.
Median OS for HER2 positive patients were 14.7 (95% CI 9–21) and 13.44 (9–24) months in the XELOX-T and XP-T, respectively. Median PFS in the XELOX-T and XP-T were 9.33 months (95% confidence interval (CI), 7–11) and 8.44 months(95% CI, 7–10) respectively. This results show that OS and PFS were similar in both XELOX-T and XP-T groups and more than three and two months higher when compared with OS and PFS baseline population.
The most common adverse events groups were neuropathy (XELOX-T 80% vs XP-T 35%), anemia (76% vs 44%), fatigue(76% vs 44%), and nauseas (46% vs 66%).
As compared with cisplatin, oxaliplatin was associated with lower incidences of grade 3 or 4 neutropenia (17 vs 13%) and thromboembolism(14 vs 7%) but with higher incidences of grade 3 or 4 diarrhea (11 vs 2 %).

Conclusion: The addition of trastuzumab to oxaliplatin or cisplatin plus capecitabine improves OS in HER2-positive advanced gastric patients when compared with baseline population.
XELOX-T can be considered as a new alternative option to XP-T for patients with HER2-positive AGC with similar effectiveness and a different toxicity profile.

Submission Category: Leadership

Session-Board Number: 6-228

Poster Title: Postdoctoral academic fellowship programs: Training for careers in pharmacy academia

Primary Author: Jeeseon Kim, Touro College of Pharmacy; **Email:** jeeseon.kim28@touro.edu

Additional Author (s):
Erica Tolle
Roopali Sharma
Neil MacKinnon

Purpose: The current post-graduate training structure does not adequately prepare practicing faculty members to assume roles in teaching and scholarship. The objectives of this study are to characterize, describe, and evaluate currently offered postdoctoral academic fellowship programs intended to prepare new practitioners for careers in academia. Furthermore, this study will discuss the need for additional post-graduate training programs for careers in academia, provide guidance for developing academic fellowship programs, and the need for accreditation to uphold quality standards for teaching.

Methods: This study will be submitted to the Touro College of Pharmacy's Institutional Review Board for approval. A list of currently available academic fellowship programs will be gathered from the American College of Clinical Pharmacy's (ACCP) directory of residencies, fellowships, and graduate programs. Listings will be cross-referenced with the American Society of Health Systems' (ASHP) 2016 Pharmacy Placement System (PPS) registry. Also, a web search will be performed using the following search terms: pharmacy, academic, and fellowship. Moreover, to identify any programs not found through the search methods, a standardized email will be sent to college of pharmacy deans through the American Academy of College of Pharmacy (AACP) directory. Programs that meet pre-specified criteria developed by the authors will be included in the final analysis. A standardized survey will be sent to the program directors to obtain information regarding each program's structure, characteristics, and outcomes. Furthermore, program directors that report at least three graduates will be asked to complete teleconference interviews to gather supplementary information detailing experiences and limitations within their respective programs. All interview sessions will be recorded and prior consent will be obtained and documented. In addition to analysis of individual programs, a comprehensive literature search will be performed to evaluate the current need for post-graduate training for

careers in pharmacy education and to offer guidance for developing and accrediting future academic fellowship programs.

Results: N/A

Conclusion: N/A

Submission Category: Pain Management

Session-Board Number: 6-229

Poster Title: Analyzing the opioid prescriptions using the National Ambulatory Medical Care Survey (NAMCS) data 2009-2013

Primary Author: Huyen Vu, University of Maryland School of Pharmacy; **Email:** hvu@rx.umaryland.edu

Additional Author (s):
Priyanka Gaitonde
Fadia Shaya
Magaly Rodriguez de Bittner

Purpose: Addiction to prescription opioids is a major public health issue in the US. To our knowledge, no study has assessed the recent trends and predictors of prescribing opioids in a nationally representative sample. Understanding the prescribing patterns of opioids will help identify factors leading to over prescribing of opioids and contribute in the design of interventions for opioid misuse/abuse prevention. Our objective is to investigate the factors associated with the prescription of narcotic/opioid analgesics among patients who have visited ambulatory care in years 2009 to 2013.

Methods: This is a pooled cross sectional study that used the entire data of visits recorded in NAMCS from 2009 until 2013. Prescription records of opioids were identified through the specific drug codes for narcotic analgesic and narcotics analgesic combination. We conducted descriptive analyses using t-test, Wilcoxon Mann Whitney and chi-square tests where appropriate to assess differences in the distribution of various patient characteristics among opioid and other prescription records. We used the multivariate logistic regression model to evaluate the association between the following factors and opioid prescriptions: year, age, gender, ethnicity, geographic location, average number of past visits in the past 12 months, average total number of medications that were prescribed, major reasons for visits, average time spent with physicians, the type of insurance and physician specialty. Statistical significance is defined as p less than or equal 0.05 with 95 percent of confidence interval.

Results: Among the total of 225 234 visits recorded from 2009 until 2013, 15 882 visits (7.05 percent) included opioid prescriptions. There were statistical significant differences observed among the opioid prescribed and opioid non-prescribed groups in terms of year of visit, race,

insurance types, geographic regions, physician specialty and major reasons for visit (all p less than 0.0001). Distribution of prescriptions for opioids as compared with others was significantly higher among older individuals (53.36 versus 45.99 years), who had more average numbers of visits in the previous year (5.55 versus 4.29), had more average total number of prescription medications (5.24 versus 2.48) and had longer average time per appointment (22.65 versus 21.87 minutes) than non-prescribed narcotic group (all p less than 0.0001). Individual characteristics that were strongly associated with receiving a prescription for a narcotic analgesic included being White, female, having private insurance coverage, residing in Southern US, at least 60 years old, having primary care prescribers, being prescribed at least 5 medications, having less than 3 visits in previous year, routine chronic problems as the major reason to visits (all p less than 0.0001) and spending 15 to 30 minutes per appointment with physicians (p equal to 0.0164).

Conclusion: The odds of being prescribed opioid analgesics were higher in White, female, those with private insurance, being located in the South, 60 years old or older, having primary care specialty prescribers, being prescribed at least 5 medications, having none to 3 visits in the last 12 months, and routine chronic problems as the major reason to visit. Knowing factors associated with a higher propensity of receiving a prescription opioid will help design interventions for preventing doctor shopping and opioid prescription misuse or abuse in patients.