

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 1-M

Poster Title: *Significant residency growth and expansion: our journey and benefits realized*

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Purpose: Pharmacy leaders understand the value of pharmacy residency programs and have been tasked by the American Society of Health-System Pharmacists (ASHP) to grow residency programs. We have embraced expansion, both in number of residents and also in the number of programs at two facilities in a larger health-system setting. This descriptive report will outline the journey of growth and demonstrate the benefits and challenges of this expansion.

Methods: Our pharmacy residency program was founded in 2007 and our first resident graduated in 2008. After two years, the program grew to include two residents, and in 2012 our program expanded to four residents. With a focus on improving quality of care provided for heart failure patients at high risk for readmission, year-long residency projects measuring Heart Failure thirty-day readmission rates were demonstrating a positive trend and warranted a request for expansion of our residency program. We therefore increased from four to eight residents, with a successful presentation to executive leaders and a commitment to include residents on the transition of care (TOC) pharmacy service for each block, a new required learning experience. We then applied to ASHP for a new residency program at our smaller sister hospital (127 beds), and implemented a new program with two residents who work closely with the eight residents in our larger hospital (390 beds). Finally, with more pharmacy leaders needed, and immense support from our executive leadership team, we successfully implemented a new Administration and Leadership Residency, with fellowship, spanning over three years. This new program started in 2016, with a resident entering our PGY1/PGY2/MHA in Administration and Pharmacy Leadership residency, to include a third year fellowship to put the invaluable training to use.

Results: Our successes were not without doubt and preceptor anxiety. Challenges have included placing eight residents into seven rotations, recruiting for ten positions in three programs, and setting precedents with fairness and equity while still promoting creativity. Residents are now in new services (Palliative care), and we have implemented the layered learning model (preceptor pharmacist, PGY1 resident and APPE student teams) on most clinical services. We place residents in leadership roles in order to learn more about leading in medication safety, formulary management, project management, education, and other real-life leadership experiences. Residents are invited to present their projects to the Quality Board, executive leaders, and the health-system team. With enhanced staff engagement and raising the bar of clinical practice across the department, we produce more publications, posters, and continuing medical education presentations. Resident projects are closely aligned with organizational priorities and goals, and we have sent six residents on global health learning experiences in Haiti and Guatemala. We capitalize on the financial benefit of the staffing component, and experience significant financial benefit related to decreasing the cost of turnover. The benefit is demonstrated at two hospitals and in our ambulatory clinics.

Conclusion: Our significant residency expansion has benefited both the Department and the organization in numerous ways both from a quality and financial perspective. While there was staff resistance initially, the staff now have embraced the residency programs and voice the opinion that the expansion was the best thing that has been done to advance practice in our area.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 2-M

Poster Title: *Developing a cost neutral business plan for a multi-hospital health system pharmacist staffing pool*

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Purpose: The American Society of Health System Pharmacist's 2013 Pharmacy Staffing Survey reported a national hospital pharmacist vacancy rate of 2.1 percent. Vacancies may exceed this rate in multi-hospital health systems such as ours, which includes a flagship university medical center. High turnover along with time-off can require existing pharmacist staff to contribute to staffing beyond the expected 40 hours weekly for one full-time-equivalent (FTE). Increased workload is associated with decreased job satisfaction, increased burnout and increased overtime expense. We aim to justify an alternative staffing model for a multi-hospital health system to support minimum staffing needs, while remaining cost neutral.

Methods: Four of the five hospitals in our health system are located in the same state and are subject to the same pharmacy laws, we decided to initially focus on developing a pharmacist staffing pool for the four hospitals within the state. The nursing service line within our organization and other pharmacy departments in the nation were surveyed to research alternative staffing models already in place. We determined overtime hours (OT) and extra time (EXW) worked by clinical and operational pharmacists in our organization to cover non-productive time. Non-productive time was defined as time required to cover paid time off (PTO), leave of absence (LOA), and medical leave (FMLA). Data regarding residents' moonlighting contributions was also collected. Financial reporting tools were utilized to quantify the expense associated with OT and EXW hours worked by pharmacists and residents. We collected information regarding OT and EXW hours worked and the associated expense for fiscal year 2017.

Results: Collectively the four hospitals require 91 pharmacists per week day and 30 pharmacists per weekend day to meet minimum staffing needs and maintain normal operations. The system has 130 budgeted essential pharmacist staff, of which 7 vacancies exist. An analysis of fiscal year 2017 data shows that 8,568 hours of OT and EXW hours were worked to help maintain minimum staffing needs; of those 4,160 hours were covered by resident moonlighting. Our analysis reveals that the associated EXW and OT expense support 3.9 over hire FTEs while remaining budget neutral. This requires current offsetting OT and EXW expense to dedicated FTE pharmacists used to cover non-productive time. Acknowledging that OT and EXW are difficult to eliminate we requested 3.5 FTEs of additional pharmacists to cover 6510 hours, or 75 percent of total OT and EXW time in FY17.

Conclusion: The cost of adding dedicated pharmacists to cover this time was offset by OT and EXW expense. We justify a multi-hospital health system staffing pool to cover 75 percent of historical PTO, LOA, and FMLA while remaining cost neutral.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 3-M

Poster Title: *Financial justification of a refrigerated carousel at an academic medical center pharmacy*

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Purpose: Recent approval of the 21st Century Cures Act allows for accelerated approval of medications, it is expected that within five years twenty five percent of all specialty medications under the Food and Drug Administration (FDA) review will be approved. By 2020 specialty medications will account for half of all pharmaceutical expense while only being used in 2 percent of patients. Hospitals will need to carry these complex, high cost medications that may require specialized handling (refrigeration) and monitoring. This project will justify refrigerated carousel dispensing technology (RCDT) for segregation of high cost/ low volume drugs at a university medical center.

Methods: The following opportunities for savings were explored in this analysis: enhanced inventory turns, reduction of outdated inventory, and segregation of 340B eligible inventory. A pre-implementation inventory turn for refrigerated products was calculated by using fiscal year 2017 total expenditures and the cost of our current inventory. An inventory turn of 14, or 25 days, was calculated using this information. Of the 204 refrigerated drugs currently stored in 5 separate refrigerators, 31 are solely administered in outpatient clinics and currently purchased at wholesale acquisition cost (WAC), subsequently going thru our splitting software for reimbursement. Segregated storage of this inventory allows 340B pricing to be available upon acquisition, mitigating the split process and reducing inventory costs. Over 1 million dollars in inventory is currently stored in multiple refrigerators, thus precise inventory cycle counts are difficult to coordinate. This results in inappropriate wastage of refrigerated products, outdated reduction and associated savings was calculated by analyzing costs associated with non-creditable wasted products in fiscal year 2017. Potential savings was also calculated by

determining the optimal minimum and maximum par levels of drug and the number of new inventory turns associated with the new par levels. This was done by averaging three months of drug usage data to determine average daily use, based upon which new minimum and maximum par levels could be calculated.

Results: Justification of this project involved identifying potential savings associated with implementation of RCDT to offset initial costs. An evaluation of RCDT was done by comparing implementation expenses with projected post implementation savings. Initial expenses include facility planning and construction costs, cost of RCDT, and 1.0 full-time-equivalent quality assurance technician. Segregating and purchasing clinic inventory at 340B pricing provides an opportunity to reduce on hand inventory costs by 50,000 dollars with each turn; with inventory being replaced every 25 days this savings is annualized to 700,000 dollars. The financial implementation of the RDCT was justified by reducing loss of outdated inventory as waste, by segregation of clinic administered medications allowing procurement at 340b pricing and avoidance of WAC and subsequent 340b splitting charges for refrigerated inventory. These savings offset the initial cost of implementation, related construction costs, and justify implementation of RCDT at our academic medical center, producing a two year return-on-investment.

Conclusion: The implementation of RCDT and associated expense is offset by the savings that can be realized by this method of inventory management. Segregating refrigerated inventory into RCDT will limit the number of staff with access to high cost/low volume refrigerated medications, allowing for monitoring of shrinkage and loss.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Evaluative Study

Session-Board Number: 4-M

Poster Title: *Evaluation of a closed versus open inpatient formulary on potential medication errors at discharge*

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Purpose: Restrictive inpatient formularies have been promoted to increase patient safety, decrease costs, and ensure appropriate medication utilization. However, restrictive formularies may also increase the risk of medication errors when clinicians switch patients' home medications to different hospital formulary medications within the same class. These errors can translate into the outpatient setting when inpatient regimens are transitioned to outpatient prescriptions. Minimal research has been done evaluating discharge prescription errors associated with closed inpatient formulary systems. The purpose of this study is to evaluate the impact of transitioning from a closed inpatient formulary to a less restrictive formulary system.

Methods: This study was a quality improvement initiative evaluating the impact of transitioning from a closed inpatient formulary to a less restrictive formulary system at a large academic medical center after adding losartan, simvastatin, pravastatin, omeprazole, and pantoprazole to the formulary. The primary objective was to determine the rate of discharge prescription errors associated with both closed and open inpatient formulary systems. Secondary objectives included potential medication errors identified on patients' discharge prescription lists, such as missing, duplicate, or incorrect medications. The rate of discrepancies between patients' discharge instructions and discharge summaries within the electronic medical record was evaluated as well. Prior to the formulary change, a retrospective chart review of patients admitted to the hospital taking angiotensin II receptor blockers, statins, and proton pump inhibitors was completed. Patients < 18 years of age and incarcerated patients were excluded from the study. Patients switched to formulary agents upon admission and discharged with prescriptions for these formulary agents were identified. Discharge instructions, discharge summaries, and discharge medication orders were evaluated for potential medication-related

errors. Following the formulary change, a prospective chart review of these same potential medication-related errors upon discharge was conducted.

Results: Prior to the formulary change, a retrospective chart review revealed 429 patients with potential medication errors upon discharge over an 18-month time period. Of these, 12.8% had two different medications within the same medication class listed on their discharge instructions. Among patients who were switched from non-formulary agents to formulary agents upon admission to the hospital, 46.8% were discharged on formulary agents without any clinical indication or explanation for the medication change. Additionally, 19.1% of patients' discharge paperwork included discrepancies between the discharge summaries and discharge instructions. These same potential medication errors are being compared pre- and post-formulary change.

Conclusion: Switching patients from non-formulary medications to formulary medications upon admission to the hospital may increase the rate of potential medication errors upon discharge. These errors may include discrepancies in discharge instructions and discharge summaries as well as duplicate discharge medication orders. The results of this study are being utilized to provide formulary decision support, improve patient care, and increase medication safety.

Submission Category: Ambulatory Care

Poster Type: Case Report

Session-Board Number: 5-M

Poster Title: *Thinking outside the pillbox: a misguided approach*

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Purpose: This case series provides three unique patient cases involving the inappropriate application of reminder packaging, commonly referred to as pillboxes, and reveals the vital role of healthcare providers in identifying these situations. Patient 1 is a 76-year-old Caucasian female being treated with warfarin in the Pharmacotherapy clinic due to a history of recurrent deep vein thrombosis and pulmonary embolism. The initial determination of warfarin maintenance needs was difficult to discern, and the INR was therapeutic for 5 out of 16 visits. Based on her inconsistent INR, the pharmacist inquired about the patient's approach regarding pillbox use. At this time, she reported confusion associated with refilling her pillbox and provided her pillbox for visual inspection at the pharmacist's request. The patient was using a plastic tackle box that was improperly organized, improperly labeled, and improperly filled. Her individualized approach to reminder packaging was contributing to the incorrect administration of her medication, directly impacting her INR. Patient 2 is a 53-year-old Caucasian female being treated with warfarin in the Pharmacotherapy clinic for bilateral pulmonary embolism. Despite routine follow-up appointments and dose adjustments, the patient continued to experience erratic INRs that fluctuated between 1.6 and greater than 8.0 during a five-week timeframe. When asked about pillbox use, she revealed that she preferred using two containers. One container was a traditional pillbox kept at home for daily use. The second container was a small pouch kept in her purse to ensure preparation for disaster or emergency situations or for convenient administration if she had forgotten to take her medication at home. The patient described filling the second container multiple times per week, which ultimately led to the inability to recall medication administration. The use of multiple pill containers stemmed from post-traumatic stress syndrome which developed after the patient was victim to a F5 tornado that devastated her hometown. This situation made her more prone to errors, resulting in

inaccurate pillbox filling and ineffective medication labeling. These errors were the probable cause of missed and/or doubled doses and were most likely the reason for her erratic INR levels. The pharmacist's intervention revealed the incorrect use of reminder packaging which was playing a vital role in the patient's medication mismanagement. Patient 3 is a 63-year-old African American female diagnosed with type 2 diabetes who presented to the Pharmacotherapy clinic for routine follow-up. During the patient interview portion of the visit, the patient expressed that her drug therapy regimen was very important to her, so she kept her medications in her possession at all times. By inquiring about the patient's technique for maintaining medication adherence, the patient revealed that she had implemented an individualized pill pouch made of tinfoil that fit in her brassiere. Although this patient thought she was using a favorable alternative to a traditional pillbox, proper medication storage and handling is also an important topic to discuss with patients. It is advised to keep most medications in a cool, dry environment because too much heat or humidity can alter their integrity and efficacy. The pharmacist played a key role in revealing this inappropriate approach to reminder packaging that could have ultimately resulted in ineffective drug therapy. As this case series suggests, there is a fundamental need for healthcare professionals to play an active role in identifying barriers that patients face regarding medication adherence. Specifically, these cases demonstrate the necessity of visual pillbox inspections by healthcare professionals, especially when nontraditional reminder packaging methods are created and implemented by patients. By revealing the root causes of adherence issues and the inappropriate use of reminder packaging, healthcare professionals can implement patient-specific interventions that contribute to favorable patient outcomes, while simultaneously decreasing the likelihood of medication errors. Institutional review board evaluation was not required as determined by the institution.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 6-M

Poster Title: *Telehealth 30-day post-discharge pharmacy service for patients with heart failure*

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Purpose: Heart failure is associated with the highest rate of 30-day all-cause readmission, thus increasing hospital costs in the US. Although various pharmacist-led care transition programs exist to improve readmission rates, transition of care via telehealth with pharmacists providing comprehensive medication management (CMM) to bridge to patients' primary care physicians has not been widely studied. The purpose of this project is to describe the implementation and pharmacists' clinical findings from telehealth pharmacy service in post-discharge management for 30 days for patients with heart failure.

Methods: Telehealth pharmacy service was implemented in July 1st 2017 at an urban surgical hospital. Patients who are discharged with a primary diagnosis of systolic heart failure with NYHA II, III, or IV and the ejection fraction less than 45% were eligible to receive telehealth service for 30 days. Exclusion criteria include patients who are discharged to skilled nursing home, hospice care, or acute rehabilitation units; those who have a ventricular assist device; and those who have terminal illness making heart failure management secondary. Patients received first telehealth visit within 48 to 72 hours of discharge, follow-up visits between the first and the last visit, and the last visit within 25 to 30 days of discharge via video conferencing or telephone. Telehealth pharmacists provided comprehensive medication management for each visit under the collaborative practice agreement. They reviewed symptoms, medications, and laboratory tests related not only to heart failure, but also to other chronic disease that patients had, such as diabetes, thyroid disorders, hypertension, and kidney disorders. They ordered and monitored laboratory tests, optimized drug treatments, and provided patient education on disease state, medications, and self-management. The communication between the hospital and the patients' primary physicians on patients' clinical status was done via electronic medical record messaging system, calls, or e-mails.

Results: Seventy-one patients were eligible and reached out for telehealth service between July 1st and December 31st 2017. Thirty-three patients (46 percent) received telehealth pharmacy service, and the 30-day readmission occurred in 18 percent of these patients due to symptoms related to heart failure exacerbation. Of 38 patients who did not receive telehealth service, 12 patients (36 percent) had death prior to or immediately following their discharge, 8 patients (21 percent) refused the service, and 7 patients were discharged before the outreach. During 6-month of 30-day post-discharge management period, telehealth pharmacists identified total of 148 medication-related problems. Insulin (20 percent) and loop diuretics (14 percent) were the common drugs with safety problems related to dose discrepancies between patient use and discharge orders, excessive doses, and adverse drug reactions, requiring pharmacists' interventions.

Conclusion: Telehealth 30-day post-discharge pharmacy service is viable transition of care delivery model that identified and resolved safety-related medication problems in patients with heart failure. Further studies on patient satisfaction and cost effectiveness need to occur before expanding the service to other high-risk populations.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 7-M

Poster Title: *Quality performance implications of integrating a pharmacist in a primary care clinic*

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Purpose: Accountable Care Organizations (ACOs) are networks of doctors, hospitals, and other healthcare providers, which share responsibility to coordinate high quality care across a specific patient population. When an ACO succeeds in delivering high quality care and spending healthcare dollars more wisely, it shares the savings for the Medicare program. Currently, the integration strategy to allow pharmacists to improve medication optimization in ACOs consisting mainly of primary care providers remains unknown. The purpose of this study is to evaluate the clinical and quality impact of the implementation of a pharmacist into a primary care clinic based in an accountable care organization.

Methods: This prospective, Investigational Review Board approved study, included Triad HealthCare Network (THN) Next Generation ACO, or Medicare Advantage plan patients with a primary care provider at one family medicine clinic. The study intervention consisted of pharmacist review of clinic patients with gaps in care for Group Practice Reporting Option (GPRO) and Healthcare Effectiveness Data and Information Set (HEDIS) ACO quality performance measures. From 10/30/17 to 2/28/18, a pharmacist provided support in clinic for 1 day per week. Upon review, the pharmacist provided medication monitoring, and pharmacotherapy optimization based telephonic and clinic-based interventions in conjunction with clinic physicians. Pharmacotherapy and quality based interventions were also communicated to providers for patients being seen in clinic for patients not on the pharmacist's schedule. Pharmacist quality measure and gap closure interventions focused on preventative health and at risk populations including diabetes and hypertension. The primary outcome was the overall quality metric completion rate for pharmacist-based interventions.

Results: A total of 516 Next Generation ACO and 721 Medicare Advantage plan patients met inclusion criteria with 1790 GPRO and 277 HEDIS quality metric gaps, respectively. Average quality gaps were 3.48 per patient for Next Generation ACO and 0.46 per patient for Medicare Advantage plans. The pharmacist provided interventions for 154 HEDIS and 52 GPRO quality metrics over the 15-week period. The pharmacist intervention overall quality metric completion rate was 51% with the majority of successful interventions (90 percent) being interventions consisting of quality based interventions for patients being seen in clinic by the primary care provider (n equals 95) rather than pharmacist telephonic/clinic based interventions (n equals 10). Overall quality metric completion rates were 61 percent and 48 percent for the Next Generation ACO and Medicare Advantage plan patients, respectively.

Conclusion: This prospective evaluation of the implementation of a pharmacist into an accountable care organization based clinic showed that pharmacist led interventions were helpful in identifying and correcting quality metric gaps in a primary care setting. ACOs should consider the placement of pharmacists into primary care settings to assist in correcting quality metric gaps and improving patient care.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 8-M

Poster Title: *Impact of pharmacist pre-visit engagement with providers on chronic opioid prescribing safety at a family medicine clinic*

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Purpose: Primary care providers (PCPs) account for approximately half of all opioid prescriptions in the United States. PCPs are often the first contact for patients with chronic pain; however, PCPs often feel chronic pain patients are challenging to manage and there is wide variability in practice patterns. The oft-called “opioid epidemic” has prompted increased healthcare discussion, federal legislation, and guidelines for prescribing opioids for chronic pain. The purpose of this study was to evaluate the impact of a pre-visit pharmacist review of high-risk patients treated with opioids for chronic pain on compliance to CDC recommendations at a family medicine residency clinic.

Methods: This study was conducted at a family medicine residency clinic. All adult patients with an appointment for chronic pain management who were prescribed greater than 50 morphine milligram equivalents (MME) per day had charts reviewed by a pharmacist prior to each appointment, with recommendations electronically sent to the provider prior to the appointment. After four months of implementation, a manual chart review of each patient was conducted to gather outcome variables. The primary outcomes were the mean MME per day and pain scores. For each patient, study outcomes were collected before implementation of pre-visit pharmacist recommendations and then again after four months of pre-visit pharmacist recommendations had been provided.

Results: During the four-month implementation of this quality improvement initiative, pharmacist pre-visit recommendations were provided for 45 patients. When comparing outcomes before and after intervention, the mean MME per day based on based on number of pills prescribed per month decreased from 135 mg to 116 mg (p less than 0.001) with no statistically significant change in mean pain scores (p equals 0.783). Statistically significant improvements were noted in the mean number of non-opioid analgesics prescribed, patients concurrently prescribed opioids with benzodiazepines, patients offered an outpatient naloxone prescription, patients with a current urine drug screen, patients with a current prescription drug monitoring program review, referrals to a pain specialist, and patients prescribed a bowel regimen.

Conclusion: Clinical pharmacists providing pre-visit recommendations for patients at high risk of opioid toxicity was associated with decreased opioid utilization with no corresponding increase in pain scores and increased compliance to CDC guideline recommendations.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 9-M

Poster Title: *Implementation of an interactive call campaign service with clinical pharmacist intervention to improve medication adherence in Medicare beneficiaries in the outpatient setting*

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Purpose: Improving medication adherence is integral to improving patient care and outcomes in the ambulatory care setting. EmmiPrevent, an interactive call campaign service, was identified as a potential tool to allow for scaling up outreach and identifying patients with potential barriers to medication adherence. This project was designed to determine whether the use of EmmiPrevent in combination with follow up from a clinical pharmacist to address identified barriers, could significantly increase our outreach and interventions for patients with identified non-adherence and thereby improve medication adherence in our population.

Methods: EmmiPrevent is a call campaign service that uses interactive voice response (IVR) technology to contact patients and allow them to self-report to a set of scripted questions. EmmiPrevent was used to call patients who had been identified as non-adherent to their targeted cholesterol, diabetes and/or hypertension medication(s) and assess need for pharmacist follow up based on patient responses to questions about their adherence to their medications. Those patients noted by this call campaign for follow-up were then contacted by our clinical pharmacist, who addressed these barriers. This pharmacist used a variety of techniques to address barriers such as medication cost, transportation issues, medication side effects, patient perceptions about medication, memory, and miscommunication with providers or pharmacies.

Results: EmmiPrevent called 3,684 patients, 1,898 were engaged and 333 patients requested follow up from the pharmacist. Of those noted for follow-up, the pharmacist was able to reach and receive verbal consent to engage with 175 new patients. From these patients engaged by the pharmacist, 128 barriers to medication adherence were identified and 407 interventions were performed to address these barriers.

Conclusion: The use of the EmmiPrevent call campaign service allowed for amplified patient outreach and engagement. Through partnering this tool with follow up from a clinical pharmacist, the project engaged 175 new patients, identified 128 new barriers for these patients to medication adherence and addressed these barriers through counseling on adherence, disease state and insurance; connecting patient with medication assistance; coordination of care with providers and pharmacies; referral to community resources; and other techniques. Through identifying and intervening to remove identified barriers, this service was successful in improving medication adherence in our patient population.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 10-M

Poster Title: *Role of a pharmacist in an urban hepatitis C clinic*

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Purpose: Since 2013, several oral, direct-acting antiviral (DAA) therapies were approved for the treatment of hepatitis C virus (HCV). The DAA's are considered specialty medications requiring high-touch care. Clinical pharmacists embedded within the clinic and pharmacy setting are qualified to provide comprehensive care and promote safe and effective medication use through patient education, monitoring, and management of drug-drug interactions. The purpose of this study is to provide a descriptive evaluation of the pharmacists' impact on the prior authorization (PA) process, management of drug-drug interactions (DDIs) and adverse drug reactions (ADRs), and adherence to laboratory monitoring in an urban HCV clinic.

Methods: The urban HCV clinic at UF Health Jacksonville was established in 2015. In this clinic, pharmacists practice within an integrated specialty pharmacy model and are an important part of the multidisciplinary team. The pharmacists are employed by the Department of Pharmacy and work within the clinic and the ambulatory pharmacy at the institution. The clinical pharmacists conduct clinic visits, ensure medication access by facilitating the PA process, and are directly involved in patient care from the PA approval process through post-treatment week 12. This was a single-center, retrospective study and was approved by the University of Florida Health Science Center Jacksonville institutional review board. All patients treated for HCV at the clinic between July 1, 2016 and June 30, 2017 were included in the study. Data was summarized using descriptive statistics consisting of frequencies and percentages for categorical variables and means, standard deviations, medians, and interquartile ranges (IQR) for continuous variables. The primary outcome of this study was the time from PA submission to PA approval. Secondary outcomes included number of appeals required for PA approval, treatment success defined as sustained virologic response at post-treatment week 12 (SVR12), number of office visits and telephone encounters conducted by the clinical pharmacists, the incidence and

management of DDIs and ADRs, and adherence to laboratory monitoring defined as completing labs within four business days of anticipated lab date.

Results: During the study period, 130 patients were treated for HCV. PAs were completed for 117 patients and the median time from PA submission to PA approval was 3 days (IQR, 1 to 14). Seventy-five (64 percent) PAs required zero appeals, 27 (23 percent) required one appeal, 10 (9 percent) required two appeals, and five (4 percent) required three or more appeals. Of the 130 patients, 113 (87 percent) achieved treatment success, nine (7 percent) were lost to follow up, four (3 percent) relapsed at SVR12, three (2 percent) stopped treatment early resulting in treatment failure, and one (1 percent) died prior to completing treatment. Median number of office visits and telephone encounters conducted by a clinical pharmacist were two (IQR, 2 to 2) and five (IQR, 3 to 7), respectively. The most common DDIs were increased monitoring with calcium channel blockers (n equals 43) and altering administration time and/or dose for proton pump inhibitors (n equals 28). The most common ADRs were fatigue (n equals 32) and headache (n equals 19). Of the patients that completed treatment (n equals 124), adherence to week four, end-of-treatment, and SVR12 lab monitoring was 85 percent, 76 percent, and 62 percent, respectively.

Conclusion: Clinical pharmacists are well-qualified to provide comprehensive care for patients in an urban HCV clinic. Pharmacists can ensure medication acquisition in a timely manner, conduct clinic visits and follow up monitoring, and manage DDIs and ADRs, which in turn, may allow the physician to see more patients and streamline the medication process.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 11-M

Poster Title: *Initiation of an ambulatory pharmacist-led PrEP clinic*

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Purpose: In New York City, new Human Immunodeficiency Virus (HIV) diagnoses decreased over 50% from 2001 to 2015 due to increases in testing, harm-reduction programs, effective antiretroviral treatment, and Pre Exposure Prophylaxis (PrEP). PrEP is indicated for patients with high-risk sexual behaviors or intravenous drug use in order to prevent acquisition of HIV. To maximize the effectiveness of PrEP, patients should receive social support and extensive counseling prior to and throughout treatment. Clinical pharmacists are well equipped to fill the role as a PrEP provider. This project was designed to describe and evaluate the initiation of an ambulatory pharmacist-led PrEP clinic.

Methods: A pharmacist with specialty residency training wrote a collaborative drug therapy management (CDTM) agreement and received approval to see patients independently in the PrEP clinic. The CDTM protocol allows pharmacists to follow national guidelines and evidence-based medication therapy management of disease states including (but not limited to) HIV PrEP and sexually transmitted infections (STIs). PrEP patients are identified and brought to clinic by referrals from medical providers, through outreach and recruitment by a PrEP specialist, and through walk-in requests. In collaboration with a PrEP specialist to provide social support and case management, patients are seen every one to three months by the clinical pharmacist as indicated. During clinical pharmacist visits, the pharmacist obtains medical and social history, performs a comprehensive medication review, assesses vitals and signs and symptoms of acute HIV infection, orders and reviews laboratory results, and assesses for adherence and adverse effects. Through this process, the clinical pharmacist determines if the patient is eligible for PrEP and prescribes when appropriate, with in-depth education and counseling.

Results: The CDTM agreement was approved and implemented within a hospital-based HIV primary care clinic. Patients are being referred to the pharmacist-led PrEP clinic by providers within infectious disease and from other providers within the hospital system, in addition to walk-in requests. Patients are actively being seen by two clinical pharmacists credentialed by the AAHIVM and three ambulatory care pharmacy residents. Patients are being evaluated, screened for HIV and STIs, and prescribed PrEP when appropriate. Clinical pharmacists are ensuring affordable access to PrEP by navigating managed care plans, obtaining prior authorizations, and providing copay assistance cards. All clinic visits are documented in the electronic medical record.

Conclusion: Clinical pharmacists have been able to effectively provide PrEP to patients at high risk of HIV acquisition through CDTM agreements in a pharmacist-led PrEP clinic. Clinic visit records will be monitored in order to review the impact of the pharmacist-led PrEP clinic.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 12-M

Poster Title: *Medication use evaluation of niacin in a Veterans Affairs healthcare system*

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Purpose: Niacin, a water-soluble B vitamin utilized for its lipid-lowering effects, has fallen out of favor due to underwhelming evidence of its benefit for atherosclerotic cardiovascular risk and poor tolerability profile compared to alternative lipid lowering options. The purpose of this review was to review niacin prescribing trends at the Central Alabama Veterans Health Care System (CAVHCS) and how they align with up-to-date evidence based medication therapy recommendations.

Methods: A retrospective chart review was conducted to determine the appropriateness of niacin use. Per facility policy, this evaluation was deemed to be non-research and was therefore not subject to institutional review board review. As of September 2017, 355 active niacin orders were present within CAVHCS. Fifty of those patients were randomly selected for chart review to determine if current niacin therapy was appropriate. Niacin therapy was determined to be appropriate if the patient had triglycerides greater than 500 mg/dL when niacin was initiated. Further determination of niacin therapy appropriateness was based on the 2016 American College of Cardiology Expert Consensus Decision Pathway on the role of non-statin therapies and the National Lipid Association recommendations for management of dyslipidemia.

Results: Seventy-eight percent (n equals 39) of reviewed patients were receiving niacin therapy inappropriately and were without documented triglyceride levels greater than 500 mg/dL upon initiation. It was found that the majority of patients receiving niacin were initially prescribed therapy for triglyceride lowering or HDL-c raising. Seventeen patients were prescribed niacin therapy for raising HDL-c levels, which was appropriate according to the available clinical practice guidelines at the time of prescribing; however, as available evidence no longer

supports prescribing niacin for the purpose of HDL-c raising, no patients are considered to be appropriately prescribed niacin for this indication. Currently, all patients who were initially prescribed niacin for HDL-c raising have triglycerides well below threshold for triglyceride targeted treatment; therefore, are not indicated to receive niacin at this time.

Conclusion: This review demonstrates current niacin use may not align with current clinical practice guideline recommendations. Inappropriate niacin utilization was found predominantly in two different circumstances including for triglycerides levels that did not exceed the recommended treatment threshold at initiation and as continuation of therapy, despite changes in guideline recommendations for lipid lowering therapy. Overall, the utilization of niacin is relatively low for this facility; however, given the proportion of patients receiving niacin inappropriately, there are potentially many who may benefit from lipid-lowering therapy optimization.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 13-M

Poster Title: *Outcomes of a primary care comprehensive medication management (CMM) implementation project at an academic health system: lessons learned from involvement in a national learning collaborative*

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Purpose: University of Utah Health Primary Care Pharmacy Services participated in the National A3 Collaborative to utilize comprehensive medication management (CMM) as a defined care process to accomplish the aim of bringing 750 of 1000 high risk patients with uncontrolled diabetes, hypertension, and use of high dose opioids to specified targets from July 2017 to May 2018. This aim was designed to motivate our clinical pharmacists and technicians to standardize their patient care process, align the philosophy of practice, and improve the practice management system to achieve improved patient outcomes and assess the clinical and operational outcomes of the project.

Methods: CMM implementation occurred with intentional stages including discussion of practice philosophy, adoption of a consistent patient care process, and honing similar practice management activities. Medication-therapy problems (MTPs) were collected within the electronic medical record (EMR) as one measure of fidelity to the care process and utilization of the practice management tool. A cohort of high-risk patients was identified and included those with a hemoglobin A1c (HbA1c) level greater than 8.9 percent, systolic blood pressure greater than 149 mm Hg or diastolic blood pressure greater than 89 mm Hg, and prescribed a morphine milligram equivalent (MME) of greater than 90 per day. Target was determined on the control side of the same threshold, such as HbA1c less than or equal to 9 percent. The pool of patients to assess was distributed across the sites based on clinical pharmacist full-time equivalent (FTE). Patients no longer seen in clinic or managed by another specialty were removed from the

patient pool. Feedback on additional mechanisms to support the adoption of CMM and improve patient outcomes was also sought from clinical pharmacists.

Results: As of February 28, 2018, 48 percent of defined high risk patients achieved their clinical goals including 67 percent in diabetes, 80 percent in hypertension and 93 percent in opioids. Within the same period, clinical pharmacists identified 6085 MTPs and typically demonstrated an increased number each month of the implementation project. Of the total number of MTPs identified, 18 percent were related to indication, 57 percent to efficacy, 14 percent to safety and 11 percent to adherence. Team members also identified several practices or tools to enhance implementation of CMM including a standardized note template, enhancement of existing peer review, and a more formalized and user-friendly mechanism for capturing MTPs. An additional need to document MTP resolution was also noted.

Conclusion: Utilization of CMM as a consistent care process by clinical pharmacists in a primary care setting yielded the identification of medication-related problems and an increase in the number of high-risk patients achieving clinical goals. Further implementation will center on standardized note documentation, documentation of MTPs identification and resolution, and peer review of clinical encounters.

Submission Category: Cardiology/Anticoagulation

Poster Type: Evaluative Study

Session-Board Number: 14-M

Poster Title: *Extended-interval home international normalized ratio (INR) testing*

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Purpose: Clinical pharmacist-run anticoagulation service (CPAS) clinics can provide high quality care for patients on warfarin, but therapy requires frequent office visits for international normalized ratio (INR) monitoring. Home INR monitoring may be more convenient, but utilizes weekly testing. Extended-interval (greater than or equal to 2 weeks) home INR testing could reduce patient burden, but lacks validation. This study evaluates if the time in therapeutic range (TTR) is non-inferior for patients using home INR testing at an extended interval compared to clinic-based testing at usual intervals.

Methods: The institutional review board approved this retrospective, case-control review of patients from Intermountain Medical Center CPAS clinic and McKay-Dee anticoagulation clinic from January 2009 to August 2017. All patients assigned to home INR testing on an approved device were screened. Non-pregnant patients 18 years of age or older who were anticoagulated for the treatment of venous thromboembolism or atrial fibrillation and assigned to extended-interval home INR monitoring were included in this review. The primary outcome of TTR was determined by the Roosendaal method. Patients with a period of clinic management within the study time frame, defined as greater than 6 INR measurements, acted as their own case-control. Statistical analysis was performed using a paired t-test, with a 10% difference in TTR considered non-inferior. INRs drawn prior to dose stabilization or during hospitalization were excluded. Notes from emergency department visits, hospitalizations, and clinic documentation of complications were used to identify bleeding and venous thromboembolism events.

Results: There were 67 home testing patients screened, 22 patients met inclusion criteria and were further reviewed (self-test n equals 22). There were 16 patients anticoagulated for a diagnosis of atrial fibrillation, and 6 patients anticoagulated for management of venous thromboembolism. There were 9 patients who also had a period of clinic management within the study time frame (clinic n equals 9). The average interval of testing for all self-test patients (n equals 22) was 15.2 days (median 14.2 days); during clinic management (n equals 9) the average interval was 18 days (median 18.4 days). The average TTR for all self-test patients was 73 percent (median 72 percent), the average TTR during clinic management was 65.2 percent (median 62.4 percent). For the case-control analysis (n equals 9), the mean difference in TTR between the home-testing period and clinic period was 3.3 percent, 95 percent confidence interval -6.3 to 12.8, p equals 0.46. There were no major bleeding events or thromboembolic events in any patients during the study period.

Conclusion: Patients with home INR testing at extended intervals had a TTR that was non-inferior when compared with routine clinic management. There were no major bleeding or thromboembolic events during the period of extended-interval testing. Extended-interval testing may be a reasonable alternative to traditional clinic management. Further research to assess extended-interval home INR testing and identify the optimal interval of home testing is warranted.

Submission Category: Cardiology/Anticoagulation

Poster Type: Descriptive Report

Session-Board Number: 15-M

Poster Title: *Liraglutide's impact on the occurrence of new onset systolic heart failure*

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Purpose: Type 2 diabetes mellitus is a major risk factor for cardiovascular disease, including heart failure. In alignment with the food and drug administration mandated cardiovascular safety analysis, certain novel agents, including liraglutide, have proven to reduce the incidence of heart failure hospitalizations. There has yet been a study evaluating the heart failure occurrence rate with these agents. Furthermore, utilizing intensive glucose control with any therapy has yet to be proven to reduce heart failure onset. Purpose of this study is to determine if exposure to liraglutide therapy has an impact on the frequency of new onset systolic heart failure occurrence.

Methods: The institutional review board approved this retrospective cohort study. Patients of 18 years of age and older from Intermountain Medical Group with SelectHealth coverage were reviewed from January 2010 to August 2017 and considered to have met the inclusion criteria if they had a diagnosis of type 2 diabetes mellitus, were prescribed metformin and liraglutide therapy, and did not have a prior documented echo, have a left ventricular ejection fraction found to be less than or equal to 45 percent or an International Classification of Disease 9 or 10 code for systolic heart failure. Patients that had a history of type 1 diabetes mellitus, gestational diabetes, use of alternative glucagon-like peptide-1 agents, thiazolidinediones, saxagliptin or alogliptin therapy, and end-stage renal or liver failure were excluded from this trial. Once the study population was identified, the same inclusion-exclusion criteria was utilized to identify a match population lacking exposure to liraglutide therapy. The primary outcome was the occurrence of reduced left ventricular ejection fraction less than 45% and/or an International Classification of Disease 9 or 10 code for systolic heart failure while on liraglutide therapy in comparison to the patient population without liraglutide exposure. Secondary outcomes included subgroup analysis based upon known additional risk factors, duration of liraglutide therapy, and presence of specific concurrent therapies.

Results: There were a total of 2,853 patients identified having been prescribed liraglutide therapy during the study period and 143 met inclusion criteria. Using the same inclusion criteria, a match population of 136 not exposed to liraglutide or alternative glucagon-like peptide-1 receptor agonists agents. Patient demographics were similar between the groups including average duration exposure to metformin. The average time of therapeutic liraglutide therapy exposure was 2.7 years during the study period. The primary outcome of heart failure occurred in 7 of 143 patients in the liraglutide group (4.9 percent), and 7 of 135 patients in the control group (5.2 percent). The proportion of patients developing heart failure was not statistically significant between the treatment group and control group with a difference of 0.3 percent, 95% confidence interval -4.9 to 5.5 percent, p equals 0.91.

Conclusion: There was no difference in the rate of development of heart failure following the exposure to liraglutide therapy. As this study included a small sample size with a small study period in considering the time line for heart failure development, this study would support need for future research addressing diabetes therapy in reducing heart failure occurrence.

Submission Category: Clinical Services Management

Poster Type: Descriptive Report

Session-Board Number: 16-M

Poster Title: *Assessment of patient safety outcomes and clinical pharmacy services efficiency before and after implementation of real-time clinical surveillance technology*

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Purpose: Drug-related adverse outcomes occur in nearly 4.7 percent of all inpatient hospital visits and are often avoidable. Realizing the opportunity to decrease adverse patient outcomes by expanding the pharmacist's role in patient-centered care, our health-system moved from pharmacist-reliance on retrospective review of printed reports to use of real-time clinical surveillance technology. This narrative describes the technology deployment, patient safety and operational efficiency outcomes after implementation.

Methods: Clinical surveillance technology was deployed to hospitals in five separate groups across our health-system as a 6-month, multi-step process. Surveillance technology used data streams from the electronic medical record and sent them through a sophisticated rule engine system. If patient data satisfied criteria for the rule algorithm, an evidence-based alert was generated in the pharmacist work queue indicating a potential opportunity for clinical intervention or drug therapy modification. Inpatient coded adverse drug events, hospital-acquired venous thromboembolism events and pharmacist productivity were tracked before and after implementation. The baseline rate for each implementation group was calculated separately and combined into the overall baseline rate. Baseline time periods for each group were: Group 1: 7/2013 to 6/2014, Group 2: 10/2013 to 9/2014, Group 3: 4/2014 to 3/2015, Group 4: 10/2014 to 9/2015, Group 5: 4/2015 to 3/2016. This combined baseline rate was then applied to the number of inpatients over the previous 4 quarters of 2017 to determine the number of coded hospital-acquired adverse drug and venous thromboembolism events if performance had not changed since baseline. The number of events that would have occurred minus the number that did occur resulted in the number of avoided adverse drug and venous thromboembolism events. Documented pharmacist clinical interventions were counted before

and after implementation, and pharmacist time to respond to alerts was collected year over year after technology implementation.

Results: Across 159 hospitals, the inpatient hospital-acquired coded adverse drug event rate in 2017 decreased by 47 percent compared to baseline. Likewise, hospital-acquired venous thromboembolism decreased by 31 percent after implementation compared to baseline. Clinical pharmacists nearly doubled their productivity after implementation, completing over 3.1 million clinical interventions in 2017 and responding to alerts an average of 3 hours more quickly in 2017 compared to 2016. These results have supported technology implementation in new hospitals added to our health-system.

Conclusion: Implementing real-time clinical surveillance technology to support clinical pharmacy services decreased the number of hospital-acquired coded adverse drug and venous thromboembolism events across our health-system. Pharmacist-completed clinical interventions increased and time to alert response decreased after technology implementation, thus improving overall inpatient care. Disclaimer: This research was supported (in whole or in part) by HCA and/or an HCA affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA or any of its affiliated entities.

Submission Category: Clinical Topics/Therapeutics

Poster Type: Evaluative Study

Session-Board Number: 17-M

Poster Title: *Comparison of the rates of release of commonly used compounded topical formulations containing one active ingredient or multiple active ingredients*

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Purpose: Transdermal dosage formulations are an important pharmacy practice that is rapidly growing for pain management. The key benefit of transdermal dosage formulations is that they may be applied locally to the site of action or irritation, serving populations unable to administer any medications by mouth. Transdermal penetration allows medications to enter systemic circulation for therapeutic effects. The purpose of this study is to assess the stability of multi active pharmaceutical ingredients in formulation as a compounded topical cream. It is predicted that drugs in transdermal formulations will kinetically behave differently in formulation than when mixed with various active ingredients.

Methods: Commonly used analgesic medications were compounded both alone and in combination with various medications in transdermal bases. The physical stabilities of the individual bases were assessed through centrifugation by extracting and weighing 1 milliliter of the transdermal sample. The samples were then spun in the centrifuge at 25 degrees Celsius at 15000 relative centrifugal force for five minutes and weighed again for determination of premature signs of instability and base separation. Drug release from the bases was determined in the Franz Diffusion Cell Apparatus over a 24-hour time frame and prepared for further evaluation. All samples were then run on the Shimadzu HPLC to determine present drug content using a validated method that evaluated specificity, linearity, precision, accuracy, lower limit of detection, and quantification discovered. Data from HPLC was then graphed to compare and contrast the peaks and rate of degradation between the single and multiple active formulations.

Results: In order to determine a true difference between formulations with a single active ingredient in comparison to multi active formulations, each formulation was individually graphed to visually depict the varying kinetic behaviors. Addition of lidocaine to multi-active formulations resulted in immediate signs of physical instability. (formulation 2-21 percent breakage, formulation 3-10 percent breakage) No other signs of physical instability were noted in formulations tested. Of the formulations tested, inclusion of lidocaine or clonidine in formulation significantly increased their rates of release than when compared to being in formulation alone. For other drugs tested, the impact of release rate varied by formulation.

Conclusion: Based on the results of this study it is apparent that formulating drugs alone or in formulations impacts their physical stability or release rate. Each result varied from its neighboring formulation in which some degraded quicker, faster, or at the same rate. Compounding pharmacists should be aware that formulating multiple drugs in transdermal bases could impact the patient's therapeutic effect.

Submission Category: Drug Information/Drug Use Evaluation

Poster Type: Evaluative Study

Session-Board Number: 18-M

Poster Title: *Evaluation of the usability of a newly developed tablet container intended to aid medication intake and enhance patient adherence*

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Purpose: Adherence has a major influence on the success of drug treatment. Therefore, some devices or instruments are used in clinical settings to help patients remember to take their medicine. Recently, a novel tablet container was developed that supports medication intake to enhance patient adherence. This container prepares tablets in advance and has an LED that flashes to notify the patient when it is time to take the medication. Tablet intake is then recorded and sent to family members and health care professionals. The usability of this tablet container was evaluated in terms of whether patients encounter problems when operating it.

Methods: Elderly patients older than 65 years with and without a history of cerebral infarction were enrolled at two community pharmacies in Japan. All patients gave written informed consent, and the study protocol was approved by the Ethics Committee of the University of Shizuoka, Japan. Patients' characteristics, e.g. degrees of finger movement function and cognitive function, were obtained. The container and the placebo tablets were donated by Otsuka Pharmaceutical Co., Ltd. (Tokyo, Japan) for this study. Patients received instructions on how to take tablets out of the container through written documents and instructional videos, but did not receive instruction from pharmacists. For the first trial, patients attempted to take one tablet out of the container after the LED flashed. If the patient could not successfully remove the tablet within 3 minutes, then a pharmacist demonstrated to the patient the procedure of removing the tablets out the container. The patients also received instructions via documents and video. The patient then attempted to take out one tablet from the container in a second trial. The success rate of taking out a tablet and the time required to take out the tablet were evaluated. A survey was conducted to evaluate the ease of using the container,

including the ease of removing a tablet, recognizing the LED flash, and understanding the instructional documents and videos.

Results: Of the 31 elderly patients enrolled, 19 (11 females, 8 males; age 72 [65 to 97] years, median [range]) did not have a history of cerebral infarction and 12 (2 females, 10 males; age 80 [68 to 87] years) had a history of cerebral infarction. In elderly patients without a history of cerebral infarction, the success rate in taking out a tablet in the first and second trials was 78.9% and 100%, respectively, while in those with a history of cerebral infarction, the success rates were 66.7% and 91.7%, respectively. There was no significant difference in the success rate between the patients (first practice, $p=0.676$; second practice, $p=0.406$). Median time to take out the tablet by patients with and without a history of cerebral infarction were 10.8 and 23.3 seconds, respectively, in the first trial, and 28.0 and 46.5 seconds, respectively, in the second trial. Multiple regression analysis indicated that impairments in finger movement function, age, and cognitive function influenced the operation time of the container ($p=0.032$, 0.069 , 0.066 , respectively). Patients surveyed stated that the ease of taking out a tablet was moderate, and the ease of recognizing the LED flash and understanding the instructional documents and videos was high.

Conclusion: This study showed that most elderly patients could operate this container. Moreover, it could be operated in a sufficiently short time (less than 25 seconds) in patients who successfully took out the tablet in the first trial. This container and its attached module, which records medication history and shares data with family members and health care professionals, may support the medication intake of patients. Use of this container may enhance patient adherence and reduce the number of forgotten doses, resulting in an improved clinical effect.

Submission Category: Drug Information/Drug Use Evaluation

Poster Type: Evaluative Study

Session-Board Number: 19-M

Poster Title: *A health-system wide evaluation of appropriateness and formulary optimization of ezetimibe*

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Purpose: Hypercholesterolemia is linked to increased risk for cardiovascular disease, which remains a major cause of morbidity and mortality in the United States. HMG-CoA reductase inhibitors (statins) remain the drug of choice for patients with hypercholesterolemia. Use of non-statin therapies, compared with statin therapy, do not provide adequate atherosclerotic cardiovascular disease (ASCVD) risk-reduction benefit relative to their potential for adverse effects. Non-statin therapies are primarily utilized for patients unresponsive or intolerant to statins. The purpose of this drug-use evaluation was to evaluate ezetimibe use in the inpatient setting and to assess the potential for formulary removal.

Methods: A retrospective chart review was performed of patients aged 18 years and older who received ezetimibe during an inpatient admission from October 2016 to July 2017 within the health-system. Patients who were ordered and administered ezetimibe per the health-system's electronic health record were randomly sampled for inclusion. The following data was collected: patient age, gender, allergy to statin and reaction history, hospital length of stay, ordering service-line, ezetimibe indication for use, ezetimibe monotherapy vs. a combination with statin, and if ezetimibe was a new start in the inpatient setting. As this was a retrospective drug use evaluation, approval from the institutional review board was not required.

Results: : A total of 100 patients were included in this retrospective analysis. The number of patients included from each hospital was evenly distributed according to hospital size. The mean age of the study population was 73 and 53 percent were male. Average hospital length of stay was 5 days. Nineteen percent of patients had a documented allergy to statin medications. The majority of patients did not have a documented reaction to statins in their allergy history. Six patients had myalgia listed as an intolerance, and one patient had hives documented for their statin reaction history. Across the health-system, ezetimibe's primary indication for use

was hypercholesterolemia/hyperlipidemia for 87 percent of patients. Seventy-one percent of patients were on statin therapy concurrently with ezetimibe, with atorvastatin being the most commonly prescribed statin. Only eight percent of patients were on combination therapy with simvastatin and ezetimibe. During the study period ezetimibe was a new start medication for five patients.

Conclusion: Inpatient administration of ezetimibe may be clinically warranted for those patients who are unresponsive or intolerant to statin therapy. Results of this drug-use evaluation revealed that a minority of patients had a documented history of statin intolerance and the majority were on concomitant statin therapy. The findings from this review resulted in formulary optimization through the removal of ezetimibe from the inpatient health-system formulary.

Submission Category: Drug Information/Drug Use Evaluation

Poster Type: Evaluative Study

Session-Board Number: 20-M

Poster Title: *Evaluation of nivolumab use in Daegu Catholic University Medical Center*

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Purpose: Nivolumab is a fully human recombinant monoclonal IgG4 antibody to the PD-1(programmed cell death receptor-1)which modulates T cell immune reactivity and is used in cancer immunotherapy. Inhibition of PD-1 receptors on the surface of activated T cells allows for a continued activation of T cells. The enhancement of cytotoxic reactivity may play a beneficial role in cancer. Nivolumab is effective treatment option as new cancer therapeutic agents, but there is a lack of experience in the management of drug use and side effects. Therefore, we attempt to evaluate the status of nivolumab use and the associated factors.

Methods: This study was retrospectively conducted with patients who had been administered nivolumab at least once at the DCUMC(Daegu Catholic University Medical Center) from September 2017 to March 2018. Data were collected from electronic medical records(EMR) included patient demographics(age, sex), indication, drug dose, administration period, and adverse events. The evaluation criteria for drug use was set based on FDA guidelines on medication-use evaluation.

Results: The total number of screened patients was 10. 8 patients were treated with FDA-approved indication(7 are lung cancer, 1 is melanoma). 2 patients(advanced gastric cancer) were administered with Japan-approved indication. 90% Patients had received intravenous nivolumab according to 3mg per kilogram of body weight and 10% was administered an unapproved fixed dose of 200mg every 2 weeks. All patients were monitored with Chest PA(Posterior Anterior), glucose level, liver function and renal function. But only 2 patients (20%) were monitored with thyroid function. Of the 10 patients who administered nivolumab, 4 patients(40%) developed adverse reactions. 1(10%) lung problem(pneumonitis), 1(10%) intestinal problem(colitis), 1(10%) liver problem(hepatitis), 1(10%) skin problems(acute dermatitis).

Conclusion: The clinical use of immune checkpoint inhibitors is expanding rapidly. Nivolumab was generally well compliant to the approved use at the DCUMC. However, side effect of Nivolumab could not be inspected carefully. From now on, more accurate guidelines and pharmacist's role for using Nivolumab appropriately and safely need to be established.

Submission Category: Geriatrics

Poster Type: Descriptive Report

Session-Board Number: 21-M

Poster Title: *Utilizing nurses improving care for healthsystem elders (NICHE) training to promote collaborative patient care in hospitalized geriatric patients*

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Purpose: The geriatric patient population, age 65 and older, is at increased risk for complications during hospitalization due to comorbidities, polypharmacy, and altered pharmacokinetic parameters. Nurses Improving Care for Healthsystem Elders (NICHE) is an international training program that aims to improve geriatric patient care. The NICHE program at our institution began in 2016 and currently represents various healthcare disciplines. This report describes the role of a pharmacist in the NICHE training program at an urban, community teaching hospital as well as the potential impact on reducing inappropriate inpatient antipsychotic use for the treatment of delirium in the elderly population.

Methods: The NICHE training program is structured to be a multidisciplinary learning experience. The program includes 16 hours of material delivered over multiple sessions and is designed to discuss the aging mind, body, and spirit. Program learners include registered nurses, patient care assistants, medical residents, physical therapists, occupational therapists, speech therapists, volunteers, clinical pharmacists, and medication-safety pharmacy fellows. One focus area of these sessions pertained to the management of delirium in geriatric hospitalized patients. While the hospital staff and volunteers play a major role in recognizing the signs of delirium, promoting mobility, and orienting patients to time and place, the pharmacist has a unique role in identifying appropriate therapy. A clinical pharmacist and two medication safety fellows provide education on the topic of delirium and geriatric prescribing principles during the session on aging body. This presentation focuses on the importance of preventing delirium to avoid the inappropriate use of antipsychotics and benzodiazepines due to unwanted side effects, including increased fall risk, and discusses treatment options if pharmacotherapy is required. Pharmacy presenters engage learners by introducing patient case

scenarios that mimic practice to challenge understanding of drug therapy, including dose, frequency, and duration.

Results: This educational program, on average, consists of 40 learners and features presentations from multidisciplinary leaders, breakout sessions, and learning activities. The training results in interprofessional collaboration amongst training participants and the use of “NICHE bins,” which include tools, such as adult coloring books, calendars, and glitter bottles, to stimulate the mind and prevent delirium in patients at an increased risk. It is still early to conclude whether including a pharmacy session targeting delirium management will lead to a decrease in the use of antipsychotics in the elderly or eliminate the use of inappropriate medications to treat delirium like benzodiazepines. Antipsychotic use and prescribing practices is currently under investigation.

Conclusion: Geriatric patients are a vulnerable patient population. Our hospital received the NICHE Hospital designation in 2016 showcasing its commitment to elder care excellence and quality improvement. A pharmacist can be an influential participant and an educator in a hospital NICHE training program. A future NICHE initiative for our hospital includes creating a delirium order set that would include a nurse-driven patient assessment, which would then trigger prevention strategies, occupational therapy consults, and/or pharmacotherapy options when necessary. The goal of this order set would be to reduce and prevent unnecessary antipsychotic and benzodiazepine use in geriatric patients.

Submission Category: Geriatrics

Poster Type: Evaluative Study

Session-Board Number: 22-M

Poster Title: *Effects of statins on functioning and mortality outcomes among subgroups of frail older adults after acute myocardial infarction*

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Purpose: Many studies have examined the effects of statins after acute myocardial infarction (AMI), but nearly all excluded frail older nursing home (NH) residents, few examined functional outcomes, and almost none examined subgroup effects. The effect of statins on muscle pain, weakness, and functional decline is controversial and remains unclear. NH residents may benefit less from statins and be susceptible to adverse drug events, especially in subgroups with cognitive or functional impairment. The purpose of this study is to evaluate the subgroup effects of statins after AMI on 1-year functional decline and death among frail older adults in the NH setting.

Methods: We conducted a retrospective cohort study using a national U.S. sample of 5,440 NH residents aged 65 and older who were statin nonusers for at least 12 months, were hospitalized for AMI between May 2007 and March 2010, and subsequently returned to the NH. The dataset comprised linked Medicare claims, Minimum Data Set clinical assessments, and NH facility data. Outcomes included 1-year functional decline and death. Functional status was measured with the Morris scale of independence in activities of daily living. Cox proportional hazards regression models were used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) comparing new statin users to nonusers after propensity score matching. By including an interaction term in the regression models, subgroup analyses were conducted for baseline physical functioning, cognitive performance, age, and length of intensive care unit/critical care unit (ICU/CCU) stay.

Results: The cohort consisted of 5,440 NH residents. The mean age was 83 years and 69% were female. There were 1608 functional decline and 4693 death events. Statin use was associated with reduced mortality regardless of baseline physical functioning, cognitive performance, age or ICU/CCU stay (P values for effect modification = 0.80, 0.64, 0.49, and 0.95, respectively). There was no difference between statin users and nonusers for functional decline regardless of baseline physical functioning, cognitive performance, age or ICU/CCU stay (P values for effect modification = 0.39, 0.34, 0.83, respectively). However, individuals age ≥ 85 were less likely to have a functional decline (HR 0.84; 95% CI, 0.68-1.03) while those < 85 were more likely (HR 1.11; 95% CI, 0.95-1.31)(P value for effect modification = 0.04).

Conclusion: NH residents who used statins had reduced mortality benefit across all subgroups. Statin use was associated with increased functional decline in patients < 85 years, but more functional decline among those age ≥ 85 .

Submission Category: Infectious Diseases/HIV

Poster Type: Evaluative Study

Session-Board Number: 23-M

Poster Title: *Comparative incidence of acute kidney injury in hospitalized patients receiving concomitant vancomycin with piperacillin-tazobactam or cefepime*

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Purpose: To evaluate the incidence of AKI in hospitalized adult patients receiving the combination of vancomycin and piperacillin-tazobactam compared to vancomycin and cefepime, and to assess the mean time to reach AKI in each group.

Methods: This study was an IRB approved retrospective cohort study at a community hospital in Denver, Colorado. A total of 185 adult patients were identified who received a minimum of 48 hours of combination therapy with vancomycin and either cefepime (n=84) or piperacillin-tazobactam (n=101) between 2014 and 2016. Data collection and chart review were performed using the electronic medical record system. Patients were eligible for study inclusion if they met the following criteria: 18 years of age or older, had a baseline serum creatinine (SCr) value within 24 hours of admission, had initiated and received 48 hours or more of therapy with combination antibiotics initiated no more than 48 hours apart, and had at least one appropriately drawn vancomycin trough that was less than 25 mg/dL. Patients who had any trough greater than 25 mg/dL were excluded along with patients who had known CKD/ESRD, recent AKI, baseline SCr 1.2 or greater, history of renal transplant or any structural kidney disease, or if combination antibiotic therapy was less than 48 hours. The primary outcome compared the incidence of AKI in each combination group according to predefined criteria set by K-DIGO, AKIN, and RIFLE. The secondary outcome assessed the mean time to be diagnosed with AKI following 48 hours of combination antibiotic therapy.

Results: At baseline neither group had a significant difference in regards to their age, gender, renal function, and number of nephrotoxic medications. For the primary outcome measure, 10.7% of the patients in the vancomycin/cefepime group experienced AKI compared to 30.7% in the vancomycin/piperacillin-tazobactam group ($p<0.05$). The mean time to documented AKI was 90 hours for the vancomycin/cefepime group compared to 75.1 hours in the vancomycin/piperacillin-tazobactam group ($p<0.05$).

Conclusion: The results of this study showed that there was an increased risk of developing AKI in patients receiving vancomycin/piperacillin-tazobactam therapy compared to vancomycin/cefepime therapy. Additionally, the mean time to reach AKI in patients who did experience it was faster for patients in the vancomycin/piperacillin-tazobactam group compared to those in the vancomycin/cefepime group.

Submission Category: Infectious Diseases/HIV

Poster Type: Evaluative Study

Session-Board Number: 24-M

Poster Title: *Evaluation of a pharmacist-led vancomycin dosing protocol in an urban hospital*

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Purpose: Vancomycin, a glycopeptide antibiotic, is indicated in the eradication of methicillin-resistant staphylococcus aureus (MRSA) and other gram positive infections. Sub-therapeutic vancomycin exposure may result in treatment failure as well as the emergence of resistant bacteria. The objective of this study was to evaluate whether the implementation of a pharmacist-led vancomycin dosing protocol increased the attainment of therapeutic trough levels.

Methods: The computerized physician order entry (CPOE) system, Soarian®, was utilized to identify patients that received vancomycin therapy from January 1, 2018- February 28, 2018. In January all patients were dosed upon physician management. In February, following the implementation of the protocol, patients were stratified upon whether they had been dosed upon physician management or the pharmacist-led protocol. The data collected included indication, culture data, serum trough level, initial and maintenance vancomycin dosing, and the patient's renal function. The outcome measured was the attainment of a therapeutic vancomycin trough, defined as 10-15 mcg/mL and 15-20 mcg/mL for severe infections.

Results: A total of 75 patients, 38 for the month of January and 37 for February were included. In January, 26 (68%) patients achieved therapeutic trough levels per indication following the first level drawn at steady state. In February, 20 patients were dosed by the pharmacist-led protocol and 17 were dosed by physician management. Of the 20 patients dosed upon the protocol, 17 (85%) achieved therapeutic trough levels per indication following the first level drawn at steady state. For the remaining 17 patients, dosed by physician management, 12 patients (71%) achieved therapeutic trough levels.

Conclusion: A pharmacist-led vancomycin protocol increases the probability of the attainment of therapeutic vancomycin trough levels. Additional data is required to further evaluate the impact of the protocol.

Submission Category: Informatics/Technology/Automation

Poster Type: Descriptive Report

Session-Board Number: 25-M

Poster Title: *Smart infusion pump interoperability: challenges and optimization efforts from the first year post-implementation*

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Purpose: Smart infusion pump interoperability with an electronic medical record (EMR) is designed to pre-populate pumps with the infusion parameters from the EMR through barcode-scanning the patient, medication, and pump. Having the order details for medications sent directly to the pump limits the amount of manual programming required by nurses, which literature suggests decreases medication errors and improves infusion management. The implementation and maintenance of smart infusion pump interoperability introduces new challenges for pharmacy informatics and medication use departments, especially in the first year post-implementation.

Methods: Implementation planning for smart infusion pump interoperability began in June 2016 with a multidisciplinary team including pharmacy, nursing, clinical engineering, clinical workflow support, project management, information technology, and representatives from our EMR and infusion pump vendors, with implementation occurring in March 2017. Challenges during the first year post-implementation included on-boarding and testing of new and modified medications, adoption of interoperability by nursing staff, manual programming without use of the dose error reduction system (DERS), medication order settings in the EMR, workflow design standardization and optimization, distinguishing primary and secondary infusions, validation of one-to-one mixture-to-pump build, anesthesia drug library redesign and consolidation, standardization of infusion concentrations, motion waste in the patient care environment, and a deficit of bolus and PCA functionality. To address these challenges, members of the pharmacy informatics and the medication use teams created standard work, developed interdisciplinary committees to focus on lean methodology for problem solving, and

implemented changes in the EMR. Initiatives to improve interoperability have continued throughout the first year post-implementation.

Results: Multiple optimization efforts were completed over the course of the first year post-implementation of smart infusion pump interoperability. A standardized method for onboarding newly approved or modified infusion medications was implemented and refined by the pharmacy informatics and medication use teams, resulting in a streamlined process for EMR build and interoperability testing. EMR data regarding interoperability use compliance by nursing was retrieved and available for review on a monthly basis, as was data collected from the infusion pumps regarding compliance with the DERS. Results of data analysis as well as opportunities for improvement exposed by the implementation of a new infusion medication administration workflow resulted in the creation of interdisciplinary efforts to improve interoperability success by modifying infusion medication settings in the EMR, redefining infusion workflows, standardizing medication ordering, and redesigning drug libraries. After implementation of the optimization efforts, there was no change in the rate of compliance for use of pump interoperability or the pump DERS; however, there was a reduction in the number of interoperability errors related to EMR system build issues.

Conclusion: Assessment of infusion medication order build in the EMR and standardization of drug libraries in the infusion pump prior to implementation of pump interoperability may prevent some infusion pump workflow challenges. After one year post-implementation of smart infusion pump interoperability, resolution of EMR system build issues was associated with a reduction of interoperability errors, but the impact of optimization efforts targeting compliance of use for pump interoperability and the pump DERS is unclear. Continuation of efforts to implement infusion pump workflow improvements may have a future impact on the compliance of use for pump interoperability and the pump DERS.

Submission Category: Informatics/Technology/Automation

Poster Type: Descriptive Report

Session-Board Number: 26-M

Poster Title: *Development of an opioid dashboard for monitoring discharge and clinic prescribing trends at an academic medical center following implementation of a new electronic health record*

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Purpose: The opioid epidemic continues to plague the nation. The CDC reports that on average, 115 Americans die every day from overdosing on opioids. Opioid dispensing at pharmacies and hospitals has increased fourfold from 1999 to 2010 and the excess supply of prescribed opioids is a significant contributor towards illegal use. Hence, evaluation of opioid prescribing habits and identification of overprescribing patterns is crucial information and a pre-requisite to development of interventions aimed at reducing inappropriate prescribing. This project was designed to discover outpatient opioid prescribing trends at an academic medical center following implementation of a new electronic health record.

Methods: An opioid data workgroup was created to identify data metric needs. This workgroup consisted of two medical directors, two pharmacy clinical directors, a medication safety officer, two informatics pharmacists, a PGY1 pharmacy administration resident and a PGY2 pharmacy informatics resident (primary development lead). The workgroup met once a week to discuss improvements to the queried data and to optimize visualizations elements for the dashboard. Data was extracted from the newly implemented electronic health record's database through a custom SQL (Structured Query Language) query, which was placed within a data visualization tool to create the interactive dashboard. Prescribing data was obtained from all clinical departments for the following opioids: butorphanol, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, levorphanol, meperidine, methadone, morphine, oxycodone, pentazocine, tapentadol, and tramadol. Intravenous drug forms were excluded. Data elements queried were as follows: order id, order time and date, discontinued order time and date, name

of the drug, sig (directions for use), drug strength, drug quantity, drug form, ordering provider name and title, supervising provider name and title, attending provider name and title, and the department where the order was written.

Results: Two types of dashboards were created as a result of needs identified by members of the opioid data workgroup: 1) A high-level institution display showing prescribing trends across the institution and within each department, and 2) A department-level display showing provider prescribing trends. The latter department-level display was needed to operationalize potential future interventions to influence best-practice prescribing among providers. Initial data acquisition identified several fields incorrectly populated within the new EMR, which prompted internal quality improvement efforts. Furthermore, total morphine milligram equivalents (MME) was calculated per prescription as a result of limitations in the data.

Conclusion: The development of an outpatient opioid prescribing dashboard was an interdisciplinary effort to begin a multi-layered strategy to track and trend opioid prescribing at an academic medical center. This tool will be deployed to department and enterprise-level stakeholders to measure progress with reducing inappropriate opioid prescribing.

Submission Category: Informatics/Technology/Automation

Poster Type: Evaluative Study

Session-Board Number: 27-M

Poster Title: *Evaluating the impact of a systematic approach to optimizing medication alerts in a health-system*

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Purpose: Limited literature evaluates a sustainable process for optimization of medication alerts when implementing a new EHR technology with clinical decision support (CDS) capabilities. This study aimed to provide health-system enterprises with a systematic approach to optimizing medication alerts with new EHR technology and evaluate the impact of systematic interventions to a medication related clinical decision support system.

Methods: An 81 week quasi-experimental study was conducted to evaluate the impact of interventions made to medication related CDS alerts by a multi-disciplinary committee. The primary endpoint was weekly acknowledgement rates of medication alerts after drug-drug interaction reclassification. Secondary endpoints included weekly provider modification rates in response to drug alerts, monthly number of alerts per 100 medication orders, and subgroup analysis of various types of medication alerts on a weekly basis. Data on alert and warning frequency, severity, and response type were analyzed subsequent to committee interventions to determine the impact of committee led interventions. Interrupted time series regression analysis was utilized to assess primary and secondary endpoints over the study time period.

Results: A significant increase in weekly provider modification and acknowledgement rates ($2.02 \pm 0.17\%$, $p < 0.001$; $1.48 \pm 0.25\%$, $p < 0.001$). Total alerts per 100 medication orders significantly decreased after drug-drug interaction classification (Pre-intervention median: 88.4 vs Post-intervention 63.1, $p = 0.017$).

Conclusion: Committee led interventions to drug-drug interactions facilitated an increase in both medication alert acknowledgement and modification rates, as well as an overall reduction in alerts.

Submission Category: Informatics/Technology/Automation

Poster Type: Evaluative Study

Session-Board Number: 28-M

Poster Title: *Clinical and economic burden of managing refrigerated medications in the acute United States healthcare settings*

Primary Author: Patrick Callahan, Becton Dickinson & Co (BD); **Email:** patrick.callahan@bd.com

Purpose: Refrigerated medication storage is a complex process. Not all refrigerators nor temperature monitoring equipment may offer the needed mix of benefits. While medical grade refrigerators are recommended, proper implementation and use is also of critical importance, including; location, appropriately sized, ensuring a level refrigerator, a well-ventilated room, an emergency electrical power-source, single-unit per electrical outlet, temperature monitor tracking, documentation and accurate alarm management. While drug manufacturers offer storage recommendations for individual medications, few practice guidelines and standards are available. This study's purpose is to assess the clinical and economic burden of managing refrigerated medications within the acute US healthcare system.

Methods: A literature review of evidence was conducted in MEDLINE, Embase, Cochrane Library databases and conference proceedings from ASHP Midyear and Summer Meetings. Studies published in peer-reviewed journals in English language from 2007 - 2017 and abstracts published from ASHP from 2012 - 2017 were screened. Additionally, grey literature was searched using Google for relevant white papers, newspaper articles and reports. Articles were included if they reported; direct evidence of the management of refrigerated medication in the acute pharmacy or POC setting, patient-specific infusions or injections, line item management of vaccines, lorazepam (Ativan), succinylcholine or neuromuscular-blocking agents, anesthesia, antibiotics, insulin or suppositories. Additionally, articles were also included if they reported the clinical and, or economic consequences of medical grade refrigerator, dorm-style under counter refrigerators or pharmacy policies and procedures. Articles focused on non-hospital pharmacy inventory management, drug formulation studies, or vaccine cold chain management in remote locations or developing countries were excluded.

Results: More than 300 articles were included in the initial stage of this analysis. Subsequent full-text screening reduced this number to a final 42 articles. Thirty-five (35) of these articles were related to vaccinations. Matthias et al, in 2007 noted in their literature review across 35 studies that 14 – 35% of refrigerators or transport shipments were exposed to freezing temperatures, possible inactivating these products. The World Health Organization (WHO) note

the potential public health issue of vaccine damage from inadequate cold chain management, including; decreased herd immunity, increased epidemic, further complicated with at-risk populations and increased healthcare spending. Hanson et al, in 2017 updated research by Mathias et al, 2007. Hanson et al, across the 45 studies included in their literature review update that vaccine cold chain management is still a persistent issue. The other articles included in this analysis discussed the issue of waste, inefficiencies, ambient vs temperature sensitive medication management process confusion on staff. Several articles were excluded, as they were published in Europe, however, these articles directly investigated the cost and economic burden of poor cold chain medication management.

Conclusion: Refrigerated medication storage is a complex process, and the utilization, documentation and management of refrigerated medication may be further complicated by varied and disconnected processes, as well as, managing remote storage locations. Future research and evolving technologies may provide improved visibility and traceability of medications which can help optimize refrigerated medication management. Further research could be warranted to directly assess the economic burden of this topic. Additionally, education of effect sub-optimal technology use and protocol compliance may further empower healthcare professionals to jointly address this issue.

Submission Category: IV Therapy/Infusion Devices

Poster Type: Descriptive Report

Session-Board Number: 29-M

Poster Title: *Smart infusion pump usage patterns by healthcare organizations and frontline nurses*

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Purpose: Intravenous infusion pumps have been used for years in the health care setting to deliver parenteral medications at specific rates. Smart pumps with dose-error reduction software allow organizations to create medication libraries with dosing guidelines. The Institute for Safe Medication Practices (ISMP) published smart infusion pump guidelines in 2009 and is collaborating with the healthcare community again to update these guidelines and establish additional best practices. In preparation for a national summit to be held in May 2018 that will kick off this initiative, ISMP has conducted two surveys on current trends in smart pump usage across the US.

Methods: Four months of survey data were collected from November 16, 2017, to March 9, 2018. Two separate surveys on smart pump usage were conducted: a 28-item survey intended for various healthcare professionals, including pharmacists, nurses, physicians, and information technology staff; and a 10-item survey for actively practicing frontline nurses, the primary users of smart pumps. Recruitment involved public announcements in the ISMP Medication Safety Alert! Acute Care and Nurse AdviseERR newsletters, which provided a link to the survey. The surveys contained both multiple choice and free text responses. A demographics section was included to capture professional discipline, practice setting, and staff level of each respondent.

Results: A total of 618 respondents, mostly hospital nurses (68%) and pharmacists (22%), completed the 28-item survey, and 438 frontline nurses who primarily work in adult medical-surgical units (30%), adult critical care units (26%), and the emergency department (13%) completed the 10-item survey. In the 28-item survey, more than 80% of respondents reported using smart pumps for IV fluids and medications, parenteral nutrition, patient-controlled analgesia, and blood administration. However, fewer reported using smart infusion pumps for syringe infusions (64%), epidural medications (52%), and MRI infusions (20%). In the 10-item

survey, 78% of front-line nurses indicated they programmed drugs into the smart pump library more than 90% of the time. However, half of the nurses reported programming plain IV fluids in the drug library less than 5% of the time. More than one-third of the nurses who reported lower compliance with using the drug library for either medications or plain IV fluids reported that the solutions were not always in the drug library. In both surveys, the most frequently reported smart pump-related errors involved secondary infusions—a topic frequently cited when respondents were asked about the biggest challenges they faced with using smart pumps.

Conclusion: These surveys are limited in that the responses do not represent a random sampling of all healthcare practitioners involved in smart pump library maintenance and use. However, the large number of respondents suggests that these results offer a glimpse into current barriers to optimized smart infusion pump use and key knowledge gaps. These challenges and knowledge gaps must be addressed before health systems consider smart pump interoperability with the EHR. Overall, these findings have helped shape questions to address as ISMP works towards updating smart pump guidelines to enhance patient safety.

Submission Category: IV Therapy/Infusion Devices

Poster Type: Evaluative Study

Session-Board Number: 30-M

Poster Title: *Potential impact of smart pump and electronic health record (EHR) integration on infusion safety*

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Purpose: Intravenous (IV) infusion medications pose safety challenges because of the multiple steps required during administration, including pump programming. Smart pumps provide safety features that can prevent medication errors by providing dosing limits. Recent advances in smart pumps permit integration with the electronic health record (EHR) medication orders, allowing for automated pump programming. This may provide additional safety, however, the impact on errors is unknown. This study aimed to assess the frequency, type, and severity of errors associated with IV infusion medications prior to smart pump-EHR integration and to determine whether these inherent errors could have been prevented by integration.

Methods: This study was conducted between June and August 2017 at a community healthcare system in San Diego, California. Data was collected from a wide range of patient care areas such as critical care, medical-surgical, orthopedics, post-operative and emergency care. A point prevalence approach was used to prospectively evaluate infusions for errors by observing administration and labeling, as well as comparing the medication name, concentration, dose and rate programmed on the smart pump with the medication order in the electronic health record (EHR). Infusions not administered on smart pumps were excluded from this study. A multidisciplinary team of pharmacists and nurses conducted the observations and entered all data into the Redcap data collection tool. The severity of each error was rated by the observers using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) Index for Categorizing Medication Errors. Additionally, each error was evaluated to determine if it would have been prevented by smart pump integration. This study was approved by the institutional review board.

Results: A total of 406 infusions were observed and evaluated for 179 patients across three hospitals. At the time of observation, most infusions were actively infusing (n=292, 72%) and using dose error reduction software (n=272, 93%). Among the remaining infusions, they were found to be either completed (n=3, 0.7%) or the pump turned off (n=111, 27%). A total of 156 errors were observed amid active infusions. The most common types of errors were medication omission (n=43, 28%), unauthorized medication (n=42, 27%), bypassing drug library use (n=20, 13%), and wrong rate (n=16, 10%). Forty errors (29%) involved high-risk medications including antiarrhythmics, anticoagulants, electrolytes, insulin, neuromuscular blocking agents, opioids, vasopressors, and parenteral nutrition. One hundred fifty errors (96%) were determined to be category C since they reached the patient, but did not cause harm. One category D error occurred that required monitoring or intervention to preclude harm but there were no category E-I errors that resulted in patient harm. Based on an evaluation of each error, many were determined to be preventable by smart pump-EHR integration.

Conclusion: Despite a high utilization of dose error reduction software, medication errors were still observed. The errors in this study were deemed to have a relatively low potential for patient harm, however, many of the errors could have been prevented by smart pump-EHR integration. It is important to also note that the point prevalence methodology has limited ability to identify errors that cause other types of harm (e.g. prolonged hospitalization). Future studies are needed to further characterize which types of errors are preventable by smart pump-EHR integration and its impact on medication safety.

Submission Category: Oncology/Hematology

Poster Type: Evaluative Study

Session-Board Number: 31-M

Poster Title: *Analysis of cutaneous adverse events of programmed cell death protein-1 inhibitors, Nivolumab and Pembrolizumab*

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Purpose: The study for immune checkpoint inhibitors was activated by recent, but it is still a lack of comparative studies of cutaneous adverse events especially for nivolumab and pembrolizumab. The aim of this study was to estimate the prescription status, frequency of cutaneous adverse events and severity of each drug prescribed for the programmed cell death protein-1(PD-1) inhibitors, nivolumab and pembrolizumab.

Methods: Among all the patients admitted or visited hemato-oncology at Samsung Medical Center during May 2015 ~ Feb 2017, electronic medical records of the patients who were prescribed for PD-1 inhibitors at least once were reviewed. The medical records included patient's sex, age, cancer type, cutaneous adverse events, symptoms, severity and programmed cell death ligand-1(PD-L1) immune test results. A symptom of cutaneous adverse events was classified by "Rash", "Pruritus" and "Urticaria". The severity of the symptoms was graded by NCI CTC AE (National Cancer Institute, Common Terminology Criteria for Adverse Events version. 4.0). This study was proceeded after approval by the Institutional Review Board.

Results: Of the 255 patients, 114 were prescribed nivolumab and 141 were prescribed pembrolizumab relatively. In the PD-L1 test, negative expression proportion of nivolumab (16.7 %) was significantly higher than pembrolizumab (5.0 %) (p-value 0.003). Of these, 38 patients (14.9 %) had shown cutaneous adverse events, and there was no significant difference between the two groups (p-value 1.000). The cutaneous adverse events onset were expressed after first dose both groups, and there was no significant difference between the two groups (p-value 0.397). Comparison of severity of symptoms to mild in pruritus (Grade 1 is 86 %), the rash was the higher severity of symptoms (Grade 2 is 44.8 %) (p-value 0.006). The comparison of onset in cutaneous adverse events, rash was found to have a high proportion (55.2 %) after 2-5th doses

(p-value 0.049). As a result of analyzing of factors affecting cutaneous adverse events showed that cutaneous adverse events increased 1.167 times (95 % CI:1.071-1.261, p-value <0.001) over the number of doses administered. When the treatment duration increased to one day, the cutaneous adverse events of occurrence was significantly 1.004 times (95 % CI:1.000-1.008, p-value 0.028) increased.

Conclusion: This study is meaningful in that it is the first study to analyze the clinical condition in the prescription status of PD-1 inhibitors and the cutaneous adverse events of immune checkpoint inhibitor in Republic of Korea. To improve the quality of life of cancer patients, further study is needed to analyze cutaneous adverse events as well as immunologically different side effects.

Submission Category: Oncology/Hematology

Poster Type: Evaluative Study

Session-Board Number: 32-M

Poster Title: *Real-world outcomes of veterans with castrate-resistant prostate cancer receiving abiraterone and enzalutamide*

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Purpose: Abiraterone and enzalutamide exhibit their activity via the androgen receptor signaling pathway. In large phase three clinical trials, both drugs showed significant increase in overall survival when compared to placebo for first-line therapy or following chemotherapy. There are no head-to-head trials comparing overall efficacy and safety for these medications. The objective of this project was to describe utilization patterns and report efficacy (overall survival, time to prostate-specific antigen (PSA) progression and PSA response rate) with abiraterone and enzalutamide use outside of clinical trials in Veterans with castrate-resistant prostate cancer within Sierra Pacific Veterans Integrated Service Network (VISN21).

Methods: This was a retrospective electronic data analysis of all VISN 21 Veterans who initiated therapy with abiraterone or enzalutamide during Fiscal Years 2012 to 2015. Data (patient demographic information, PSA lab results, prescription data, documented adverse events, and date of death) was collected through a query of the VISN 21 Clinical Data Warehouse and Vital Status file. For purposes of the project, the primary project outcome, overall survival (OS), was defined as time from the first day of abiraterone or enzalutamide prescription to death from any cause. Follow-up continued until patient died, or through September 30, 2017. Secondary outcomes, including time to PSA progression and PSA response rate, were defined using the Prostate Cancer Working Group 2 (PCWG2) criteria. Patients who did not have baseline PSA lab and at least two follow up PSA labs were excluded from the analysis for secondary outcome. The outcomes were compared for abiraterone and enzalutamide.

Results: Of 431 patients who met inclusion criteria, 286 received abiraterone only (ABR), 60 received enzalutamide only (ENZ), 82 received abiraterone followed by enzalutamide (ABR-ENZ) and 3 received enzalutamide followed by abiraterone (ENZ-ABR). Age at initiation was similar between ABR and ENZ groups (75.7 years (95 percent CI 74.62 to 76.74) and 75.2 years (95 percent CI 72.56 to 77.87) respectively, p equals 0.75). All included patients were followed for at least 24 months and as of September 30, 2017, 348 (80.7 percent) death events had been observed: 232 (81 percent) of 286 patients in ABR, 40 (67 percent) of 60 patients in ENZ, 73 (89 percent) of 82 patients in ABR-ENZ and 3 (100 percent) of 3 patients in ENZ-ABR. Overall survival in ABR was similar to that in ENZ (17 months (95 percent CI 14.5 to 19.5) and 16 months (95 percent CI 10.6 to 21.4) respectively, p equals 0.35). Of 344 patients who met criteria for secondary outcome assessment, PSA response rate in ABR was 52 percent compared to 62 percent in ENZ (p equals 0.21); median time to PSA progression in ABR was 7.1 months compared to 9.0 months in ENZ (p equals 0.19).

Conclusion: There were no statistically significant differences in overall survival, PSA progression and time to PSA progression between abiraterone and enzalutamide groups of Veterans with metastatic prostate cancer within Sierra Pacific Veterans Integrated Service Network (VISN21).

Submission Category: Oncology/Hematology

Poster Type: Descriptive Report

Session-Board Number: 33-M

Poster Title: *Characterization of oncology related medication issues in the emergency department among oncology patients who received chemotherapy two weeks prior*

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Purpose: Cancer patients present to the emergency department with a diverse set of symptoms that may be treatment or disease related. Symptom management for oncology patients is complex and often treated differently compared to non-oncology patients. Initial evaluation of oncology patients and subsequent therapy in the emergency department are critical to patient outcomes. The purpose of this study is to identify the most common adverse events in oncology patients upon presentation to Houston Methodist Hospital emergency department.

Methods: Over a 13 month period (January 1st, 2017 to February 1st, 2018), a database was created and identified 443 patients who were admitted to the emergency department and received chemotherapy two weeks prior. Fifty patients who received azathioprine (n=34) and hydroxyurea (n=16) were excluded because they did not have active malignancy. A retrospective review of chief complaints and admitting diagnosis in the medical charts was performed for 393 patients. The top three most common adverse events upon presentation to the emergency department were identified. Medications received within the first 24 hours of admission to the emergency department were evaluated for appropriateness and potential pharmacist intervention. The intervention with the most impact will be determined based on a generated impact score rubric. For each medication-related issue identified, the rubric will assess the feasibility for pharmacists to intervene in a standardized way. The sum of the potential for impact scores will be added up and multiplied by the proportion of patients who would have benefited from the intervention.

Results: Preliminary results have identified dehydration, fever/neutropenia, and pain (15%, 15%, and 17% respectively) as the three most common adverse events among oncology patients who received chemotherapy two weeks prior to presentation at Houston Methodist Hospital emergency department. Analysis to identify the intervention with the most impact is ongoing but preliminary results have identified fever/neutropenia as the most common adverse event with the most opportunities for pharmacist related interventions. Twenty-eight patients presented to the emergency department with febrile neutropenia. The most common medication-related issues identified were inappropriate initial dose and choice of antibiotics administered for febrile neutropenia in the emergency department, and occurred in 21 out of 28 patients.

Conclusion: The most common symptoms among oncology patients upon presentation to the ED at Houston Methodist Hospital have been identified and characterized. This characterization will help identify oncology-related medication issues in the ED that should be addressed by future quality improvement projects.

Submission Category: Pain Management/Palliative Care

Poster Type: Descriptive Report

Session-Board Number: 34-M

Poster Title: *Change in medical residents' and students' acute pain management knowledge before and after a series of pharmacy-led in-services*

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Purpose: As the opioid crisis in the United States and the state of Florida have been declared public health emergencies, healthcare practitioners are searching for ways to minimize the use of opioids in their facilities. The use of a multimodal approach to pain management has been recommended in the literature, aiming to provide enhanced analgesia by utilizing different medication classes while also decreasing the overall amount of opioid medications prescribed. The purpose of this study was to assess the impact of a 3-series in-service on acute pain management on Internal Medicine (IM) residents' and students' knowledge.

Methods: This study was approved by the Palm Beach Atlantic University Institutional Review Board. Current IM residents and students were required to attend three separate in-services on acute pain management. Each IM resident's attendance was consistent from one in-service to another unless the resident had other residency-related obligations, for which they could not attend the in-service. Each in-service was developed and presented by a PGY1 pharmacy resident and clinical pharmacy team. Prior to each in-service presentation, all attendees were given a multiple choice assessment pertaining specifically to the content to be covered during the presentation. After the in-service presentation, attendees were given the same assessment. A percentage score was given based off of how many questions were answered correctly throughout each assessment. The assessment provided at the last in-service was cumulative. In-service topics included the current opioid epidemic in the United States, guideline management of acute and chronic pain, and implementation of a multimodal approach for acute pain management in the hospital. The primary outcome was the change in IM residents' and students' knowledge of acute pain management based on change in assessment scores before and after each in-service.

Results: A total of 24 IM residents and students attended the first in-service, 19 IM residents and students attended the second in-service, and 23 IM residents and students attended the third in-service. The average score for all attendees was 87.9% prior to and 90.0% after the first in-service. For the second in-service, the average score was 71.5% prior to and 87.7% after the in-service. On the final, cumulative survey, attendees collectively scored 59.6% prior to and 75.1% after the in-service. The IM residents scored higher on the assessments than the students on both pre- and post-tests; however, both cohorts generally experienced an improvement in scores after the in-service was given.

Conclusion: After a series of in-services on acute pain management was conducted, both resident and student knowledge improved after each presentation. However, long-term retention of knowledge was not measured and further research should be done to examine the potential long-term impact of the educational series.

Submission Category: Pain Management/Palliative Care

Poster Type: Evaluative Study

Session-Board Number: 35-M

Poster Title: *Establishing consensus on valid and feasible quality indicators for opioid stewardship in the hospital setting*

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Purpose: Optimizing pain management remains a major challenge for health care systems, and the majority of currently published data focuses on outpatient management of chronic pain. To optimize inpatient, acute pain management, hospitals need a defined set of appropriate quality indicators that can be used to track pain and opioid stewardship efforts that are major determinants of inpatient care safety and quality. The purpose of this project was to develop a set of valid and feasible quality indicators for an inpatient opioid stewardship program.

Methods: Consensus was established using a 4-step process: (1) literature search, (2) feasibility screen, (3) validity screen, and (4) expert panel discussion. Candidate quality indicators were extracted from literature search of published guidelines, policies, and papers on pain management and opioid stewardship. Feasibility screening excluded indicators that cannot be reliably extracted from the electronic health record and that are irrelevant to pain management of patients who are hospitalized or treated in an emergency room. Validity screening used an electronic survey that was distributed to key stakeholders including physicians, pharmacists, nurses, administrators, managers, and outcome researchers. Stakeholders rated each indicator using a 9-point Likert scale (with 1 indicating lowest validity and 9 indicating highest validity) assessing the validity of each indicator for improving opioid prescribing, improving quality of care and patient safety, and targeting opioid stewardship interventions. Each indicator was preliminarily categorized as follows: appropriate if the lower bound of the 95 percent confidence interval around the mean rating was above 7, inappropriate if the upper bound was below 7, and uncertain if otherwise. These results were presented during an expert panel discussion where stakeholders discussed preliminary category assignments, revised indicator

wording, added additional indicators, and verbally voted to assign indicators to final categories of appropriate or inappropriate. The hospital's Institutional Review Board approved this study.

Results: Of 37 references reviewed, 27 references yielded 90 unique candidate quality indicators. The System Pain Management Committee added 8 indicators. Feasibility screening excluded 31 quality indicators. The validity survey was distributed to 228 stakeholders; 46 people provided complete responses. Stakeholder panel discussion yielded the following 19 appropriate quality indicators: (1) average dose of morphine milligram equivalents (MME) administered per day, (2) proportion of hospital days with 1 or more severe pain rating score, and the proportion of patients with: (3) greater than 50 MME/day, (4) greater than 90 MME/day, (5) intravenous opioid pushes, (6) long acting or extended release opioids, (7) as needed opioids with duplicate indications, (8) documentation of a standardized pain management plan, (9) defined pain goals (10) defined function goals, (11) naloxone administration, (12) concurrent interacting medications, (13) opioid administrations with a Pasero Opioid-induced Sedation Scale greater or equal to 3, opioid discharge prescriptions after (14) emergency room visits and (15) hospital admissions, (16) discharge prescriptions exceeding 50 MME/day, opioid prescriptions exceeding (17) 3-5 days if discharged from an emergency department or (18) 7 days if discharged from the hospital, and (19) opioid discharge education.

Conclusion: This study established consensus and developed a set of 19 appropriate quality indicators for an opioid stewardship program focused on pain management in the hospital and emergency room settings. Multiprofessional clinician, administrator, and researcher stakeholders engaged in the decision making process. The selected indicators emphasize the importance of inpatient opioid dosing and discharge opioids prescriptions. These results provide opioid stewardship programs with feasible and valid targets that can be optimized through stewardship interventions. These appropriate quality indicators will need to be prioritized through future research steps.

Submission Category: Pharmacy Technicians: Competencies/Development/Other

Poster Type: Descriptive Report

Session-Board Number: 36-M

Poster Title: *Piloting decentralized unit-based technicians to optimize pharmacy provided services*

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Purpose: Bedside delivery service offers an enhanced patient experience and provides positive return on investment. Presently, 35% of discharging patients are provided this service. Despite continuous improvement efforts, rates remain consistent. Another transition of care service offered is high risk medication histories, currently completed by pharmacists. However, volumes were noted to be higher than anticipated and limiting time for additional patient care activities. The technician staffing model offers little variety, with technicians performing dispensing-oriented functions. The medication history role presents opportunity for technicians to use their knowledge and offers an excellent opportunity to directly connect the technicians' work to the patient.

Methods: In this pilot project, two shifts were created from 0700 to 1530 and 1130 to 2000 on two internal medicine units for technicians to provide unit-based support for prescription bedside deliveries and medication histories Monday thru Friday. Three current bedside delivery technicians were trained on the functions and expectations to complete medication histories for patients at high risk for readmission. The technicians' daily responsibilities included offering and delivering discharge prescription services as well as identifying and completing medication histories and validating patient and family interviews with additional source data. Physicians, advanced practice practitioners, and nursing leadership were identified as stakeholders to assist in educating caregivers on use of e-prescribing and bedside delivery services. The measures of success included percent discharged patients served, prescription delivery turnaround time, and total medication histories completed.

Results: During the course of the five week pilot, a total of 95 patients received discharge prescription services from the decentralized technician. Prior to the pilot, the median weekly capture rate for prescription delivery services was 25% and 20% for each unit. After implementation, the median capture rate rose to 40% and 72% capture rate for prescription services. The median turnaround time was 1.25 hours. A total of 25 out of 31 (81%) medication histories were completed for patients at high risk for readmission, a median of 1 per day.

Conclusion: The decentralized unit-based pilot achieved an increase in the median capture rate of prescriptions for both units, which previously plateaued at around 35%. The pilot offered an advanced technician role of participating in the completion of medication histories, which in turn gave pharmacists more time to focus on other clinical activities and elevated pharmacy technician practice. Next steps include implementation of additional unit-based activities (e.g. automated dispensing cabinet maintenance, drip rounds) and expansion to other patient care units.

Submission Category: Psychiatry/Neurology

Poster Type: Evaluative Study

Session-Board Number: 37-M

Poster Title: *Healthcare resource utilization, direct costs, and indirect costs associated with major depressive disorder: added burden of suicidal ideation and treatment resistant depression*

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Purpose: People living with depression have greater healthcare resource utilization (HRU), and incur more work impairment, compared with people living without depression. Less is known about the additional economic burden that patients with both suicidal ideation and treatment resistant depression (TRDSI) may have in the major depressive disorder (MDD) population. This study compared economic outcomes among MDD patients with TRDSI versus patients without TRDSI.

Methods: Retrospective analyses were conducted using the 2013 US National Health and Wellness Survey (NHWS), which is a nationally representative, self-administered, internet-based survey of US adults. Patients with MDD were defined as: reporting clinician-diagnosed depression and either PHQ-9 scores of 10 or higher or PHQ-9 scores between 0 and 9 and on one medication for depression. Among MDD patients, those with SI were defined by a moderate-to-high score to PHQ-9 Item 9 ("Over the past 2 weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?"). Among MDD patients, TRD was defined by PHQ-9 scores greater than or equal to 15 and on 2 or more concomitant antidepressants. Patients with bipolar disorder or schizophrenia were excluded. Patient subgroups included: MDD patients with TRDSI and MDD patients without either TRD or SI. HRU, including outpatient visits, emergency room (ER) visits, and hospitalizations, was self-reported based on the number of visits during the prior 6 months. Work productivity impairment was assessed using the Work Productivity and Activity Impairment questionnaire. Direct and indirect costs were estimated using average HRU costs from Medical Expenditure Panel Survey and average wages from Bureau of Labor Statistics

data, respectively. Bivariate analyses compared outcomes between MDD patients with TRDSI versus patients without TRDSI.

Results: Among 75,000 NHWS respondents, 6,997 respondents met study eligibility of having MDD (9.3 percent). Of MDD patients, 166 had TRDSI (2.4 percent) and 5,747 did not have TRDSI (82.1 percent). The average number of ER visits (0.71 vs 0.34, p less than 0.001), hospitalizations (0.50 vs 0.15, p less than 0.001), and outpatient visits (12.57 vs 6.68, p less than 0.001) during the prior 6 months was significantly higher for patients with TRDSI compared with patients without TRDSI. Average estimated direct costs were 19,528 dollars per patient per year (PPPY) for patients with TRDSI and 7,392 dollars PPPY for patients without TRDSI (p less than 0.001). Patients with TRDSI reported a significantly higher proportion of lost productivity at work, presenteeism (52.7 percent vs 25.1 percent, p less than 0.001), and a significantly higher proportion of missed work, absenteeism (14.4 percent vs. 6.1 percent, p less than 0.001), compared with patients without TRDSI. Average estimated indirect costs were 23,229 dollars PPPY for TRDSI patients and 9,736 dollars PPPY for patients without TRDSI (p less than 0.001). Average estimated annual economic burden, combining indirect and direct costs, was 42,757 dollars PPPY in TRDSI patients and 17,128 dollars PPPY in patients without TRDSI.

Conclusion: MDD patients experiencing TRDSI reported greater HRU and economic burden than MDD patients without TRDSI. Results show the need to better understand subpopulations with MDD, including uncovering effective treatment options that may assist MDD patients with TRDSI.

Submission Category: Psychiatry/Neurology

Poster Type: Case Report

Session-Board Number: 38-M

Poster Title: *Identification and treatment of rapidly progressive myeloneuropathy induced by copper deficiency*

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Purpose: A 59 year old female presented to our Neurology clinic in May, 2017. She complained of bilateral numbness in her feet accompanied by pain for two months. She had sustained several falls due to lack of pedal sensation, one of which resulted in a pelvic fracture. The patient had a diagnosis of diabetes, and was placed on gabapentin for symptoms of neuropathy prior to her referral to Neurology. She experienced no relief, and gabapentin was subsequently discontinued. Upon initial examination she demonstrated absent vibration and proprioception to knee level. No atrophy or decreased muscle tone were noted. Except for the knees, reflexes were diminished. Romberg sign was positive. She was ambulating with a cane. Her past medical history was positive for pancreas divisum with her most recent bout of pancreatitis in 2016. She had a distant history (teens and 20s) of anorexia nervosa and bulimia. Recent history included normocytic normochromic anemia and electrolyte abnormalities (hypokalemia, hypomagnesemia). The patient was 62 inches tall and weighed 36.7kg ultimately leading to a diagnosis of malnutrition and failure to thrive. Diagnostic testing to determine the cause of the myeloneuropathy included hemoglobin A1C, alpha-tocopherol, gamma-tocopherol, methylmalonic acid, vitamin B12, vitamin B6, paraneoplastic antibody, celiac panel, syphilis, antinuclear antibody screen, and HIV screen. No abnormal results were identified. Her homocysteine level was slightly elevated at 12.4umol/L. Electrolytes were normal except for potassium which was 2.5mmol/L two days prior to her visit. Six days earlier, her white blood cell count was low (2.6k/ul), red blood cells were slightly below normal (3.48m/ul), and hemoglobin and hematocrit were both low (9.8gm/dL and 30.6% respectively). Though she was anemic, the differential did not demonstrate neutropenia which is a common finding in copper deficiency. Copper level evaluation was planned, but the patient was treated for hypokalemia and hospitalized with pancreatitis causing a delay. The level was subsequently drawn in August, and severe copper deficiency was confirmed (12mcg/dL). Three months after her first clinic visit, the patient returned complaining of progressive symptoms that had risen to the level of her groin. She claimed to be unable to feel the urge to urinate or defecate. In addition,

symptoms were now present in her hands and were progressing up her arms. Iron studies, folate and zinc were all within normal limits. MRI of the cervical spine demonstrated hyperintensity, and electromyography results were consistent with length dependent axonal sensorimotor polyneuropathy. Intravenous copper infusions were planned for rapid replacement. The patient received cupric chloride 2mg in 100ml of normal saline daily for five days, followed by oral copper supplementation dosed at 3mg three times daily. Her copper level was normal three days after the final infusion (81mcg/dL). Subsequently, additional levels obtained over the next two months remained in the normal range (126mcg/dL and 98mcg/dL). The patient underwent physical therapy, and her strength improved. She is able to ambulate with a walker. While progression of symptoms ceased with normalization of her copper level, the myeloneuropathy did not improve. Copper deficiency is an infrequent finding in the United States. It is associated with syndromes of malabsorption, and is most often diagnosed in patients who have undergone Roux-en-Y gastric bypass surgery. It also occasionally results from excessive zinc exposure, myelodysplastic syndromes, and chronic feedings via tube or parenterally. (Our patient was started on tube feeds after the deficiency was diagnosed). While patients have experienced partial resolution of symptoms up to two years after copper level normalization, most do not recover fully. Given the speed of progression, and the ability of copper replacement to halt advancement of the myeloneuropathy, levels should be obtained in all patients with unexplained progressive symptoms. It is prudent to initiate supplementation immediately upon diagnosis of deficiency to limit disability.

Submission Category: Psychiatry/Neurology

Poster Type: Case Report

Session-Board Number: 39-M

Poster Title: *Monoclonal antibody-mediated inflammatory encephalopathy after ocrelizumab administration for multiple sclerosis*

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Purpose: This case describes a suspected antibody-mediated response to disease modifying therapy with ocrelizumab in a 58-year old male with multiple sclerosis. Ocrelizumab is an anti-CD20 monoclonal antibody that has been shown to decrease disease activity and clinical relapse in patients with primary progressive and active relapsing forms of multiple sclerosis. Ocrelizumab may cause infusion reactions (pruritus, rash, urticaria, bronchospasms, etc.) and patient was appropriately pre-medicated with acetaminophen, diphenhydramine and methylprednisolone prior to ocrelizumab infusion. Several weeks after receiving his second dose of ocrelizumab 300mg intravenously the patient's wife described a subacute decline in the patient's mental status, a progressive worsening of lower extremity weakness and drowsiness. High dose oral steroids were initiated for management of a possible relapse of his disease. Five days later the patient presented to the emergency room with unresponsiveness and developed acute respiratory failure with hypercapnia and periods of apnea that required intubation and admission to an intensive care unit. Examination of the patient showed a non-focal obtundation with intact brainstem reflexes. Magnetic resonance imaging of the brain showed findings that are compatible with his diagnosis of multiple sclerosis, no significant interval change, no new or progressed lesions, no enhancing lesions to suggest active demyelination, no foci of true restricted diffusion that would suggest an acute infarction, and no hydrocephalus or mass effect. A lumbar puncture showed normal opening pressure and cerebral spinal fluid studies were unremarkable except for a non-specific elevation in protein. Infectious and viral processes were ruled out by the Infectious Disease service physician and the working diagnosis became possible ocrelizumab-induced monoclonal antibody reaction given the temporal location and patient report of malaise after his last infusion. Three doses of methylprednisolone 1000mg intravenous daily were administered and plasmaphoresis was initiated every other day for five treatments in an attempt to clear the ocrelizumab, which has a half-life of twenty-six days. A long-term electroencephalogram was obtained which showed

diffuse background slowing consisting of discontinuous theta/delta range slowing. Intermittent sharp activity and rhythmicity that occurred in earlier portions of the recording resolved and the findings of the test were felt to be consistent with a moderate to severe global encephalopathy. The summary of the electroencephalogram report commented that this is usually a non-specific finding that is most often, but not exclusively, seen in toxic, metabolic or infectious etiologies. A course of lacosamide was initiated for empiric management of the noted cortical irritability. The patient continued to improve during his hospital stay, was extubated and gradually became more awake, alert and oriented, appropriately interactive and able to follow commands. He was transferred to an inpatient rehabilitation unit and then transitioned to outpatient therapy with plans to follow up with an epileptologist regarding weaning of the lacosamide. The decision was made to not continue with further ocrelizumab therapy and the neurologist recommended that the patient be initiated on disease-modifying therapy with tereflunomide. A U.S. Department of Health and Human Services MedWatch form was completed and submitted to the FDA Safety Information and Adverse Event Reporting Program. We present the first known case of an antibody-mediated inflammatory encephalopathy presumed secondary to administration of the disease modifying medication ocrelizumab.

Submission Category: Psychiatry/Neurology

Poster Type: Evaluative Study

Session-Board Number: 40-M

Poster Title: *Evaluation of economic burden and readmission risks among patients with treatment-resistant depression admitted in US hospitals*

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Purpose: The economic burden among Major Depressive Disorder (MDD) patients with treatment-resistant depression (TRD) who are admitted into hospitals in the US may be substantial. The objective of this study was to characterize and evaluate the hospital length of stay (LOS), hospital cost, readmission risks and economic burden associated with readmissions among MDD patients with TRD compared to non-TRD MDD patients.

Methods: Adult (age ≥ 18 years) patients admitted between 1/1/2012 and 9/30/2015 with a primary discharge diagnosis of MDD were identified from the Premier Perspective Hospital Database. The first of such admission was defined as the index hospitalization with the corresponding admission date as the index date. MDD patients were grouped into cohorts of TRD and non-TRD MDD based on treatment suggestive of TRD. Patients were defined as having TRD based on the utilizations of any of the following during admission: electroconvulsive therapy, transcranial magnetic stimulation, vagus nerve stimulation, receipt of olanzapine/fluoxetine capsules (Symbyax) treatment, or receipt of any anti-depressants and one of four MDD-approved antipsychotics (aripiprazole, brexpiprazole, olanzapine, quetiapine) during day 1-2 of the index hospitalization. Propensity score matching (PSM) was carried out to match the TRD vs. non-TRD MDD patients on a 1:1 basis. Multivariable logistic regression was used to generate the propensity scores. Among the PSM matched population, patient demographics and clinical characteristics were compared. Additionally, index admission healthcare resource use, including the index hospital LOS and associated hospital costs, were compared between the two cohorts. Hospital readmission rates and associated healthcare resource use and hospital costs 6-months post-index hospitalization were measured with both

bivariate statistics and multivariable Cox regression, which was further used to evaluate the risks of hospital readmissions while controlling for key patient characteristics.

Results: After the PSM, 45,066 patients were identified in each cohort. The matched cohorts' mean age was 46 years, 56.7% were female and 71.2% were white ($p>0.05$). The mean hospital LOS (7.4 days vs. 5.9 days, $p<0.0001$) and hospital cost (\$8,681 vs. \$6,632, $p<0.0001$) for the index hospitalization were higher for patients with TRD vs. non-TRD MDD. The percentage of patients with all-cause (24.4% vs. 20.0%, $p<0.0001$), MDD-related (17.0% vs. 13.3%, $p<0.0001$), and suicidal ideation/attempts (SIA)-related (12.8% vs. 9.5%, $p<0.0001$) readmissions in the follow-up period was higher for patients with TRD vs. non-TRD MDD. On a per patient basis, the all-cause (\$3,690 vs. \$2,797, $p<0.0001$), MDD-related (\$2,314 vs. \$1,608, $p<0.0001$), and SIA-related (\$1,489 vs. \$998, $p<0.0001$) mean total hospital costs for readmissions were higher for TRD vs. non-TRD MDD patients. The combined (index hospitalization + readmissions) hospital cost (\$12,370 vs. \$9,429, $p<0.0001$), and the total hospital LOS (10.7 days vs. 8.3 days, $p<0.0001$) were also higher on a per patient basis for TRD vs. non-TRD MDD patients. Regression results showed that the risk of readmission for hospitalized TRD vs. non-TRD MDD patients was 25% higher for all-cause, 31% higher for MDD-related, and 37% higher for SIA-related readmissions.

Conclusion: This large scale real-world hospital database analysis used inpatient treatment suggestive of TRD to identify such patients. After patient matching, the study suggests that hospitalized patients with TRD vs. non-TRD MDD are associated with substantially higher hospital cost, LOS, and readmission risk. More effective treatment and care continuity for MDD patients with TRD may help reduce this additional burden and potentially reduce readmission rates.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 41-M

Poster Title: *Impact of a discharge alert tool on pharmacist discharge medication review*

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Purpose: Medication discrepancies may occur when patients are discharged from the hospital. Medication reconciliation identifies and resolves medication discrepancies, and the review of a patient's medication list is the first step of medication reconciliation. Recent evidence suggests that pharmacist review of discharge medications is associated with decreased medication discrepancies and adverse events associated with drug therapy issues, and decreased readmission rates. The purpose of this study is to evaluate the impact of a pharmacy discharge alert tool on the number of pharmacist discharge medication reviews completed, and to determine whether a pharmacist intervention was performed during after-visit summary (AVS) medication review.

Methods: This retrospective study of the impact of a discharge alert tool on pharmacist medication review utilized data from the electronic health record (EHR) to identify patients 18 years of age and older discharged from the inpatient medicine service of an academic medical center. Study exclusions were patients who left against medical advice, expired during hospitalization, transferred to another hospital, or discharged to hospice or jail/prison. Data collected included patient age, date and time of discharge, discharge disposition, discharge pharmacy activities (including AVS medication review completed and intervention performed on the AVS), total number of medications on the AVS, and the presence of a high alert-medication (anticoagulant, opioid, or insulin) on the AVS medication list. The primary outcome is the proportion of patients with AVS medication review completed by a pharmacist before and after implementation of the discharge alert tool. Secondary outcomes include the number of pharmacy interventions performed per AVS medication review, the number of patients discharged with a high-alert medication, and the number of medications on the AVS medication

list per discharged patient. The secondary outcomes will compare data collected prior to and after the implementation of the discharge alert tool. This study was approved by the Institutional Review Board.

Results: The proportion of patients with pharmacist AVS medication review completed pre-implementation of the discharge alert tool was 20 percent versus 29 percent post-implementation. This was a difference of 9 percent (95 percent CI, -0.21 to 0.029, P equals 0.138). After the implementation of the discharge alert tool, the proportion of AVS medication reviews with a pharmacist intervention increased from 11 percent to 18 percent (P equals 0.159). The proportion of patients discharged with a high-alert medication pre- and post-implementation was 52 percent and 48 percent respectively (P equals 0.570). The proportion of patients with a high-alert medication and AVS medication review completed by a pharmacist pre-implementation of the discharge alert tool was 33 percent versus 67 percent post-implementation (P equals 0.036). The number of medications on the AVS medication list per discharged patient pre- and post-implementation was comparable with a mean of 12 medications.

Conclusion: There was no statistically significant increase observed in the number of pharmacist discharge medication reviews completed before and after the implementation of a discharge alert tool. The discharge alert tool resulted in an increased number of patients on high-alert medications with pharmacist discharge medication review completed. While the discharge alert tool did not significantly increase pharmacist discharge medication review, there is potential utility of the tool to improve pharmacist visibility of the AVS medication list. The findings of this study may be useful to hospital administration as they evaluate existing interventions to improve pharmacist medication reconciliation and patient safety outcomes.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 42-M

Poster Title: *Integration of a meds-to-bed program within existing transitions of care pharmacy services*

Primary Author: Gregg Albright, Ascension-All Saints Hospital; **Email:** gregg.albright@ascension.org

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Purpose: Ascension-All Saints Hospital has a Chronic Disease/Transitions of Care pharmacist service to help manage our high risk patient population, including underinsured or uninsured patients with chronic diseases who are likely to return due to medication mismanagement or non-adherence. Our objective was to determine if a meds-to-bed program would enhance already existing comprehensive discharge pharmacy services by increasing patient satisfaction and reducing the risk of readmissions. A secondary objective was to determine if revenue was sufficient to add additional staff to expand the service.

Methods: This is a quality improvement project and does not require IRB approval. Ascension-All Saints, through our Chronic Disease/Transitions of Care pharmacy service, had an 'informal' meds-to-bed program for our high-risk patients and those who specifically requested bedside delivery of medications. In June of 2017, we identified two units in the hospital to begin a formal meds-to-bed program based on the following criteria: patients discharged primarily to home, support from the nurse manager for the service, and consistent staffing of nurse case managers. A discharge meds-to-bed flowsheet was developed and a consult was created in the electronic health system to allow the nurse or physician to notify pharmacy upon patient enrollment. Educational materials for staff were created including: an e-mailed description of the purpose of the project, flowsheets to identify the workflow, and live presentations to nursing staff. A start date of August 2017 was targeted to formally begin this service on two 20-bed units. Barriers to success were addressed through monthly meetings to optimize the process and daily reviews of meds-to-bed status were done at nursing huddles. Data collection included: 1.) the number of participating patients by month, 2.) patient satisfaction scores by

unit, 3.) readmissions for those using the service, 4.) the number of prescriptions by month, and 5.) total Rx revenue for the month based on an average gross revenue/Rx.

Results: Patient participation rate increased from 14% to 38% on the units where this service was offered. The participation rate for the entire hospital grew from 9% to 26% through the seven months in the study period and the total number of patients who used the service increased from 38 to 104 during the same period. We reviewed Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores in the category of ‘Medicines’ for the units, questions 16 and 17 on the survey:• how often did hospital staff tell you what the medicine was for?• how often did hospital staff describe possible side effects in a way you could understand?

Scores remained inconsistent with an average score of 65.5% in the initial seven months of the program. All-cause readmission rates for this population were calculated and compared to the all-cause readmission rate for the hospital. Rates for the study group for the 7-month period August to February were 5.92% while the rate for the hospital was 11.25%. And finally, prescriptions captured during this time grew from 152 to 318. Total estimated revenue during the study period was calculated at \$228,616, or a yearly net revenue projection of \$391,913.

Conclusion: The meds-to-bed program has steadily increased in the number of participants and number of prescriptions referred to the outpatient pharmacy. Readmission rates were lower in this population, approximately half of those who were not enrolled in the program. While patient satisfaction, or HCAHPS, scores remain inconsistent, anecdotal feedback from floor nurses and physicians has been positive. More data needs to be collected regarding patient satisfaction to identify trends. Revenue generated from referrals to the outpatient pharmacy indicates the service will support itself and has allowed a dedicated meds-to-bed pharmacist to staff up to 8 hours per day.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 43-M

Poster Title: *Development and implementation of a dashboard for monitoring barcode medication administration (BCMA) compliance at a large academic medical center*

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Purpose: Barcode medication administration (BCMA) is a cornerstone to any hospital system's medication safety program. Performing this systematic double check by scanning the patient armband and medication barcode before administration must occur consistently to be able to effectively catch and prevent potentially harmful wrong patient, medication or dose errors. The Leapfrog hospital survey published a benchmark goal for hospitals to achieve greater than 95% BCMA compliance. This project was launched to assist a medical center in achieving this benchmark by offering actionable data for nursing and pharmacy leaders to respond to and create proactive process improvement.

Methods: A tableau dashboard was created to offer actionable BCMA compliance data to nursing and pharmacy leaders within an academic medical center, including three hospitals: adult, children's and psychiatric and several outpatient infusion centers. This work was led by a medication safety officer and data analyst. The initial data load into tableau occurred, and basic views for BCMA compliance with drilldown per hospital, unit, medication and staff member were built. Further development and optimization of views occurred via focus groups involving nurse managers, charge nurses, nurse educators and quality nurses. Data validation occurred through the quality data analytics group. The dashboard was launched in June of 2017 during a medical center focused medication safety month. The medication safety officer partnered with the enterprise nurse quality committee to define several discovery units where initial rapid PDSA cycles occurred. Questions and discoveries with the data were shared within the nurse quality committee, and best practices among discovery units were shared. Access to the dashboard was limited to nursing, pharmacy and quality leaders, and identified views to staff data was limited to those in direct reporting alignment. A speaking tour to educate on BCMA data available was completed by the medication safety officer to many nurse centric

groups including: educator council, systems support, medical center nursing board and quality improvement groups.

Results: In November of 2017, the medical center converted its electronic health record (EHR) to EPIC, and the dashboard was rebuilt and relaunched. Access maintenance and further dashboard optimization continues to occur. BCMA compliance after dashboard launch in June 2017 was 92% for the enterprise as a whole, 92% for the adult hospital, 92% for the children's hospital and 94% for the psychiatric hospital. Compliance rates increased over the fall of 2017 with the use of the dashboard and process improvement work across the system. Before EHR conversion 11/3/2017, BCMA compliance had risen to 94% for the enterprise as a whole, 94% for the adult hospital, 95% for the children's hospital and 95% for the psychiatric hospital. BCMA compliance had a significant drop with EHR conversion with many scanners not working initially, and rates dropped to 89% for the enterprise that month. After the BCMA compliance dashboard was rebuilt and relaunched, rates have increased slowly and steadily. During the week of 2/26/2018, the medical center reached 95% BCMA compliance for the first time as an enterprise, 8 months after the initial launch of the dashboard tool.

Conclusion: The development and implementation of a BCMA compliance dashboard was a multidisciplinary effort to offer actionable data for process improvement for this cornerstone medication safety strategy. The medical center was able to reach its benchmark goal because leaders across the enterprise used this interactive tool and improved compliance rates.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 44-M

Poster Title: *Evaluation of appropriate use of propofol and dexmedetomidine in intensive-care units within an academic medical center*

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Purpose: To characterize appropriate and safe use of continuous sedation in patients admitted to any adult intensive care unit (ICU) within a tertiary-care, academic medical center. Secondary analyses included appropriate monitoring of products utilized, average amount of product utilized, and financial impact of each product. Safety outcomes, such as elevated triglycerides, hypotension, or discontinuation of therapy for any reason, were explored.

Methods: A report of patients who received propofol or dexmedetomidine in one of the adult ICUs at our institution from January 1, 2016 to December 31, 2016 was generated from the electronic medical record database. Inclusion criteria were adult patients age 18 or older, located in any 1 of 5 adult ICUs requiring continuous sedation for a non-procedural indication. Patients were excluded if sedation was for procedural purposes only, for paralysis, or for the treatment of status epilepticus or alcohol withdrawal. A selection of data collected included hospital and ICU length of stay (LOS), defined Richmond Agitation-Sedation Scale (RASS) titration parameters, amount of drug administered, ventilator days, appropriate RASS monitoring, and Sequential Organ Failure Assessment (SOFA) score. The primary endpoint of appropriate indication for use was defined as a clinical condition that warranted therapy with either sedative (ie, dexmedetomidine or propofol) that met the inclusion criteria. Appropriate monitoring was defined based on our institution's current pain, agitation, and delirium guidelines.

Results: We identified 1,844 patients who received propofol or dexmedetomidine for non-procedural use within one of the adult ICUs at our institution. Patients were categorized by ICU location, and 30 patients were selected from each location using a random number generator yielding 150 patients who accurately reflected the standard care of mechanically ventilated patients in our hospital system. Due to bedside procedural use of sedation, a further 36 patients were excluded from our analysis. Overall, for the primary endpoint of appropriate use, all 114 patients had a clear indication for use of continuous sedation. In regards to safety, 14.5% (n=17) of patients did not have a defined RASS goal. RASS was inappropriately documented in 40% (n=46) of patients. Only 25% (n=29) of patients had a daily awakening trial recorded. Patients who were monitored inappropriately utilized more drug products than those who were monitored appropriately. One patient discontinued therapy due to propofol-related infusion syndrome.

Conclusion: Proper management of patients receiving continuous sedation ensures patient safety and can mitigate unnecessary use of medications. Adherence to daily awakening trials has been shown to reduce time on the ventilator potentially decreasing the risks associated with mechanical ventilation. Inappropriate monitoring results in higher consumption of medication and increased costs. Adoption of universal continuous sedation restriction criteria may improve monitoring and medication use compliance. Re-education of pharmacy and nursing team-members may increase appropriate monitoring of patients treated with continuous sedation. Further studies may be able to identify factors for patient readiness to discontinue sedation when clinically appropriate.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 45-M

Poster Title: *Best practice alerts and recommendations for potentially inappropriate medications in older adults: one year later*

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Purpose: In order to provide care that is safe, reliable, efficient, and patient centered, and to avoid poor health outcomes including confusion, falls, and adverse events, a system of best practice alerts and recommendations for potentially inappropriate medications in adults aged 65 and older was implemented into the electronic medical record system at a large academic medical center. An analysis of the data one year later was performed to ensure continuous quality improvement.

Methods: An analysis of potentially inappropriate medications in older adults at a large academic university medical center was performed to determine medication utilization. In order to avoid alert fatigue, a comprehensive review of potentially inappropriate medications was completed to determine medications of highest priority by cross referencing the American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults, the Screening Tool of Older Person's Potentially Inappropriate Prescriptions, and the Screening Tool to Alert doctors to Right Treatment. The list of potentially inappropriate medications in older adults to be associated with best practice alerts and recommendations was presented to medication safety committees and physicians to ensure appropriate application to clinical practice. Medication safety pharmacists worked in conjunction with pharmacists specialized in informatics to coordinate relevant clinical parameters for the alerts and recommendations. To create hospital-wide awareness, an in-service was created and made available prior to implementation. To direct appropriate therapy, in-line dose warnings, safety alerts with dose recommendations, and medication warnings were implemented into the electronic health record system. After incorporation of the alerts and recommendations, an analysis of utilization of potentially inappropriate medications in older adults was performed one year later to observe the impact and utility of the process implementation.

Results: Over a 90 day period prior to and after the implementation of the best practice alerts and recommendations, in patients 65 years and older, there were 12,272 prescriptions for discrete doses of potentially inappropriate medications. The primary outcome was the amount of discrete doses prescribed at the recommended dose defined as the recommended dose set by our institution or lower. There was a statistically significant difference in appropriate prescribing for specific individual medications, and an overall trend in improvement for prescribing appropriate doses after the process implementation. The rate of the primary outcome of appropriate discrete doses was higher after the implementation of the best practice alerts and recommendations versus before [3,024 (56.3%) versus 3,159 (45.8%), $p < 0.05$]. A month to month analysis of the percentage of appropriate doses and amount of prescriptions of potentially inappropriate medications was performed to account for variability in prescribing between months and no notable differences in trends were found. The results of an analysis of appropriate total daily doses were consistent with the results for discrete doses. Reasons for prescriber best practice alerts and recommendations medication overrides included "MD approved", "benefit overrides risk", "tolerated previously," and "other."

Conclusion: The implementation of effective best practice alerts and recommendations for potentially inappropriate medications in adults 65 years and older at an academic medical center resulted in an increase in appropriate prescribing by healthcare providers even one year later.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 46-M

Poster Title: *Implementation of pharmacy morbidity, mortality, and process improvement rounds at a tertiary academic medical center*

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Purpose: Pharmacy Department Morbidity, Mortality, and Process Improvement (PMMPI)

Rounds were initiated to support the quality and safety improvement efforts of a pharmacy department at a tertiary academic medical center. To our knowledge there are no previously published data on pharmacy specific morbidity and mortality rounds. The purpose of this study is to evaluate the impact of PMMPI Rounds on facilitating medication safety improvements and promoting a culture of safety.

Methods: This study was reviewed by the Partners Healthcare Institutional Review Board and was deemed a quality initiative study. A PMMPI Rounds committee meets once a month to review recent safety reports and selects cases to be presented. Cases presented at the PMMPI Rounds from September 2016 to November 2017 were reviewed and data were collected on any quality improvements surrounding each case. Data collected included number of cases presented, topics covered, and any updates to guidelines, operations, or policies. Other data collected included continuing education credits and additional in services provided for each case. To assess how the PMMPI Rounds impact the pharmacy department's practice, an online survey was distributed to staff.

Results: Ten cases were presented during eight different PMMPI Rounds. Topics covered were use of blood factors in cardiac surgery, epinephrine administration in anaphylaxis, high concentration insulin ordering and administration, half dose thrombolytic use in the treatment of pulmonary embolism, patient controlled analgesia safety, alcohol withdrawal management, anticoagulation management, choice of sedative agents in the intensive care unit, and use of a hypersensitivity pathway in penicillin allergic patients. Of these cases, four resulted in guideline

updates, six resulted in operational changes, and two resulted in policy changes. A total of seven continuing education hours were offered as well as four additional in-service presentations. Twenty-five pharmacists completed the PMMPI Rounds survey. Of the pharmacists who participated, 24 pharmacists responded that the PMMPI Rounds have positively impacted the way they practice pharmacy, 24 felt that these rounds facilitate further discussion regarding medication safety, and 18 pharmacists feel more comfortable filing safety reports after attending PMMPI Rounds.

Conclusion: PMMPI Rounds have resulted in many medication safety improvements at a tertiary academic medical center. The majority of survey responders at this institution feel as though PMMPI rounds have improved their practice and facilitated discussion on medication safety.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 47-M

Poster Title: *Development of an electronic trigger tool at a children's hospital within an academic medical center*

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Purpose: Development of the Pediatric All-Cause Harm Measurement Tool marked an important step in the evaluation of pediatric adverse drug events (ADEs); however, at this time, further testing to identify the positive predictive value (PPV) for each trigger, assess appropriate set points, and capture harm prevalence has not been conducted. Therefore, the purpose of this study was to evaluate the validity and reliability of select recommended triggers based off the 2016 study by Stockwell et al for detecting ADEs in a pediatric population.

Methods: This is a single-center, retrospective cohort analysis of pediatric patients (less than 18 years old) admitted to University of North Carolina (UNC) Children's Hospital and who received trigger-associated medications between January 2015 and December 2016. Eligible patients were identified via Carolina Data Warehouse for Health and UNC Health Care electronic health system. Patient care areas such as the emergency department, operating rooms, and post-anesthesia care units were excluded. Trigger-detection encounters were evaluated by both reviewers using pre-established, consensus ADE criteria as determined by a panel of pediatric and medication safety specialists at UNC Medical Center. The study protocol was approved by the institutional review board, and informed consent was waived due to the retrospective nature.

Results: A total of 3,836 positive triggers were included in this study. Incomplete documentation was the leading cause for event exclusion, 8/27 (30 percent). For the aggregate 12-part trigger tool package, 1055 positive ADEs were identified, leading to a PPV of 27.5 percent. The triggers with the highest PPV included protamine 4/4 (100 percent), flumazenil 1/1 (100 percent), and vancomycin-related events 51/67 (76.1 percent), respectively. Phenytoin level greater than 30 mcg/mL or free level greater than 2.5 mcg/mL resulted in the lowest PPV, 1/12 (8.3 percent).

Conclusion: This study lays the foundation for further studies to develop a robust pediatric trigger tool. While some triggers showed strong PPV, results may have been skewed by the small number of individual trigger activations. These results, however, set an initial benchmark to utilize moving forward with additional trigger tool studies, such as developing multi-element triggers, determining sensitivity and specificity of triggers, or mobilization of the trigger tool to an automated system.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 48-M

Poster Title: *Early assessment of an opioid peer review committee in a family medicine residency clinic*

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Purpose: In response to the opioid epidemic, the Centers for Disease Control and Prevention (CDC) published guidelines to provide guidance for prescribing opioids to adult patients with chronic, non-cancer pain. As a result of these guidelines, the Sparrow Family Medicine Residency program established an opioid peer review committee to systematically review patients on chronic opioid therapy for safety and efficacy. The primary objectives of this project were to determine the impact of the committee on opioid prescribing as measured by change in morphine milligram equivalents (MME) per day and prescribing of naloxone.

Methods: This project included patients from two family medicine residency clinics who had been reviewed by the opioid peer review committee between June 2016 and October 2017. The committee consists of medical residents, attending physicians, a clinical pharmacist, student pharmacists, and a nurse care manager that meet on a monthly basis to review two to three patients on chronic opioid therapy. After review, a letter is sent to the primary care provider with recommendations regarding opioid discontinuation, alternate therapy, and appropriateness of naloxone. For this project, age, race, gender, insurance coverage, MME per day, concurrent benzodiazepine use, mental health disorders, and whether or not naloxone was prescribed and filled were collected from the charts of the reviewed patients. MME per day was calculated using the CDC guidelines and assessed immediately before committee review and up to the most currently available date using the state prescription drug monitoring program. As per the CDC guidelines, patients for whom naloxone should have been offered included those on 50 or more MME per day, history of overdose, history of substance abuse, or concurrent benzodiazepine use. Statistical analysis was completed using SPSS version 24. A p value less than 0.05 was considered statistically significant.

Results: A total of 29 patients were included for comparison. Mean patient age was 60 and 79 percent of reviewed patients were Caucasian. Sixty five percent of patients had a Medicare prescription plan. Sixty nine percent had a mental health disorder, including depression, anxiety, and bipolar disorder. Fifty two percent of patients were also taking a benzodiazepine at the time of review. Mean MME before the review was 131 and 124 after (p equals 0.37). Despite all reviewed patients meeting criteria for a naloxone prescription, only 27 percent were prescribed naloxone and only 10 percent filled the prescription at the pharmacy.

Conclusion: A standardized format to review patients on chronic opioid therapy is one strategy to mitigate risk associated with opioid use. Although a decrease in opioid use was not observed in this study, an increase was also not observed. Plans for a naloxone education program that oversees the prescribing, education, and follow up for both patients and prescribers is currently being considered.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Evaluative Study

Session-Board Number: 1-T

Poster Title: *Evaluation of prescriptive analytics to reduce length of stay through targeted pharmacy services in an acute care practice model*

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Purpose: Advanced pharmacy practice models that foster pharmacists' leadership and accountability for patient outcomes are imperative for the profession. Length of Stay is a clinical outcome metric used to represent efficiency in healthcare. Prescriptive analytics can be used to advance patient care opportunities. UNC Medical Center has an extended LOS, as compared to similar hospitals. A previous study utilized descriptive and predictive analytics to identify service lines with the highest opportunity for pharmacy impact. The objective of this study was to evaluate the impact of a LOS Program integrated into an acute care practice model on organizational, patient, and financial outcomes.

Methods: The LOS Program was launched in three UNCMC service lines, which had an identified extended LOS and high opportunity for pharmacy impact. The Program followed an Implementation Science approach, as an exploration study over a three month time period. Three pharmacists were targeted to enroll in the exploration phase. A quasi-experimental design with mixed methods was utilized to compare the effect of the LOS Program in the piloted services before and after implementation. Patients previously admitted to these services served as comparative, historical controls in a time-series design. Organizational and financial performance metrics including LOS, patient adverse events avoided, and inpatient days saved was ascertained from existing electronic records within the organization. Clinical pharmacists who executed the exploration study completed a fidelity survey every month of the exploration period. The pharmacists also completed a 60-minute face-to-face semi-structured interview regarding their experiences with the Program following

conclusion of the study period. Descriptive statistics was utilized to characterize patient demographic data and intervention type for the targeted population. Quantitative statistics using a rank sum test was utilized to assess acute care LOS. Data was presented as mean and median for continuous variables and percentages for categorical variables. Qualitative data was analyzed using thematic coding with a constant comparative approach to identify categories that characterize pharmacist perception of the LOS Program and implementation outcomes.

Results: The primary endpoint of LOS across the participating services was assessed. During the 2017 study period, the mean LOS was 7.66 days, a decrease from 8.14 days during the control period. The median LOS decreased from 4.95 to 4.12 from 2016 to 2017, respectively ($p < 0.011$). The most common documented interventions included antibiotic intravenous to oral conversion and discharge prescription ownership. Patients receiving the LOS Program in 2017 experienced a mean 11.5 hour decrease in LOS compared to the 2016 control group. Overall, there was a reduction of health care utilization as a result of decreased LOS across 458 patients, equating to \$437,921 over the 3 month period. Semi-structure interviews revealed several themes, including positive program impact on pharmacist professional development. The interviews also revealed a high degree of commitment to carrying out the interventions moving forward. Overall, the pharmacists experienced writing discharge prescriptions and discharge medication reconciliation as the most impactful component of the Program. The Implementation Science themes assessed also revealed a high degree of fidelity in implementing the program. Implementation themes include pharmacists' perception that the Program is appropriate for their patients. The pharmacists also found that the Program workload is feasible to integrate with their current responsibilities.

Conclusion: This exploration study demonstrated the ability of a pharmacist-driven LOS Program in the acute care setting to positively impact organizational, patient, and financial outcomes. By implementing a LOS Program model across multiple patient care service lines that were representative of the entire acute care setting, the generalizability and feasibility of this model were confirmed. The value of the LOS Program was established through its ability to demonstrate a reduction in LOS.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 2-T

Poster Title: *Improving hospital consumer assessment of healthcare providers and systems (HCAHPS) scores and increasing patient education through interprofessional collaboration: an opportunity for pharmacists and pharmacy learners*

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Purpose: Many institutions continue to struggle with improving the HCAHPS scores on medication teaching. At our institution, a multidisciplinary work group consisting of the case manager, social worker, discharge nurse coordinator, pharmacist, and unit nursing staff initiated walking care coordination rounds to meet with patients on a daily basis to discuss their plan of care and any potential barriers for discharge. When available, a pharmacy learner also becomes a vital part of the interprofessional team and can be leveraged to provide effective communication and education on medications and serves as an additional resource to meet hospital metrics.

Methods: In March and September of 2017, walking care coordination rounds began on an internal medicine and neurology unit, respectively. Rounds were performed daily for approximately one to two hours during the weekdays. During interdisciplinary rounds, the nursing staff gives a brief report discussing the patient's reason for admission, care plan, and disposition. Patients are encouraged to participate, if able, and to ask the interprofessional team if they have any questions regarding their current plan of care and discharge disposition. The pharmacist or pharmacy learner also takes this opportunity to provide education on new medications and high risk medications. Prior to discharge, patients are also seen by pharmacist or pharmacy learner for medication discharge education. Detailed discharge instructions are given to the patient or caregivers by the discharge nurse coordinator. We evaluated our institution's HCAHPS scores on patients' responses pertaining to education on new medications' purpose and side effects, and the purpose for taking each medication upon discharge from hospital. Scores reviewed were three months before and after care

coordination rounds were initiated. In addition to the HCAHPS scores, we also reviewed the numbers of medication and discharge education notes completed by pharmacist and pharmacy learner before and after care coordination rounds commenced on respective units.

Results: Based on the results from before and after the initiation of walking care coordination rounds, a positive trend in HCAHPS scores were observed for both units. Since the scores are proprietary, we are unable to share the specific percentages of patients' responses. For the question regarding patient's understanding of each medication's purpose post discharge, a positive trend in scores was observed for all three months post initiative on the medicine unit. For the neurology unit, a positive trend in scores was also observed for all three months post initiative with the question related to side effects of new medications. The number of notes entered by both pharmacists and pharmacy learners increased after care coordination rounds were initiated. This may be attributed to increased day to day interaction with patients and improved discharge planning with the interprofessional team.

Conclusion: During a hospitalization, the pharmacist or pharmacy learner are well-qualified to review medication additions, deletions, or any other changes with the patient and caregivers. Interprofessional collaboration through walking care coordination rounds can improve HCAHPS scores, increase the number of patient educations performed, and create great learning opportunities for pharmacy learners. These rounds allow learners to be engaged during their Advanced Pharmacy Practice Experiences (APPEs) by utilizing a patient-centered approach as advocated by the Joint Commission of Pharmacy Practitioners and supports the Accreditation Council for Pharmacy Education Standards 2016 and Core Entrustable Professional Activities.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 3-T

Poster Title: *Assessing pharmacist productivity using an operations dashboard in an academic medical center*

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Purpose: Identifying key performance indicators within a hospital pharmacy service delivering direct patient care continues to be a challenge for leaders. The use of dashboards to report meaningful metrics within a pharmacy department has been identified as a valuable tool to assess productivity and workload amongst the staff. Given the known difficulties with capturing accurate and complete information, attempts can be made to establish measures that are specific to the institution and provide a reflection of daily work activities. This project was implemented to review centralized pharmacist staffing metrics in an academic medical center.

Methods: The pharmacy leadership team submitted ideas for metrics specific to the clinical staff pharmacists working within the main pharmacy locations to be reviewed monthly. The metrics that were selected for inclusion into the dashboard were the following: total hours worked in the main pharmacy, total number of orders verified, total number of documented clinical interventions in the electronic medical record, total number of orders verified per hours worked, and total number of documented clinical interventions per orders verified. The reports also included an overall composite percentile for two of the metrics to show peer to peer rankings and comparisons. The data was collected from the time and attendance system and the electronic health record. Results were collected monthly and shared with all of the clinical staff pharmacists in quarterly intervals. Each pharmacist was assigned a random three digit number to identify their specific data on the report and these numbers were shared with each one privately. The staff were educated on the dashboard and it was reinforced that the data was not going to be used as a punitive measure.

Results: The quarterly publication was an attempt to share this data with the clinical staff pharmacists and review measures on consistency, performance, and add clarity around peer to peer comparisons. The finalized reports sent to the participants established noticeable trends with order verification patterns and helped to emphasize the importance of clinical documentation while working in the central pharmacy. The monthly reports showed that the amount of orders verified and documented interventions did not vary much between pharmacists working a consistent amount of hours in each report. The data also facilitated dialogue with the pharmacists and pharmacy operations manager, as the pharmacists had no prior knowledge on how they compared to their peers and what their individual performances had been historically in terms of the reported metrics. Discussions were also centered around many of the variables that had an effect on the data, such as other responsibilities within the pharmacy, day to day variances, quality of individual work not captured, and the impact of patient acuity on the measures. Given these known limitations of the dashboard, the operations manager has received quite a bit of feedback and suggestions on how to improve future analyses to avoid misleading inferences.

Conclusion: The operations dashboard provided a foundation for reviewing staffing metrics among pharmacists and established internal benchmarks around performance within the department. The challenges identified with the data collected serve to show the difficulty in capturing the full extent of a pharmacist's productivity when staffing in the pharmacy.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 4-T

Poster Title: *Improved purchasing strategies to maximize savings and improve inventory management for 340B eligible outpatient pharmacies*

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Purpose: In 2015, McKesson Pharmacy Optimization® (RxO) was engaged to conduct an analysis to help evaluate the benefit for the University of Missouri Health System (MUHS) to standardize purchasing across 9 outpatient pharmacies. MUHC leadership committed to ongoing collaboration with McKesson Pharmacy Optimization to refine and improve NDC selection and implementation to maximize savings and improve inventory management for 340B eligible outpatient pharmacies. Supply disruptions, pricing volatility, and patient utilization require validation of purchasing standardization strategies.

Methods: The initial analysis would consist of a comparison of the most cost effective NDC from both 340B and WAC accounts to identify a recommended NDC and project the lowest acquisition cost based on historical purchase volume by class of trade. Additional cost approaches were evaluated to consider the impact of significant differences between the 340B and WAC acquisition prices. The first phase included implementation and tracking of 106 items that resulted in nearly \$1 million in savings compared to baseline purchases. The second phase aimed to improve pharmacy acceptance of purchasing recommendations, expand the number of items to implement, and validate items already implemented. The approach was to separate pharmacies into groups based on volume of 340B eligible patients and identify the most cost effective NDC using criteria for each group. Subsequently, the team would prioritize implementation for items with the most savings for the system that had the same recommended NDC for both groups. Implementation of this initiative included dedicating of lead pharmacy technician to manage system updates, communicate supply disruptions, and answer questions from pharmacy staff. Financial monitoring was performed post-implementation for both phases by calculating realized savings for the volume purchased of

implemented NDCs comparing actual spend to average or median unit price for each class of trade from a defined baseline period.

Results: The project has spanned over 2 years with over \$1.5 million in realized savings to MUHC. Phase 1 had 106 items resulting in \$936,071 in savings with 60% capture rate. Phase 2 added savings of \$459,295 over 5 months by implementing 135 additional items. The capture rate increase to 71% in phase 2 and raw service level increase from 75% to 84.8% on implemented NDCs. The average percentage of items previous implemented that require review is between 20-35%. On average, 10-15% of items change because of significant price increases defined by MUHC as items with alternative NDC savings of more than \$500 from implemented NDC. Product availability challenges account for changes to an additional 10 -20% of items. Although savings for implemented items will deteriorate over time it is important to monitor changes. MUHC leadership stated that “it makes us feel good that we are keeping an eye out to balance optimization and efficiencies with drug purchasing”.

Conclusion: The in-depth analysis clearly proves that a strategy for purchasing the most cost effective NDC is complex given the volatility in 340B and WAC pricing and it requires visibility to system purchase volume and pricing. There is not a single approach for pharmacy managers to select the most cost effective NDC to achieve optimal savings.

Additional benefits not included in the savings calculations are 1) improved service level based on proactive purchasing projections, and 2) improved operational efficiencies and opportunity to decrease physical inventory by reducing the number of products to manage and centralizing the buying decision.

Submission Category: Administrative Practice/Management/Financial Management/Human Resources

Poster Type: Descriptive Report

Session-Board Number: 5-T

Poster Title: *Design and regulatory implications of a new 503a-503b health system sterile compounding service*

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Purpose: Due to the recent high profile cases of safety risks in pharmacy compounding, health systems are considering insourcing compounding services to more closely manage that risk. In 2013, the FDA created the 503a and 503b compounding designations, which gave the federal government jurisdiction over 503b outsourcing facilities. States still regulate 503a compounding pharmacies, which must compound pursuant to a prescription. In addition, registration and environmental testing expenses associated with implementing 503a and 503b pharmacies create a barrier to building these facilities without a thorough financial analysis as well as a regulatory understanding of both state and federal requirements.

Methods: A large number of factors were included for consideration in this project. A financial analysis determined that the volume of intravenous compounded medications and associated cost savings would support a 503a or 503b compounding facility. In addition, state and federal regulators were consulted for confirmation that plans aligned with all relevant regulations. Similar health-systems were contacted in order to validate the feasibility of the operational plans. This facility is included in a larger building that will centralize a number of different components of health system operations outside of the pharmacy services, including linen services and centralizing supply procurement and inventories. The physical considerations for these departments needed to be included into the feasibility analysis, as well as any pharmacy-specific needs.

Results: Yale New Haven Health System has decided to move forward with a 503a facility, and to build the physical location capable of a relatively quick conversion to a 503b outsourcing facility. Due to the novelty of the 2013 regulations, and the additional guidance expected from the FDA in the near future, the landscape for 503a and 503b facilities is expected to stay relatively dynamic in the near-term. Though Yale-New Haven Health System may build a 503b

facility that follows all current regulations, these may change in the short-term. A 503a compounding pharmacy has a longer history of regulation within the states and still leaves room for anticipatory compounding and patient-specific labeling. In addition, the state of Connecticut has regulations that are in discord with federal law, namely not allowing any facility to dispense medications directly to patients without being classified as a pharmacy. By federal law, a 503b facility must be classified as an outsourcing facility and not a compounding pharmacy.

Conclusion: Ambiguous state and federal regulations, which contradict themselves at times, continue to increase the complexity of implementing a centralized pharmacy compounding service. In addition to the current ambiguity, federal regulators are finalizing the applicability and feasibility of the compounding rules. Though compounding pharmacy has significantly evolved since the 2013 amendments, the additional congressional hearings as well as legal cases show that the FDA, patients, and pharmacists still have much to decide about future of intravenous sterile medication compounding.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 6-T

Poster Title: *Creation of a medication refill protocol and development of a centralized pharmacy-assisted refill pilot*

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Purpose: There is a growing demand for primary care providers, while access to these providers is shrinking. This contributes to increased workload for physicians and often burnout. Burnout influences patient safety, quality of care, physician turnover, and patient satisfaction. Pharmacists can practice as providers under a collaborative drug therapy management agreement and assist with the achievement of the Institute for Healthcare Improvement Quadruple Aim to enhance patient experience, improve population health, reduce costs, and improve the work life of health care providers. This protocol intended to establish practice standard expectations for the medication refill process and to guide refill decision making.

Methods: A literature search was performed and listserv requests submitted in order to gather information on both nursing and pharmacy driven refill protocols across the country. An interdisciplinary committee which consisted of pharmacists, nursing leadership, and an accreditation and regulatory specialist was formed to oversee the creation of the protocol. A report of most commonly prescribed medications in hospital-based outpatient clinics was utilized to determine which medications should be included within the protocol. Prescriptions for acute care medications and schedule II through IV medications were excluded from the report. Pharmacist, physician, and nursing feedback was requested from staff at several different primary care clinics and specialty clinics to agree upon the criteria for medication refill and quantities to be refilled. Criteria evaluated when assessing refills included last office visit, relevant laboratory values and frequency of monitoring, and any medication-specific requirements. Assessment of control of chronic disease state metrics such as blood pressure, blood glucose, cholesterol, asthma, and COPD were also included. After completing an initial training program that includes didactic education and practical experience, a competency assessment was created that must be completed with a score of 80% or greater prior to using

the protocol. A feasibility analysis was also performed to determine an appropriate refill volume for a pharmacist involved in a pilot.

Results: A protocol has been created to establish practice standard expectations for the medication refill review process within hospital-based ambulatory clinics and to provide guidance to pharmacists and other health care providers when evaluating medication refill requests. Over three hundred commonly prescribed medications were split into 21 different classes and included in this protocol. The majority of medications listed instruct authorizing 90 day supplies with 3 refills, contributing to increased medication adherence. Pharmacists may authorize prescription refills and communicate recommendations for laboratory monitoring to providers. If patients do not meet refill criteria, the request is routed to the prescriber with recommendations. Recommendations include scheduling a follow-up visit, additional monitoring, or alternative therapies. Prescriptions sent from the emergency department, upon hospital discharge, and from procedure clinics were excluded from the protocol in addition to any schedule II through IV and acute care medications. Results of the feasibility analysis yielded that on average, each pharmacist would likely require an average of 3.5 minutes per refill and can therefore complete 68.6 refills in this four hour time period. A pilot was developed where a pharmacist covers the refill request work queue in a clinic for four consecutive hours each week using the refill protocol.

Conclusion: With a high incidence of provider burnout and alert fatigue, enhanced guidance and support for physicians authorizing refills is essential. Additionally, utilization of a consensus document for refill criteria approved by pharmacy, nursing, and medical leadership serves as a valuable resource for new pharmacy and medical residents who may be unfamiliar with the required monitoring. Through this initiative, pharmacists have the opportunity to identify patients who would be good candidates for additional pharmacy services to enhance overall patient care.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 7-T

Poster Title: *Analysis of international normalized ratio (INR) control in outpatients enrolled in a warfarin management protocol featuring patient dose adjustment*

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Purpose: In the outpatient primary care setting, warfarin remains a viable option because of the aging population, expansion in indications for use, and low cost compared to newer agents. However, increased demands for a provider's time has led to inconsistent methods for managing warfarin. The warfarin management protocol at Coastal Medical was implemented to create a standardized procedure that assists providers in the management of warfarin. The purpose of this study was to determine if the implementation of a warfarin dosing protocol improved INR control and decreased frequency of INR testing among outpatients in the primary care setting.

Methods: This retrospective chart review of a single primary care practice in Rhode Island was approved by the institutional review board at the University of Rhode Island. Patients were included if they were on warfarin and had six months of INR data pre-protocol and six months of INR data on protocol. The protocol was used by advanced practitioners and was adapted from Ebell's systematic approach to warfarin dosing. A laminated dosing chart was provided to the patient and the patient was required to get routine lab draws based on the protocol. The primary objective of this study was to determine if the implementation of a warfarin dosing protocol improved INR control. The adequacy of anticoagulation was determined by measuring the percentage of INR tests that were within target INR range of 2.0-3.0 (expanded INR range plus or minus 0.2). The secondary objective was to determine if the implementation of a warfarin dosing protocol decreased the frequency of INR testing. The number of INR tests greater than 4.0 before the protocol were compared to the number of INR tests greater than 4.0 after protocol implementation.

Results: The mean age of the study population (n equals 35) was 76 years old (SD plus or minus 10.7). Among the outpatients on the warfarin management protocol, there were no statistically significant differences pre vs. on protocol when comparing INR control and frequency of testing. Among those without respiratory disease, INRs in therapeutic range were significantly increased by 4 percentage points on protocol (69 percent, 65 percent; p equals 0.003), while for those with respiratory disease, INRs were more often in therapeutic range pre-protocol (81 percent, 57 percent; p equals 0.003). Women had on average one less INR test on protocol compared to the pre-period, while men had on average two more INR tests on protocol (-0.93, 1.67; p equals 0.029). There were no statistically significant differences when the number of tests were compared according to indication, comorbidities and CHA₂DS₂-VASc score. There were fewer INR test results greater than 4.0 while on protocol when subgroups were compared, albeit these differences did not achieve statistical significance.

Conclusion: The implementation of a warfarin management protocol in this primary care practice did not show statistically significant differences in INR control or frequency of testing. However, the protocol was not associated with worsening INR control. Further study in a larger patient population is needed to evaluate these outcomes, patient satisfaction with the program and the outcomes evaluated in this study.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 8-T

Poster Title: *Burden of medication non-adherence associated with barriers acquiring and organizing medications in the United States adult population*

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Purpose: Non-adherence is divided into primary, medications the patient does not fill at pharmacies, and secondary, dispensed medications that the patient does not take as prescribed. In 2009 the Network for Excellence in Health Innovation (NEHI) estimated that non-adherence along with suboptimal prescribing, drug administration, and diagnosis could result in as much as \$290 billion per year in avoidable medical spending or 13 percent of total health care expenditures. The purpose of this study is to assess the burden of acquiring and organizing medications that can contribute to primary and secondary non-adherence, respectively, measured by a consumer internet survey.

Methods: Original data was collected from 4,993 individuals that participated in the study via a structured thirty two minute online survey from October 30th to December 4th in 2017. The survey structure, topics, and questions were developed and informed by a targeted literature search. The literature search was performed using PubMed and Google Scholar. Publications were screened if they contained key terms related to overall medication use, non-adherence in the United States, and the clinical and economic burden of medication non-adherence. To qualify for the survey participants were required to be: aged 18 years or old; visited a pharmacy at least two times to pick up a medication within the past six months with at least one of the trips taking place within the past month; are part of the decision making process when choosing the pharmacy location they visit; and take at least one daily medication either orally or non-orally. Data was weighted to reflect the US population. Survey topics included: patient behaviors associated with acquiring medications; factors that impact patient decision making when selecting a pharmacy to acquire; adherence to prescribed regimens; and patient attitudes

and current practices organizing medications. This research study was determined to be exempt by the Western Institutional Review Board.

Results: On average, respondents managed 6 medications on a daily basis with 96% primarily responsible for managing their own medications. Self-reported adherence, always taking medications as directed by a physician, was 73%; while suboptimal adherence or never taking medications was reported by 27% of respondents. Factors with the potential to impact primary non-adherence include: cost, lack of perceived need, insurance issues, forgetfulness, and inconveniences associated with the pharmacy. Twenty six percent of respondents reported not acquiring an individual medication within the past year with no observed differences between different age groups. Primary non-adherence was reported by 6% of respondents who never return to pick up their medications after leaving the pharmacy without their medications. On average, respondents wait 13 minutes before leaving the pharmacy with 28% leaving without their medications. Multiple studies have demonstrated that increasing the complexity of a medication regimen is associated with decreased adherence. A potential opportunity to improve secondary non-adherence includes better mechanisms to organize medications. In this survey, 75% of respondents spent an average of 9 minutes organizing and managing medications at least once a week. Furthermore, 18% reported their current system as bothersome.

Conclusion: The relative convenience of acquiring and organizing medications are significant determinants of a patients' willingness and ability to adhere to medication regimens and therefore improve health outcomes. In this survey, self-reported suboptimal adherence was 27% yet the NEHI estimates the problem to be even greater with an estimated 33% to 50% of US patients not taking their medications as prescribed. Barriers that impact primary non-adherence can be alleviated by addressing cost, education, insurance issues, and inconveniences associated with the pharmacy. Solutions that require minimal time and hassle when organizing and managing medications have the potential to improve secondary non-adherence.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 9-T

Poster Title: *Comparison of interventions made in an ambulatory pharmacist-managed refill model to usual physician care*

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Purpose: With the demand for primary care increasing, innovations that assist in saving provider time and relieving administrative burden are necessary. Studies have shown collaborative practice agreements between physicians and pharmacists decrease prescription refill request burden, increase patient care time and satisfaction, and decrease refill turnaround time. However, there is limited data to demonstrate the clinical impact of a centralized, high-volume, dedicated pharmacist prescription refill model. The purpose of this study was to compare the composite of accepted medical interventions initiated by the pharmacist-managed authorization center (PMAC) at the time of refill request to usual care.

Methods: The institutional review board approved this retrospective, observational non-inferiority study. Included patients 18 years and older with an established primary care physician (PCP) under the collaborative practice agreement and had a PCP visit within 18 months were identified. Patients with a refill request for non-controlled, chronic medication managed by the PCP from January 1, 2016 – March 31, 2016 were assigned to the control group (usual care). Patients with refill requests from January 1, 2017 – March 31, 2017 were assigned to the intervention group (pharmacist reviewed). The primary outcome was composite medical interventions (drug related problem resulting in a therapy change, laboratory monitoring ordered, or office visit scheduled) compared to usual care. Of the intervention group, the following secondary endpoints were collected: total, type, and acceptance rate of recommendations. Non-inferiority was concluded if the 2-sided upper boundary of the 95 percent confidence interval for the difference in medical intervention rate between refill request groups was less than 2 percent. If the upper bound of the 95 percent confidence

interval was below 0, then superiority would be concluded. A total of 4,030 refill medications were needed to achieve 80 percent power to detect the non-inferiority margin. Nominal variables were reported as n(percent) and compared using chi-squared test, while continuous variables were reported as mean plus or minus SD and were compared using student's t-test.

Results: A total of 3,830 patients were included, with 4,732 requested medication refills, 2,549 reviewed by PMAC and 2,183 by usual care. Medical interventions occurred in 90 medications in the control group (3.5 percent), compared to 153 in PMAC group (7.0 percent). The difference in total composite medical interventions between the control and intervention groups was -3.5 percent (95 percent CI, -4.8 percent to -2.2 percent). Since the upper bound of the 95 percent CI was below 0, both the non-inferiority and superiority margins were met. Medications reviewed by PMAC had significantly higher number of new laboratory monitoring and scheduled appointments (P equals 0.36 and P less than 0.001, respectively). PMAC also experienced more drug therapy changes, however that difference was not statistically significant (P equals 0.16). There were 294 overall recommendations observed by PMAC (13.5 percent). Of these, 60 (20.4 percent) were drug therapy recommendations, 70 (23.8 percent) were laboratory monitoring requests, and 164 (55.8 percent) were requests to schedule an office visit. The acceptance rate of pharmacist recommendations was 52.0 percent overall; acceptance of drug therapy recommendations, laboratory monitoring requests, and requests to schedule an office visit were 48.3 percent, 45.7 percent, and 56.1 percent, respectively.

Conclusion: The use of PMAC was superior to usual care for reviewing refill requests. There was a statistically significant improvement in overall medication monitoring and patient follow-up. Further studies are needed to assess the clinically significant impact of pharmacist interventions on long-term outcomes.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 10-T

Poster Title: *Implementing a medications to clinic program for patients on long-term anticoagulation*

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Purpose: Warfarin is used for the prevention and treatment of thromboembolic conditions. Due to its narrow therapeutic index, warfarin requires routine INR monitoring to ensure patients are within safe therapeutic range. Medication non-adherence is one of the main reasons for patients not being within therapeutic range. Delivering medications to patients through mail-order pharmacies and “medications to bedside programs” have demonstrated a benefit by improving adherence and increasing patient satisfaction. The medications to clinic service was implemented to improve medication adherence, decrease missed appointments, and improve clinical outcomes by bringing warfarin to the anticoagulation clinic at the end of their visit.

Methods: This new service was implemented at a pharmacist-run anticoagulation clinic within the internal medicine, cardiology and family medicine clinics. Patients who wish to enroll in this program will be filling warfarin at The Brooklyn Hospital Center (TBHC) Pharmacy, which opened in the summer of 2017. After a patient completes a warfarin visit, the pharmacotherapy specialist sends an electronic prescription under a collaborative drug therapy management agreement (CDTM) to TBHC Pharmacy and notifies the outpatient pharmacist. Pharmacy students, residents or pharmacotherapy specialists then pick up the prescription from TBHC pharmacy and bring it to the patient in clinic. Patients also have the option to be escorted to the pharmacy or to pick up their prescription on their own.

Results: Currently, four patients are using TBHC Pharmacy to fill warfarin on a routine basis. One of these patients was a new start to warfarin, while three have been on warfarin previously and switched to the TBHC Pharmacy. All patients are African American with an average age of 50 years old. With the implementation of the medications to clinic program, there has been a trend in increased time in therapeutic range (TTR), adherence to medication, and adherence to appointments. There were numerous barriers that limited the enrollment of patients in this

program. The biggest limitation was the lack of insurances that were accepted by TBHC Pharmacy upon opening. Another limitation was that TBHC Pharmacy does not deliver medications outside of the clinic or hospital. Many patients require transportation to clinic and desired a pharmacy that delivers medications to their home. Finally, the last limitation was that TBHC Pharmacy did not carry all of the strengths of warfarin upon opening. These limitations significantly decreased the amount of patients that could utilize TBHC Pharmacy initially. However, with the pharmacy now accepting most insurances and carrying all strengths of warfarin, more patients should be able to enroll in the medications to clinic program.

Conclusion: A pilot of a medications to clinic program has shown a trend in increased TTR, adherence to medications and adherence to appointments. Due to the success in the pilot study, the medications to clinic service will be continued. With a larger sample size, we will be able to perform a statistical analysis to evaluate improvements in clinical outcomes.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 11-T

Poster Title: *Feasibility of clinically integrated comprehensive medication management in a patient centered medical home*

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Purpose: The American Medical Association defines clinical integration as the coordination of patient care across conditions, providers, settings and time. Concepts of clinical integration are echoed in the support of team-based care as a building block for highly effective primary care, and as an essential component of the patient centered medical home (PCMH) model. Clinical pharmacists are often included in team-based care, however, services are more frequently co-located than fully integrated in real time. The purpose of this demonstration project is to evaluate the feasibility of incorporating the concept of clinical integration into comprehensive medication management (CMM) through collaborative interdisciplinary visits.

Methods: Prior to implementation, a service proposal was developed based on a system needs assessment. With support of pharmacy leadership and a physician champion, clinical pharmacist services began July 2017 with one clinical pharmacist at one PCMH site. The initial clinical pharmacist time investment was 0.2 FTE. During the initial phase, the pharmacist and physician champion established a workflow for integrated comprehensive medication management. Workflow and documentation procedures were continuously evaluated and adapted to ensure sustainability. The resulting process was then expanded to include a PGY1 pharmacy resident paired with medical residents. An initial population of focus and additional secondary target populations were selected based on institutional initiatives, reported quality measures and provider input and include: diabetic patients with an A1c greater than 9 (population of focus), poorly controlled hypertension, and polypharmacy (greater than 8 chronic medications). In September 2017, the workflow was presented to all attending and resident physicians in clinic and subsequently rolled out to include all patients in the target population.

Results: CMM was implemented as an integrated component of a regular physician visit. During integrated visits, pharmacists collect an accurate medication history and assess for medication therapy problems prior to the physician assessment, develop the treatment plan with the physician based on both assessments, and implement the plan with or without the physician present, as appropriate. Pharmacist notes are entered into the electronic health record and allow for tracking of medication therapy problems. Pharmacists follow-up with patients by phone or by scheduling the next appointment under the primary care physicians schedule, with an effort to schedule during pharmacist shifts. The pharmacy team also responds to drug information requests, troubleshoots medication access issues, develops patient education and provider education tools, and assists in quality improvement efforts. Pharmacists have been well received in clinic by prescribers and other clinic staff. Initial results from quality improvement initiatives have supported an additional 0.2 FTE at the original PCMH site, as well as 0.4 FTE at another PCMH site.

Conclusion: Incorporating CMM into a clinically integrated visit did not significantly alter the pharmacist patient care process. Benefits include ease of communication, shared decision making and opportunities for cross-disciplinary teaching. There are, however, challenges in practice management leading to difficulty reaching the population of focus and ensuring consistent tracking and follow-up. Outcomes from this demonstration project have successfully lead to the expansion of the service. Future work will focus on reaching targeted high-risk populations more effectively and streamlining aspects of CMM practice management.

Submission Category: Ambulatory Care

Poster Type: Descriptive Report

Session-Board Number: 12-T

Poster Title: *Impact on antibiotic prescribing after pharmacy-led education and implementation of a point of care rapid influenza diagnostic program in a medically underserved community health center*

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Purpose: Overprescribing of antibiotics is a significant public health issue in the community that requires collaboration and education to combat this problem. Many patients expect an antibiotic when they contract a respiratory illness regardless of the etiology of the infection. The purpose of this study is to determine the number of antibiotic prescriptions that were avoided after implementing pharmacist-led education on bacterial versus viral respiratory infections and administration of a rapid influenza diagnostic assay in an ambulatory care setting.

Methods: This study was approved by the university's Institutional Review Board. The community health center (CHC) provides non-emergency medical care and pharmacist-led chronic disease state management to those who do not have access to health care services. Prior to implementation of the rapid influenza diagnostic program, education was provided to the primary care providers (PCP), fourth year student pharmacists, and clinic staff on bacterial versus viral upper respiratory tract infections (URTIs). During triage, patients who were noted to have symptoms associated with URTIs or the flu were referred to the clinical pharmacist for further evaluation and potential administration of the rapid influenza diagnostic test (RIDT). Informed consent was obtained. When RIDT was administered, the pharmacist (and/or student pharmacist) consulted with the PCP regarding the results to recommend the best course of therapy. Additionally, a retrospective review of antibiotic prescribing practices for URTIs and/or associated symptoms from October 2016 through July 2017 to compare this year's cohort with the previous year. The primary outcome was to determine the number of antibiotic prescriptions avoided after pharmacist-led education and implementation of the RIDT program throughout the 2017 -2018 flu season. Secondary analysis included patient demographic information, number of RIDT tests administered, and surveys of CHC staff regarding perceptions

of antimicrobial stewardship and pharmacists conducting point of care testing for influenza after implementation of the program.

Results: Retrospective analysis from October 2016 through July 2017 highlighted an opportunity to promote antimicrobial stewardship at the CHC. Forty patients met criteria for retrospective review where 25 patients (62.5 percent) received antibiotics regardless of whether viral or bacterial infection was suspected. Antibiotics prescribed were predominantly ciprofloxacin, amoxicillin, and azithromycin. Prospective analysis shows 52 patients presented with URTI symptoms. Of those, 42 met inclusion criteria for RIDT; however, only 10 patients received the RIDT. Of patients screened, five received an antibiotic prescription (50 percent). Reasons RIDT was not administered include: missed as a candidate during triage and presented during night clinic when pharmacy team is not present. Cumulative data of the 42 patients who were eligible for RIDT shows 24 patients received an antibiotic (57.1 percent). No patients tested positive for influenza; however, the RIDT program facilitated collaboration between PCPs and pharmacists with antibiotic prescriptions avoided. The number of antibiotics prescribed for URTIs decreased approximately 12 percent from last year in patients who received the RIDT and 5 percent in the cumulative cohort after the implementation of pharmacist-led education and the rapid influenza diagnostic program. Survey results from the CHC staff showed implementation of the antimicrobial stewardship program was well received.

Conclusion: The implementation of pharmacy-led education prior to and during influenza season introduced and reinforced antimicrobial stewardship in the CHC. While the study was limited in size, this program provides preliminary data to support the positive impact pharmacists can have when working interprofessionally on a healthcare team to perform point of care testing and promote antimicrobial stewardship in a medically underserved ambulatory care setting.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 13-T

Poster Title: *Retention in care for pre-exposure prophylaxis (PrEP) services and related factors at an urban community health center*

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Purpose: The care continuum for pre-exposure prophylaxis (PrEP) mirrors that of HIV in many ways yet has not been as clearly defined. Few studies have investigated barriers to patients receiving continued care for PrEP. Patients discontinuing PrEP or not being retained in care remains a great barrier to continued HIV prevention. This study investigated the rates of retention for PrEP services at an urban community health center. The primary objective was to identify patterns of retention and related sociodemographic factors. The secondary objective was to examine patient-identified reasons for discontinuing PrEP to aid in improvement of clinical services and retention rates.

Methods: Men and women older than age 18 who had provided consent to the clinic and utilized PrEP services previously between April 2016 to July 2017, were identified from the electronic health record and classified as either retained in care, not retained in care, or lost to follow up. Retained in care was defined as patients having two or more appointments for PrEP services within the last six months prior to July 1, 2017. Demographic data included age, sex/gender, race/ethnicity, primary language, and insurance status. Patients identified as lost to follow up were contacted by phone, provided informed consent, and enrolled in the study survey. Patients were able to take the survey via phone or email dependent on preference. Patients were asked a total of three questions regarding utilization of PrEP services and reasons for discontinuing services. The primary study question was related to reasons patients discontinue PrEP services as well as barriers to retention. The Institutional Review Board of the University of Missouri-Kansas City approved this study protocol. Data was analyzed by descriptive statistics.

Results: A total of 339 patients utilized PrEP services at this urban community health center during the designated time period; 138 (40%) were classified as retained in care while 188 (55%) were not retained. A remaining 14 (4%) patients met the definition for lost to follow up, having previously met the retention in care definition but having no PrEP appointments in the last six months prior to data collection. Overall, 301 (89%) patients identified as male, 34 (10%) as female, and 4 (1%) as transgender. Majority of patients identified as white (n=217, 64%), primarily spoke English (n=323, 95%), and had private insurance (n=198, 58%). Demographic data for patients lost to follow up was similar to overall patient data; mainly identifying as male (n=12, 86%), white (n=12, 86%), English-speaking (n=12, 86%), and having private insurance (n=8, 57%). These patients were contacted to complete the patient survey regarding discontinuation of PrEP services.

Conclusion: Retaining patients in continued care and follow up for PrEP services remains a barrier to widespread, effective HIV prevention. A majority of patients were not retained or were lost to follow up for PrEP services at this urban community health center. While patients cited several reasons for discontinuing PrEP services, most patients utilizing these services are still at risk for HIV infection yet are not retained in care with recommended and routine follow up.

Submission Category: Ambulatory Care

Poster Type: Evaluative Study

Session-Board Number: 14-T

Poster Title: *Assessing the impact of pharmacists' recommendations during a telehealth interprofessional epilepsy appointment and their alignment with quality measures*

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Purpose: The United States physician shortage continues to escalate. Rural communities experience significant disparities with only 13.1 physicians and three specialists per 10,000 patients. To address this provider shortage and expand access to care for underserved communities with epilepsy, a national, non-profit organization initiated an interprofessional telehealth program. In collaboration with a medication therapy management provider and academic institution, a telepharmacist conducted comprehensive medication reviews (CMR) during tandem appointments with an epileptologist. The study purpose was to: identify gaps in care based on the telepharmacists recommendations; and determine whether these recommendations aligned with Health Effectiveness Data Information Set (HEDIS) performance measures.

Methods: A retrospective chart review was conducted on patients who had an appointment with an integrated interprofessional care team consisting of: an epileptologist, nurse coordinator and a telepharmacist. This novel approach integrated provision of services by the team, from geographically distinct remote locations. The telepharmacist conducted a CMR via video conferencing technology. Recommendations for any conditions or medications were made to the epileptologist, primary care provider, and patient as appropriate. The consultation was documented in the electronic health record in real time. For the analysis, the pharmacists' recommendations were categorized according to 24 pre-selected HEDIS performance measures or a non-HEDIS measure. Descriptive statistics were utilized to assess patient demographics and pharmacist recommendations via an electronic spreadsheet. This project was approved by the academic institution's Institutional Review Board.

Results: A total of 86 initial and 36 follow-up appointments were conducted over 19-months, from April 2016 to October 2017. Patient age ranged from four to 76 years, with a mean of 26.2 and standard deviation (SD) of 14.8. Fifty-two percent of patients were female. Patients were taking an average of 6.1 medications (SD 3.6). A total of 159 comorbidities or conditions were identified in the EHR. There were a total of 306 recommendations, with an average of 3.6 per patient (SD 3.2). Forty-one (13.4 percent) recommendations aligned with the pre-selected HEDIS measures. The most commonly identified measures included medication management for depression (31.7 percent), hypertension (24.4 percent), and asthma (9.8 percent); and comprehensive adult diabetes care (14.6 percent). Insufficient documentation to confirm a targeted HEDIS measure prevented categorization of the remaining 265 recommendations. For example, a patient's diagnosis was listed as a respiratory condition and it was not possible to determine if it qualified for inclusion in a HEDIS measure for asthma thus, decreasing the number of recommendations aligning with HEDIS measures.

Conclusion: This retrospective analysis showed that approximately 13 percent of telepharmacists' recommendations aligned with HEDIS quality measures. Future work is needed to investigate whether improving the depth of pharmacists' recommendations results in greater alignment with these measures. This also may demonstrate the added value of telepharmacists and their role as integral partners in novel telehealth approaches.

Submission Category: Ambulatory Care

Poster Type: Case Report

Session-Board Number: 15-T

Poster Title: *Safety implications of a high-risk medication and a language barrier*

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Purpose: This case report describes a situation in which warfarin was incorrectly administered secondary to a language barrier, the results of that error, and the possible solutions to prevent such errors in the future. A 62-year-old Spanish-speaking Hispanic male with mitral valve replacement and atrial fibrillation was referred to the anticoagulation service in February 2009 with a target International Normalized Ratio (INR) goal of 2.5-3.5. Patient-reported history during clinic visits is complicated by the patient's limited ability to speak, read, or understand the English language. His adult son often accompanied him to his visits to aid in translation. After more than eight years of fairly stable warfarin doses between 11mg and 14mg per week, his INR was found to be greater than 8.0 during a routine follow-up appointment (Visit 0). Prior to this visit, his warfarin regimen was 13mg per week for four consecutive visits using 1mg strength tablets. There were no identifiable causes for the elevated INR; patient reported taking his warfarin dose as directed, with no changes in dietary vitamin K intake, medications, or health status. He reported drinking one beer in the previous week. The patient's son was contacted via telephone to ensure no translation barrier occurred and all potential sources of elevation in INR could be identified, as he was not present during that visit. The patient was instructed to skip warfarin doses for two consecutive days, take 1mg on day three, then return for repeat INR testing on day four (Visit 1). He was also advised to bring all home medications and pillbox to that appointment for review. During Visit 1, his INR was again greater than 8.0 despite holding 38 percent of his dose in the previous three days. His son was present to help provide accurate information. Upon visual review, it was determined that a vial of warfarin 2.5mg was also present which was prescribed during a hospitalization three months prior. At time of discharge, without a translator present, he misunderstood his medication instructions and thought that warfarin 2.5mg was the same as amlodipine used for blood pressure. Therefore, he had been taking an additional 2.5mg of warfarin daily, resulting in a total of 30.5mg per week, which is more than double his usual dosage. He developed a subconjunctival

hemorrhage and large bruise to his abdomen. With patient approval, the 2.5mg warfarin prescription was confiscated and destroyed to avoid further mix-up. As phytonadione was unavailable, dietary vitamin K intake was advised, and warfarin doses were held until Visit 2, which was four days later. At this visit, his INR was 2.0 and bruising and bleeding symptoms were much improved. Warfarin was resumed at 13mg per week and subsequent INR values ranged between 2.4 and 3.5 for the following 5 visits with intended dosing. This patient case describes how the lack of a translator or use of an inexperienced translator to relay information concerning patient medication therapy can be very unsafe and risky. Although this patient did not experience permanent damage, the consequences could have been dire. This type of situation can be avoided in the future if limited English proficiency (LEP) patients are provided with trained medical interpreters during their hospital and clinic visits.

Submission Category: Chronic/Managed Care

Poster Type: Descriptive Report

Session-Board Number: 16-T

Poster Title: *Economic impact associated with reduction in surgical eligibility with use of an exhalation delivery system with fluticasone (EDS-FLU) in nasal polyps: a cost reduction model*

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Purpose: Chronic rhinosinusitis with and without nasal polyps (CRSwNP, CRSsNP), is a debilitating chronic inflammatory disease affecting ~12% of U.S. adults. Current treatment is associated with high failure rates; 50% of patients with CRSwNP have undergone endoscopic sinus surgery (ESS), and approximately 8% of patients with CRSwNP undergo ESS yearly. Repeat ESS for uncontrolled symptoms or polyps is 20.6%/5 years. In multiple clinical trials EDS-FLU demonstrated a broad improvement in symptoms, polyp elimination, and reduced ESS eligibility. A cost reduction model was developed to estimate the potential economic impact of reduced ESS cases in patients with nasal polyps treated with EDS-FLU.

Methods: A 3-year cost reduction model was developed, incorporating disease-related parameters derived from the medical literature, market research, and EDS-FLU clinical trials: Adult population (77.39% of the population), NP prevalence in adults (1.2%), NP ESS rate (8%), ESS cost (\$14,083; weighted cost of ESS (CPT codes 31238-40, 31254-56, 31267, 31276, 31287, 31288), balloon sinuplasty (31295-97) and drug-eluting implant (0406T, 0407T) procedures in U.S. IQVIA claims from 2012-2016, adjusted to 2017 U.S. dollars), ESS revision probability (20.6% over 5 years transformed to a yearly probability of 4.51%), ESS intraoperative complication rate and cost (1%; \$21,114), ESS post-operative complication rate and cost (17.3%; \$2,457), post-ESS healthcare utilization year 1 (\$1,369) and year 2 costs (\$1,000), year 1-3 EDS-FLU market share (3%, 6%, and 12% of adult patients with CRSwNP), and ESS reduction rate with EDS-FLU treatment (70%). The model compared two scenarios: a) the cost associated with current surgery rates per million members, and b) cost savings resulting from reduction in ESS eligibility observed in EDS-FLU clinical trials, adjusted for projected three-year market shares in a 1 million-member health plan. Per-member and per-patient-per-month (PMPM,

PPPM) costs were adjusted to 2017 dollars. A probabilistic sensitivity analysis (PSA) with 1,000 simulations was conducted, where each simulation simultaneously and randomly varied all model parameters around their 95% confidence intervals to determine the potential range of surgeries and costs avoided with EDS-FLU.

Results: In a 1M member plan, 2,006 patients with NP would undergo ESS over three years, costing ~\$30,801,452 (\$0.85 PMPM). ESS, ESS revisions, and intra- and post-operative ESS complications combined accounted for 80% of costs among ESS patients. Based on projected market shares for years 1-3, the blended market share over the 3-year period was 7%. Treating this proportion of ESS candidates at the specialist level with EDS-FLU would avoid 98 (70%) ESS cases, 4 revisions, and 1 complicated surgery, saving \$1,511,545 (4.9% of ESS costs). In addition, \$97,220 in office visit, \$61,581 in endoscopy, \$29,683 in medication, and \$8,883 in radiology-related costs would be avoided. Overall, a savings of \$0.047 PMPM, or \$5.68 PPPM would be realized. The PSA showed that between 51 and 178 ESS cases would be avoided, with corresponding savings between \$0.02 and \$0.09 PMPM (\$2.91 and \$11.98 PPPM), net of drug acquisition costs.

Conclusion: In this cost reduction model, the reduced ESS eligibility produced by adoption of EDS-FLU for treatment of a health plan's population of patients with CRSwNP demonstrates potential for meaningfully reduced ESS-associated direct healthcare costs. Future real-world studies would be useful in assessing the actual impact of EDS-FLU on these and other patient and economic outcomes.

Submission Category: Emergency Medicine

Poster Type: Evaluative Study

Session-Board Number: 17-T

Poster Title: *Effect of hemodynamic instability on time to initiate post-intubation sedation in the emergency department*

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Purpose: Rapid Sequence Intubation (RSI) is an established method of inducing anesthesia in patients who are unable to maintain their own airway. RSI occurs often in the Emergency Department (ED), and it is standard practice to administer sedative medications along with paralyzing agents in order to facilitate procedure visualization during RSI. Frequently, a delay may occur when administering continuous sedation post-RSI in patients who are hemodynamically unstable. The purpose of this study is to determine time to initiation of post-intubation sedation or analgesia in hemodynamically stable patients after RSI compared to patients who are not hemodynamically stable.

Methods: This retrospective cohort group study was reviewed and approved by the Institutional Review Board (IRB) and included patients admitted to the ED between July 2016 to October 2017. Patients were included if they were greater than 18 years of age, admitted to the ED with recorded administration of etomidate, and received a NMB in a RSI event. Patients were excluded from the study if they had mechanical circulatory support devices (MCS), received continuous or intermittent intravenous sedation or analgesia within 60 minutes prior to RSI, did not receive post-intubation sedation or analgesia within 120 minutes post-RSI, had post-cardiorespiratory arrest, or were deemed to be inappropriate candidates for sedation or analgesia. Patients were divided into those who were hemodynamically stable versus those who were not hemodynamically stable. Hemodynamic instability was defined as systolic blood pressure (SBP) of less than 90 mmHg or mean arterial pressure (MAP) of less than 65 mmHg. The primary outcome was time to initiate post-intubation sedation or analgesia in each of the aforementioned groups. Secondary outcomes are selection of post-intubation sedation or analgesia, dosing, hemodynamic endpoints and occurrence of hypotension post intubation. A priori sample size calculation estimated approximately 230-250 patients to detect a 10 minute

difference in time to sedation with standard deviation of up to 29 minutes. Linear regression analysis will be performed to analyze the primary outcome.

Results: A total of 265 patients were included in the study per the aforementioned inclusion and exclusion criteria. Out of these, 32 patients were deemed hemodynamically unstable per the predetermined criteria as defined above and 233 patients were hemodynamically stable at the time of RSI. More males were in the hemodynamically unstable group (N= 19/32; 59%) than compared to the hemodynamically stable group (N= 102/233; 44%) but were similar in the mean age of 63 years (IQR: 55-71) and 64 years (IQR: 54-76) respectively. The most common sedation used after RSI was propofol. For the primary outcome, hemodynamically unstable patients received sedation on average 54 minutes after the NMB compared to the hemodynamically stable group of 31 minutes (p value = 0.0477).

Conclusion: Without controlling for other variables, the time to initiate continuous sedation in patients who were hemodynamically unstable was significantly longer than hemodynamically stable patients at a single institution.

Submission Category: Home Care

Poster Type: Descriptive Report

Session-Board Number: 18-T

Poster Title: *Implementation of pharmacist home visits for high risk patients to enhance medication reconciliation and reduce hospital readmissions*

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Purpose: Exeter Health Resources network consists of Exeter Hospital, Core Physicians, and Rockingham Visiting Nurses & Hospice. Each entity's electronic medical record operates independently from the next without integration. Patients discharged from the hospital have a ninety-six percent discrepancy rate in medication lists resulting in more calls for clarification. Additionally, patients with a diagnosis of congestive heart failure or chronic obstructive pulmonary disease have readmission rates greater than ten percent. This study describes the use of pharmacist home visits and medication reconciliation for the reduction of telephone calls between providers as well as hospital readmissions.

Methods: Patients are screened upon admission to Exeter Hospital for a Core Primary Care Provider and qualifying diagnosis of either congestive heart failure or chronic obstructive pulmonary disease. Of these patients that elect home care for post-discharge management to be provided from Rockingham Visiting Nurses Association and Hospice are then enrolled in the Transition of Care program. Each patient is seen prior to discharge a minimum of one time in order to introduce the role of a pharmacist in their care and to provide medication discharge counseling services. Patients are asked to self-assess confidence levels in managing medications once discharged using the Wasson Confidence Index. It is then the responsibility of the Transition of Care Pharmacist to reconcile the patient's most current medication list across the continuum of care. Following discharge the pharmacist will provide a medication therapy management driven visit in the home setting. Along with medication therapy management services, motivational interviewing techniques are employed with each patient in order to ensure a more patient-centric approach to care management. At the end of each visit patients are again asked to self-assess using the same Wasson Confidence Index tool.

Visit notes are then provided to the primary home care clinician as well as the patient's primary physician.

Results: From June 17, 2016 to December 31, 2017 there were 176 patients enrolled into the Transition of Care Program with 96 of these patients having a pharmacist home visit. Of the patients that had a pharmacist visit, only 4 were readmitted within 30 days for a readmission rate of 4.17%. Emergency room visits and observation admissions were not included in this number. Additionally, data from Medicare was also examined to show that patients were not readmitted outside of the Exeter Health Resources continuum. Exeter Hospital reports 30 day readmission rates for patients with congestive heart failure at 18.045% and 16.725% in 2016 and 2017, respectively. In an audit performed in 2015 there was a 96% (23/24 charts) medication discrepancy rate. Over the time period of the transition of care program, the telephone call rate from visiting clinician in the field to provider has decreased from 96% of cases to 0%. The average number of medication reconciliation related discrepancies decreased from 4 per month to 0 and has stayed at this rate until today. Wasson Confidence Index scores improved, on average, from 7.56 at point of discharge to 8.87 after follow up visit in home.

Conclusion: Pharmacist intervention has proven to be beneficial to both the patient and each health care facility. Having a pharmacist involved with the patient using medication therapy management skills as well as motivational interviewing makes a notable difference. Patients are staying out of the hospital longer, having higher quality of life and an interest in managing their own care. High call volume between clinicians has decreased resulting in less staff rework, patient dissatisfaction and potentially adverse patient outcomes.

Submission Category: Home Care

Poster Type: Descriptive Report

Session-Board Number: 19-T

Poster Title: *Use of home health and other healthcare services among privately-insured patients with and without treatment-resistant depression*

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Purpose: To describe home health services (HHS) use in commercially insured patients among three cohorts: 1) treatment-resistant depression (TRD), 2) major depressive disorder (MDD) who did not develop TRD (non-TRD MDD), and 3) without MDD (non-MDD). To characterize use of other healthcare services in these populations, overall and within each cohort, stratified by whether patients were users of HHS.

Methods: A retrospective longitudinal cohort study utilized US healthcare claims (07/2009-03/2015) from the OptumHealth Care Solutions, Inc. database, which contains administrative claims of privately-insured employees and their dependents. MDD patients were identified using diagnosis codes. TRD patients were defined as those with MDD who initiated a third unique antidepressant or augmentation treatment following two different lines of therapy of adequate dose and duration. Patients included in this study were 18-64 years of age at the index date, which was defined as a patient's first antidepressant medication claim (or random date for non-MDD patients), and had at least 6 months of continuous eligibility pre- and post-index. Patients were excluded if they had a diagnosis for specific psychiatric comorbidities (i.e., psychosis, schizophrenia, manic/bipolar disorder, dementia), if they had Medicare coverage, and if they had a claim for an antidepressant during the 6-month baseline period prior to the index date. Cohorts were stratified by use of HHS, which was based on place of service, provider type and relevant procedure codes. Patient data for up to 2 years following the index date was used to assess health outcomes, TRD status, and use of HHS. Patient characteristics, healthcare resource use, and costs were stratified by HHS, and were reported using descriptive statistics and rates.

Results: Of 149,884 non-MDD, 33,068 non-TRD MDD and 6,411 TRD patients, 18.0 percent of TRD, 12.4 percent of non-TRD MDD, and 6.5 percent of non-MDD patients received HHS during follow-up. Among patients receiving HHS during follow-up, ~25 percent had baseline HHS, per patient per year (PPPY) rates of HHS visits and costs were: 3.41 and 1,223 dollars in non-MDD, 3.89 and 1,175 dollars in non-TRD MDD and 4.55 and 1,419 dollars in TRD. HHS comprised a relatively small proportion of overall healthcare costs, (5.5 percent in non-MDD, 4.1 percent in non-TRD MDD and 3.5 percent in TRD). Mean all-cause healthcare costs were universally higher for HHS users relative to non-users: 40,040 vs. 12,272 dollars PPPY for TRD, 28,767 vs. 7,227 for non-TRD MDD and 22,340 vs. 3,479 for non-MDD. At baseline, mean Quan-CCI indicated a higher level of comorbidities amongst HHS users, 0.5 vs. 0.1 for non-MDD, and 0.6 vs. 0.2 for both non-TRD MDD and TRD, with vs. without HHS use, respectively. Mental-health related services contributed a smaller proportion of the overall healthcare costs in non-TRD MDD and TRD patients with HHS (17.3-21.9 percent) versus those without HHS (25.2-37.2 percent), respectively, while these represented 3.7 percent in non-MDD patients.

Conclusion: Patients with TRD have higher resource use and costs compared with non-TRD MDD and non-MDD patients, with approximately 1 in 5 privately-insured TRD patients using HHS. Among HHS users, the small contribution of mental-health related services to overall healthcare costs and higher comorbidity burden suggests comorbidities may be key drivers of HHS utilization. These findings support that HHS are an acceptable and utilized healthcare delivery model in TRD populations. Future work is needed to explore the potential role of HHS in delivering behavioral health services and reducing the high burden of healthcare costs and resource use in TRD populations.

Submission Category: Infectious Diseases/HIV

Poster Type: Evaluative Study

Session-Board Number: 20-T

Poster Title: *Evaluation of daptomycin use within an urban teaching hospital*

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Purpose: Daptomycin (DAP) is a lipopeptide intravenous antibiotic indicated for the treatment of gram-positive infections; including complicated skin and soft tissue infection and Staphylococcus aureus bloodstream infections. To reduce the development of drug-resistant bacteria and maintain drug efficacy, DAP was added to the Howard University Hospital formulary as a restricted antibiotic. The purpose evaluation was to determine whether DAP use was consistent with the restricted antibiotic criteria at the Howard University Hospital.

Methods: A retrospective chart review was conducted of patients who received DAP and met the inclusion criteria from September 1, 2016 –February 28, 2018. Data collected included vancomycin or linezolid exposure prior to DAP, a documented patient allergy to vancomycin or linezolid, and whether the pharmacy had received a verbal confirmation from the ID physician to begin DAP therapy.

Results: A total of 45 patients were identified with DAP orders during the study period. Of the 45 patients, 38(84%) of the DAP orders met the criteria for use for restricted antibiotics, 27(60%) patients were treated with vancomycin, and 6(13%) patients were treated with linezolid prior to the initiation of DAP, while 5(13%) of patients had documented non response to previous vancomycin use. The remaining 7(16%) of patients did not receive vancomycin or linezolid prior to therapy and did not have a documented intolerance/ allergy to either drug.

Conclusion: Overall, DAP utilization at the Howard University Hospital was appropriate. Continuous education is required to increase the physician's knowledge base as it pertains to the requirements necessary to prescribe DAP therapy at our institution.

Submission Category: Infectious Diseases/HIV

Poster Type: Evaluative Study

Session-Board Number: 21-T

Poster Title: *Utility of routine laboratory testing at the end of treatment for hepatitis C (HCV) with ribavirin-free direct acting antiviral (DAA) regimens*

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Purpose: With the widespread adoption of safe and robust ribavirin-free DAA regimens, the need for frequent laboratory testing, a mainstay of historical interferon-based HCV regimens, is unclear. Currently, testing is recommended in HCV management guidelines at 4 weeks of treatment (required by some health plans to document viral suppression), but there is no consensus about the need for subsequent testing prior to 12 weeks after treatment completion, when the absence of detectable serum HCV RNA defines a sustained virologic response (SVR). End-treatment testing, routinely performed at many centers including our own, was assessed to determine clinical utility and potential for cost-savings.

Methods: We hypothesized that: (a) the proportion of patients achieving SVR, with respect to the presence versus absence of undetected serum HCV RNA at 4-weeks and at end-treatment, would be indistinguishable, and (b) end-treatment laboratory testing would not detect adverse events that escaped previous recognition. We performed a retrospective review of patients seen in the UVM Medical Center Hepatology clinic treated with DAA regimens between January 1, 2017 and April 1, 2017. Subjects were identified from the electronic medical record and internal pharmacy data were used to confirm the type of DAA regimen prescribed. Exclusion criteria included the use of ribavirin or the presence of decompensated cirrhosis, since each would require frequent biochemical testing to monitor for potential drug toxicity. Subjects with incomplete data during treatment were also excluded. Laboratory monitoring was performed in accordance with current AASLD/IDSA guidelines and included measurement of hemoglobin, aminotransferases, serum creatinine and HCV RNA. The primary outcome was defined as the proportion of patients achieving SVR stratified by the presence or absence of detectable HCV RNA at week 4 and at end treatment. Secondary outcomes included the proportion of patients

with aminotransferases greater than 2.5 times the upper limit of normal, serum creatinine greater than 2 mg/dL, and hemoglobin less than 10 g/dL at week 4 and at the end of treatment. Descriptive statistics were used to analyze all data.

Results: The study population comprised 208 patients. The most common HCV genotype was 1, and the majority of patients were treatment naïve (77.4 percent). Cirrhosis was present in 34.1 percent of patients. The majority of genotype 1 patients were treated with ledipasvir/sofosbuvir, while genotype 2 or 3 patients received sofosbuvir/velpatasvir or daclatasvir/sofosbuvir. Treatment duration was consistent with the AASLD/IDSA guidelines: 8 weeks, 8.6 percent; 12 weeks, 80.3 percent; 24 weeks, 11.1 percent. Overall 97.1 percent of patients achieved an SVR. There was no significant difference in SVR rate between patients who had a detectable versus undetectable viral load at week 4 (96.8 percent vs. 100 percent; $p=1.0$). One patient had a detectable viral load at end-treatment indicating an on-treatment failure, while all other patients did not have detectable virus present. At baseline, biochemical liver test abnormalities were common, with 46.2 percent and 43.3 percent of patients having an elevated serum AST or ALT, respectively. At week 4, elevations in serum AST and ALT were present in only 7.7 percent and 3.4 percent of patients, and at end-treatment 3.8 percent and 2.4 percent of patients. Serum creatinine and hemoglobin were not impacted by treatment.

Conclusion: These findings indicate that laboratory testing at end-treatment with ribavirin-free DAA HCV regimens does not provide significantly new information with respect to virologic response or safety, which has not already been generated at 4 weeks of treatment. Elimination of routine end-treatment testing in this setting has the potential to result in reduction of resource utilization, cost savings, and increased value.

Submission Category: Informatics/Technology/Automation

Poster Type: Descriptive Report

Session-Board Number: 22-T

Poster Title: *Instance-based optimization of order groups following electronic health record (EHR) implementation*

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Purpose: Order sets are a collection of related orders aggregated in a single location for a specific condition, process, or clinical situation that allow providers to quickly place orders for a patient during computerized provider order entry. The use of order sets has shown to improve ordering efficiency and increase adherence to evidence-based medicine, thereby decreasing variation in care and improving patient outcomes. However, order sets require regular maintenance due to changes in evidence, medication shortages, or updates to internal processes. Optimizing order sets through standardization and modularization should decrease the resource burden required to review and maintain these order sets.

Methods: In order to quantitatively measure and compare order set and order group similarity, we used instance-based matching. Instance-based matching compares the overlap of the order group members from one order group to another based on the orders they produce, calculated as the the Jaccard coefficient. In our study, we manual reviewed order groups that had perfect overlap based on the medication order dose, route, frequency, and duration (Jaccard =1). The goal of manual review was to determine if the order groups are truly duplicates or candidates for standardization, accounting for additional variables such as administration instructions and phase-of-care. We focused on order groups that contained cefazolin, clindamycin, and vancomycin to limit our initial result set.

Results: We identified 52 distinct order group pairs with identical medications, doses, routes, frequencies, and durations for manual review. The unique pairs consisted of 39 different order groups used in 37 different order sets. One order group was re-used in 21 order sets, while 31 other order groups were used in only 1 order set. After manual review, we identified 5 common themes for differences between the order groups: required selections, display name,

administration instructions, manual restrictors, and order group nesting. For example, non-identical “Rx Administration Instructions” were found in 21 of the identified order groups, all of which were related to differences in peri-operative administration times. Additionally, 7 order group pairs had the other order group nested in it in order to adjust specific settings, such as the administration instructions, duration, or phase of care.

Conclusion: Using a standard base order group and setting specific configurations one level up, by nesting a standard order group within the more specific order group to adjust settings, we have an opportunity to standardize 24 base order groups used in 22 order sets. This analysis encountered many challenges when manually reviewing layered order sets. However, we found this instance-based method as useful in identifying opportunities to begin standardizing components of our order sets.

Submission Category: Informatics/Technology/Automation

Poster Type: Descriptive Report

Session-Board Number: 23-T

Poster Title: *Identifying pharmacist-relevant predictors of adverse events among adult type-2 diabetes patients*

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Purpose: Type-2 diabetes (T2DM) patients experience numerous adverse events that can be effectively managed by a multi-disciplinary team. Within such teams, pharmacists may play a critical role in helping to manage medication profiles to identify and mitigate potential adverse outcomes. However, what is poorly understood is the role that specific pharmacist-relevant factors play in a patient's risk of experiencing adverse events. Our objective in this study was to assess potentially pharmacist-modifiable risk predictors across a panel of different adverse events in a large cohort of adult T2DM patients.

Methods: Our study population included T2DM patients aged 65 years or older with continuous healthcare coverage between 2009 and 2011 from 3 Kaiser Permanente regions (Northern California, Colorado, North West). Kaiser Permanente is an integrated healthcare delivery system serving roughly 11 million members. This study was reviewed and approved by the institutional review board at Kaiser Permanente. We used an observational retrospective cohort study design to assess which patient-level predictors were associated with adverse outcomes within, and across, 5 adverse outcomes (hypoglycemia, hip fracture, syncope, admission to the emergency department (ED) or hospital with diabetes as the principal diagnosis, and death). We used logistic regression to model these outcomes and assessed the performance of models with area under the receiver operating characteristic curves (AUC). We used the same predictors from 2010 for each model, including: systolic blood pressure, gender, education level (grouped by percent of population with bachelor degrees), household income (a census block group variable), race, pharmacy 30-day copay, refill history of three T2DM-related drug classes (ACE-i/ARBs, oral anti-hyperglycemics and insulin, statins), LDL and A1C levels, count of

medicines, 17 specific comorbidities and history of same outcome having occurred in the prior two years (except for death).

Results: Our study population included 120,256 T2DM patients with a median age of 74.3 years (SD \pm 6.8) and with 50.4% being male. Most patients were White (58.5%), followed by Hispanic (12.8%), Asian and Hawaiian/Pacific Islander (10.9%), Others (9.9%), and Black (7.8%). Mean (\pm SD) hemoglobin A1C and LDL were 6.9 ± 1.1 and 80.4 ± 28.7 , respectively. The prevalence of our 5 study outcomes was: death (5.0%), syncope (4.3%), an emergency department (ED) visit or hospital admission with diabetes as the principal diagnosis (3.9%), hip fracture (0.6%), and hypoglycemia (0.2%). Using same predictors, model discrimination (AUC) was good to very good across models: 0.803 (hypoglycemia), 0.786 (hip fracture), 0.772 (death), 0.753 (ED or hospital admission), and 0.706 (syncope). Experiencing the adverse event in the preceding two years had the strongest association with 4 outcomes of interest (besides death), ranging from OR 4.15 [3.74-4.60] (ED visit or hospital admission) to 7.41 [3.66-13.5] (hypoglycemia). Each additional medication was associated with a 2% (hip fracture and hospital/ED utilization) to 7% (hypoglycemia) increase in the odds of an adverse event. Chronic kidney disease, depression and retinopathy were associated with at least a 9%, 21% and 28% increased risk of an adverse event, respectively.

Conclusion: The prior history of an adverse event within the prior two years and global medication burden were associated with increased risk of adverse events among T2DM patients. Other predictors consistently associated with increased risk across diverse models included race, chronic kidney disease, depression and retinopathy. These patient factors could be used to identify high-risk T2DM patients to be managed proactively with pharmacist intervention through medication reconciliation, renal function monitoring and dosing, risk mitigation related to visual impairment or mental health referral, counseling on medication-use and lifestyle habits, and chronic disease management through programs such as medication therapy management programs.

Submission Category: Informatics/Technology/Automation

Poster Type: Descriptive Report

Session-Board Number: 24-T

Poster Title: *Pilot implementation of computerized prescriber order entry (CPOE), bar code medication administration (BCMA), and pharmacist verification of medication orders in an outpatient clinic setting*

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Purpose: The advantages of BCMA and electronic ordering are recognized to include enhanced patient safety and increased accuracy of medication administration and documentation. Previous studies show a high percentage of preventable medication error rates in the emergency department and other outpatient settings. To comply with Joint Commission Standards, and improve medication safety management, the VA San Diego recently introduced the use of BCMA and CPOE dialogues in ambulatory care areas to replace the previous process of medication documentation orders in the absence of pharmacist review and verification. This pilot was initiated to identify barriers for implementation and solutions for expansion.

Methods: Primary care clinics were selected as the location for the outpatient clinic medication order pilot implementation due to staff familiarity with existing solutions, volume of medication orders, and ease of integration with current workflows. The number and types of medication orders placed at primary care clinics were evaluated to identify which medications would require creation of a new medication quick order or order set, and what types of menus would be needed. Sites which did not yet have the hardware and space for BCMA were also evaluated. Once the needs and requirements were evaluated, the menus, quick orders, and process enhancements were created in collaboration with pharmacy, nursing, and medical staff. Providers were educated on where to access these new order dialogues, how to place orders, as well as what the design of new menus and quick orders might look like. Nursing was educated on the use of BCMA hardware and software. Simultaneously the pharmacy department devised a plan to handle the added ambulatory clinic workload. Once solutions were in place, primary care clinics were activated. Then medication orders and workflows were evaluated post-implementation for issues and areas of improvement.

Results: In the year prior to the pilot, 36,066 clinic medication orders (average 2,774 per month) were placed in 672 clinics across the entire medical center without pharmacy review and verification. Of these, 1,684 medication orders were being placed per year in the 71 primary care clinics alone. Based on orders placed in primary care clinics, 53 different medications were identified, and the majority of medication orders were placed by the top 30 medications. For these top 30 ordered items, standard order sets were created. The remaining 23 medications had 5 or less orders in the previous year and were left to be ordered through a general text order dialogue. The majority of medications administered in clinic in the past year were vaccines, and steroid injections.

Conclusion: This project piloted the use of new medication order dialogues and BCMA at primary care clinics as an initial test of feasibility for implementation across the rest of the medical center. The initial implementation of the new process in primary care clinics was successful. However, improvements to provider education and nursing processes to support recurring orders are indicated before further implementation throughout the remaining 601 ambulatory clinics utilizing medications.

Submission Category: Informatics/Technology/Automation

Poster Type: Evaluative Study

Session-Board Number: 25-T

Poster Title: *Evaluation of aminoglycoside dosing after implementation of clinical decision support for aminoglycoside ordering at a large academic medical center*

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Purpose: Aminoglycoside dosing is highly complex and has a narrow therapeutic index. Advancement in dosing strategies has explored extended interval dosing to increase efficacy and reduce the incidence of adverse effects, in particular nephrotoxicity. Clinical decision support (CDS) is one strategy to help guide prescribers to optimize dosing. CSD for aminoglycoside ordering was implemented in April 2015 to guide in decision support for all adult inpatients across the enterprise. This pre and post analysis evaluates aminoglycoside dosing patterns as a result of CDS.

Methods: CDS implemented two methods of decision support based on the patient's renal function adjusting the aminoglycoside order to either extended interval or traditional dosing nomograms. To assess the impact of the CDS on aminoglycoside dosing 100 patients who received aminoglycosides (gentamicin, tobramycin, or amikacin) from June to August (pre group 2013; post group 2015) at the medical center main campus were included. Patients were excluded if they were less than 18 years of age, aminoglycosides were given for peri-operative prophylaxis, tuberculosis and non-tuberculosis mycobacterium, or received aminoglycosides immediately prior to admission. The primary outcome measure was to assess aminoglycoside dosing in accordance with institutional dosing protocols. Dosing was classified as optimal if in accordance to protocol for both dose and frequency. Dosing weight was defined as actual body weight, unless obese, then adjusted body weight was used. Secondary outcomes included assessment of peak, trough, and random levels. Aminoglycoside induced nephrotoxicity was evaluated using the RIFLE kidney classification in patients receiving aminoglycosides > 5days. The project involved internal quality assessment and improvement activity part of standard health care operations in the local setting rather than research and did not require IRB approval.

Results: The majority of patients in both study populations received gentamicin (40 percent pre group and 53 percent post group) and were located in the intensive care unit at time of ordering (57 percent pre group and 54 percent post group). Baseline characteristics did not differ between the two study groups. Aminoglycoside dosing in accordance to protocol for both dose and frequency increased from 65 percent to 70 percent (95 percent CI, P equals 0.45). Dose in accordance to protocol improved from 67 percent to 75 percent (95 percent CI, P equals 0.144). There was a statistically significant increase in extended interval dosing orders from 21 percent to 43 percent (95 percent CI, P equals 0.001). Secondary outcomes measured a decrease in number of levels ordered in the post group compared to the pre group, 57 and 67 levels respectively. The percentage of levels in range between the two groups did not differ significantly between the pre group and post group, 56 percent and 61 percent respectively. No significance was found between the incidences of nephrotoxicity between groups.

Conclusion: Implementation of CDS for aminoglycoside ordering increased the proportion of aminoglycosides ordered using extended interval dosing. Utilization of extended interval dosing optimizes the likelihood of pharmacokinetic-pharmacodynamic target attainment and increases safety of aminoglycosides by theoretically decreasing the incidence of nephrotoxicity. Future enhancements in the electronic health record will allow weight-based CDS which may further improve aminoglycoside dosing in accordance to protocols.

Submission Category: Informatics/Technology/Automation

Poster Type: Evaluative Study

Session-Board Number: 26-T

Poster Title: *Pharmacokinetic comparison of nomogram-clinician dosing and Bayesian clinical decision support tool for personalized neonatal gentamicin therapy*

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Purpose: Utilization of nomograms and clinician-dosed regimens to develop aminoglycoside therapy has been suboptimal in achieving target concentrations and minimizing adverse drug-related events due to inter-subject variability. Specifically in neonates, limitations to current regimens and monitoring practices may have resulted from simplified nomograms and dosing recommendations to aid clinical workflow. Using published pharmacokinetic-dynamic models, population-specific parameters and inclusion of patient covariates, Bayesian-guided dosing regimens show promising improvements in individualizing neonatal aminoglycoside therapy to achieve therapeutic drug levels. This study evaluated the effectiveness of a Bayesian-assisted clinical decision support (CDS) software for gentamicin dosing in neonates against regimens from nomogram-clinician dosing.

Methods: This retrospective cohort study evaluated the effectiveness of the nomogram-clinician strategy and the simulated Bayesian CDS strategy (InsightRX) in dosing neonatal gentamicin to pharmacokinetic targets. Subjects included neonates (≤ 30 postnatal days) who received at least one gentamicin dose between 01/01/2013-12/31/2017 and had at least one therapeutic drug monitoring (TDM) concentration drawn. Data was collected on patients' gestational age, weight, height, serum creatinine, TDMs, medication administration times, and blood draw times. These data points were used in Bayesian analysis to determine the patients' expected pharmacokinetic profile and to control for procedural variations in the clinical setting. These pharmacokinetic parameters were applied to the nomogram and clinician-adjusted regimens as well as the Fuchs et al. model CDS and Bayesian CDS-adjusted dosing simulations to project their respective serum drug concentrations. A comparison of the regimens and their predicted gentamicin levels and area under the curve (AUC) between the nomogram-clinician

strategy and CDS tool determined the effectiveness of the two methods. For the primary outcome, the analyses consisted of the McNemar paired proportional statistics between the four measures for achieving pharmacokinetic targets in newborns with suspected or indicated infections. Secondary outcomes examined the differences in effects from drug and disease interactions, time to achieving pharmacokinetic targets, and costs of treatment.

Results: For the nomogram and CDS regimens' simulations, 339 patients had one TDM set (peak and trough concentrations). For the clinician-adjusted and CDS-adjusted regimens' simulations, 55 of the 339 patients had more than one TDM set. Median pharmacokinetic parameters were 0.0521L/hr/kg clearance (SD 0.016), 0.454L/kg distribution volume (SD 0.101), and 7.99hrs half-life (SD 2.750). In initial regimens, CDS regimens (96.17%) achieved peak 6-15µg/mL significantly more times than the Nomogram regimens (86.43%) [p-Value <0.001]. Using patient-specific data from TDMs in the subsequent regimens, CDS-adjusted regimens (94.03%) achieved peak 6-15µg/mL significantly more times than the Clinician-adjusted regimens (65.67%) [p-Value <0.001]. In initial regimens, CDS regimens (94.10%) were not significantly different than the Nomogram regimens (92.33%) in the number of times to achieve trough <2µg/mL [p-Value =0.180]. Using patient-specific data from TDMs in the subsequent regimens, CDS-adjusted regimens (97.01%) were not significantly different than the Clinician-adjusted regimens (91.04%) in the number of times to achieve trough <2µg/mL [p-Value =0.125]. In initial regimens, Nomogram regimens (49.56%) achieved AUC 70-120µg/mL*hr significantly more times than the CDS regimens (30.38%) [p-Value <0.001]. Using patient-specific data from TDMs in the subsequent regimens, CDS-adjusted regimens (52.24%) achieved AUC 70-120µg/mL*hr significantly more times than the Clinician-adjusted regimens (29.85%) [p-Value <0.050].

Conclusion: The CDS regimens achieved peak and AUC targets more often than the nomogram-clinician dosed regimens for neonatal gentamicin therapies. The CDS regimens and nomogram-clinician dosed regimens had no significant difference in achieving trough targets. Use of Bayesian-assisted CDS software illustrated advantages that can lead to shorter time to reach therapeutic effectiveness goals while minimizing toxicities. While CDS dosing was more effective, the combination of clinician and CDS-guided dosing can potentially achieve greater effectiveness in designing personalized neonatal gentamicin therapy. Future works can compare with different pharmacokinetic models for the goodness of fit in this population.

Submission Category: Investigational Drugs

Poster Type: Descriptive Report

Session-Board Number: 27-T

Poster Title: *Novel Application of pharmacy informatics at an investigational drug service at an academic medical center*

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Purpose: Yale-New Haven Hospital is a 1500 bed academic medical center in New Haven, Connecticut and the main teaching and research institution for Yale School of Medicine. The Investigational Drug Service (IDS) is based out of the pharmacy department and supports many clinical trials performed at the Yale-New Haven Hospital (YNHH) and its affiliates. YNHH has a closed loop for medication safety which includes automation and technology for distributing and dispensing medications and a robust electronic health system for ordering and administration

Methods: At any given time, YNHH has over 100 active investigational drug studies with unique methodologies that requires IDS to follow strict guidelines and may include blinding and randomization. As the Investigational Drug Service supports all of these trials, increased efficiency in all steps of the process is necessary to keep pace with the ever-increasing demand for IDS services. Six clinical drug trials included the integration pharmacy automation technology and clinical informatics to improve efficiencies and enhance medication safety. These methods include: automated dispensing cabinets (ADC) for storage of the drugs, computerized order entry (CPOE), auto-verification, randomization of the subject population while maintaining subject blinding to the extent necessary. In addition to subject randomization, the integrated, computerized method allows for real-time auditing of the study process.

Results: For primary investigator (PI) initiated trials, subject randomization was built in the CPOE system making it easier and more efficient. This electronic method has also created efficiencies related to implementation of the study across multiple areas.

Conclusion: This integration of patient randomization, computerized provider order entry (CPOE), and Automated Dispensing Cabinets (ADC) are novel applications that can be used to enhance investigational drug research. The use of integrated automated systems can create economies of scale in the investigational drug service resulting in a more efficient means of delivering study medications to subjects. In addition, this will make it easier to provide investigational drug services across multiple locations where investigational drug services are not physically located.

Submission Category: Operating Room Pharmacy

Poster Type: Evaluative Study

Session-Board Number: 28-T

Poster Title: *Safety, efficacy and cost of neuromuscular blockade agent reversal for sugammadex compared with neostigmine and glycopyrrolate*

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Purpose: Neostigmine and glycopyrrolate are commonly used for neuromuscular blockade (NMB) reversal. Disadvantages include a slow onset, insufficient efficacy for deep blockade reversal and a poor side effect profile. Sugammadex is approved for reversal of rocuronium and vecuronium. The average onset is 3 minutes or less, compared with 10-30 minutes for neostigmine. In initial studies, side effects of sugammadex included QTc prolongation, aPTT prolongation and rare cases of anaphylaxis. Subsequent trials could not confirm these associations and found a reduction in side effects compared with neostigmine. This study evaluated the differences in efficacy, safety and cost between sugammadex and neostigmine.

Methods: This study was a single center, retrospective cohort study of patients prescribed sugammadex (S) or neostigmine and glycopyrrolate (NG) for NMB reversal during a one-month period in 2016. Immediately following the addition of sugammadex to formulary, education and training was provided to all anesthesia and critical care physicians to guide appropriate sugammadex dosing using qualitative train of four (TOF) monitors and weight-based dosing recommendations. The dose of neostigmine was decided by the clinician. Patients were included in this study if they were aged 18 to 89 years and were excluded if they did not have an extubation time recorded. The primary outcome for this medication review was the adherence to hospital dosing guidelines. Secondary outcomes included the incidence of individual adverse events (QTc prolongation, aPTT prolongation, bleeding and anaphylaxis), rates of reintubation, average time to extubation, average hospital length of stay, mortality and cost.

Results: A total of 191 patients (S, n= 95 and NG, n= 96) were evaluated. Baseline demographics were similar; there were differences in surgical procedures between the two groups. In total, 11 (11.6%) sugammadex patients did not meet criteria for proper use due to: dose too high based on TOF (n=5), dose too low based on TOF (n=4), CrCl <30 mL/min (n=1), or no TOF recorded (n=1). The average time between administration and extubation was 17.91 minutes and 21.85 minutes (p=0.012) in the S and NG groups, respectively. Sugammadex reversal cost approximately \$11 more per patient compared with neostigmine and glycopyrrolate reversal. There was no difference in adverse effects between the two reversal agents.

Conclusion: Reversal of neuromuscular blockade with sugammadex was faster than reversal with neostigmine and glycopyrrolate. Multiple confounding factors affect the time to extubation including: surgery type, duration of anesthesia, and use of other sedating medications. This pharmacoeconomic evaluation helped confirm that the adverse effect profile did not differ between agents and patient safety may be improved with sugammadex when considering the faster reversal and decreased time to extubation. Study limitations include the retrospective design, small sample size and short study duration. Future large, prospective studies are needed to fully assess the comparative efficacy of sugammadex versus neostigmine and glycopyrrolate.

Submission Category: Pediatrics

Poster Type: Descriptive Report

Session-Board Number: 29-T

Poster Title: *Improving the pediatric culture of safety by reducing IV bypasses in DoseEdge*

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Purpose: Differences in dosage forms and variability of drug concentrations lends significant challenges in promoting a culture of safe medication practice in a pediatric population. Empirical procedures do not exist within pediatric IV workflow software to adequately address the variability of dosage forms of high risk medications. DoseEdge is an IV workflow software that functions to improve standardization of compounded medications. Circumvention or “bypass” of DoseEdge can occur when logistical challenges are encountered, increasing the potential for error and patient harm. This study seeks to identify and fix the cause of bypasses in DoseEdge in the pediatric pharmacy IV room.

Methods: This is a descriptive analysis with a mixed method study design. Data was extracted in two phases, phase 1 (PH1) and phase 2 (PH2). PH1 consisted of bypass data from DoseEdge obtained retrospectively from January to April 2017 for the pediatric and neonatal pharmacies at Presbyterian Hospital. Bypasses were filtered into two separate groups, true bypass and non-true bypass. True bypasses were defined as completion of a sterile compounded process not verified through DoseEdge by a pharmacist. Non-true bypasses were defined as label request and were excluded from analysis. A3 methodology carried out by LEAN experts determined and analyzed the root cause of DoseEdge bypasses in PH1, and implemented interventions. Interventions were implemented from May to August 2017, no data was collected during the implementation period. Post intervention DoseEdge data from September to December 2017 was collected and defined as PH2. PH2 data was analyzed using the same methodology as PH1, generating the PH2 data pool. Post implementation review by LEAN experts analyzed PH2 data.

Results: There were a total of 563 bypasses, 14,198 total doses in PH1. Bypasses accounted for 4% of total ordered doses in PH1. Five general categories of bypasses were identified: Dose less than 0.1ml (53, 0.37%), DoseEdge system issue (2, 0.01%), DoseEdge system not used by staff (21, 0.14%), Incorrect build in DoseEdge (147, 1.03%), Not built in DoseEdge (340, 2.39%). Three interventions were implemented from May to August 2017: (1) the hardstop in DoseEdge for doses less than 0.1mL was removed and an inline verification rule, similar to a time-out, was developed for all doses less than 0.1mL; (2) DoseEdge Bypass Tracking sheets were developed, in conjunction with staff education, requiring a detailed description for situations in which staff were unable to use DoseEdge; (3) weekly meetings with pharmacy safety to increase collaboration and timely updates in DoseEdge. PH2 yielded a total of 263 bypasses, and 12,111. Bypasses accounted for 2.1% of total doses ordered in PH2. The same categories were analyzed; Dose less than 0.1ml (0, 0.0%), DoseEdge system issues (10, 0.08%), DoseEdge system not used by staff (14, 0.12%), incorrect build in DoseEdge (79, 0.65%), not built in DoseEdge (160, 1.3%).

Conclusion: This study concluded a decrease in nearly 50% of total bypasses from PH1 to PH2, validating the success of implemented interventions. A3 methodology analysis, highlighted that utilization of pediatric pharmacy expertise was fundamental for the success of implemented interventions. In addition, collaboration with DoseEdge helped increase standardization of IV workflow, significantly reducing bypasses, and ultimately, decreased potential in patient harm for pediatric and neonatal pharmacies. Complex patient needs and variability of drug dosage forms, will always promote challenges in safe medication practice in pediatric populations. This study suggests that communication, intervention, and standardization are means to mitigate these challenges.

Submission Category: Precepting/Preceptor Skills/Education Training

Poster Type: Evaluative Study

Session-Board Number: 30-T

Poster Title: *Impact of psychological debriefing on the mental health of pharmacy residents participating in a 24-hour, in-house clinical pharmacy on-call program*

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Purpose: The UChicago Medicine Clinical Pharmacy On-call Program (CPOP) is a 24-hour, in-house service provided by pharmacy residents. During CPOP shifts, pharmacy residents respond to emergent clinical scenarios that may lead to increased levels of depression, anxiety, and/or stress. While higher rates of depression in medical trainees are well established, there are few studies describing mental health patterns in pharmacy residents. This study aims to describe levels of depression, anxiety, and stress among PGY1 pharmacy residents participating in the UChicago Medicine CPOP and evaluate the effects of implementing a psychological debriefing program on pharmacy resident mental health.

Methods: For 12 months, ten PGY1 pharmacy residents will be evaluated via completion of the modified Depression Anxiety Stress Scale (mDASS-21) during their first five independent CPOP shifts, midpoint CPOP shift, and final five CPOP shifts. Additionally, participants will undergo psychological debriefing to discuss difficult situations and unprocessed emotions from CPOP shifts. Stress perception scores (SPS) are generated during psychological debriefs to reflect stress levels from the past 24 hours. The primary endpoints of this study are mDASS-21 and SPS scores. Results of the mDASS-21 from the final CPOP shift will be compared between the UChicago Medicine Pharmacy Residency 2016-2017 and 2017-2018 classes. A paired-samples t-test will be conducted to compare rates of depression, anxiety, and stress in PGY1 pharmacy residents participating in a CPOP before and after participating in a formalized psychological debriefing program. Additionally, a logistic regression will be performed to determine if any events experienced during CPOP shift correlate with levels of SPS.

Results: Median scores of depression, anxiety, and stress from the first CPOP shift were 3 (IQR 2, 11.5), 12 (IQR 8, 16), and 17 (IQR 11.5, 20), respectively. Median scores of depression, anxiety, and stress from the fifth CPOP shift were 1 (IQR 0, 3.5), 3 (IQR 2, 9.5), 5 (IQR 2.5, 15.5), respectively. Median SPS from the first and fifth CPOP shift were 2 (IQR 2, 2) and 1 (IQR 1,1), respectively.

Conclusion: Preliminary results show decreases in mDASS-21 and SPS from the first CPOP shift to the fifth CPOP shift. Future directions include the completion of a Wilcoxon signed rank test to compare mDASS-21 and SPS scores in PGY1 pharmacy residents before and after the opening of an adult level 1 trauma center.

Submission Category: Professionalism and Career Development

Poster Type: Evaluative Study

Session-Board Number: 31-T

Poster Title: *Impact of a research panel event on pharmacy students*

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Purpose: The number of students attending the ASHP Midyear Clinical Meetings has continuously increased; however, no student pharmacy organization has hosted an informational event regarding research. Students are not formerly introduced to the topic of research in the academic curriculum, and many learn about research opportunities during their Advanced Pharmacy Practice Experience rotations—often be too late, as projects take several months to complete. The SSHP chapter at St. John's University decided to host the College's first Research Panel Event, and performed a study to evaluate whether such an event helps to inform students of what research entails and the commitment involved.

Methods: SSHP hosted a Research Panel Event on campus involving three faculty members and five student speakers to discuss their experiences and answer students' questions about research. The event was presented in a panelist-format to help facilitate discussion between the students and the panelists. Proceeding the faculty panel, student speakers who previously completed a research project participated in a roundtable discussion to share their research experiences and answer additional questions. A pre and post survey was administered to evaluate the impact of the research panel event in helping students gain a better understanding about research. The survey employed "Select All That Apply" questions as well as a Likert scale with a range of 1-5; 1 being "Strongly Agree" to 5 being "Strongly Disagree".

Results: A total of 60 sets of surveys were collected; 7 of those surveys were omitted from analysis due to incompleteness. Prior to the start of the event, five students (5/53) expressed a lack of interest in conducting research, and approximately half (54.7%) were uncertain about the time commitment involved. Initially, 33/53 (62.3%) estimated that a research project would take over 4 months to complete, while the remainder thought it would take less time. In the post-event evaluations, the majority (81.2%) of participants expressed increased understanding of the general principles of research, and 41/53 (77.4%) acknowledged that it takes over 4 months to complete a project. Nearly all (51/53) expressed interest in research, with 48/53 (90.6%) students interested in pursuing clinical research and 40/53 (75.5%) also interested in drug information research. Overall, 35/53 (66.0%) of attendees preferred to learn about research through a research panel event. Approximately half (24/53) wanted to learn from their Drug Literature/Drug Design course. In the final evaluation, a majority of participants (50/53) responded that the event answered all their questions about research and 49/53 (92.5%) agreed that the event had met their expectation. 47/53 (88.7%) of the students would recommend the Research Panel Event to friends.

Conclusion: The upward trend in the post evaluation responses indicate that the Research Panel Event was successful in educating students about the basics of research, what it entails, and the opportunities available. The students' evaluations of the event also helped SSHP gauge the importance of hosting informative events about research.

Submission Category: Psychiatry/Neurology

Poster Type: Evaluative Study

Session-Board Number: 32-T

Poster Title: *Real-world economic burden associated with treatment-resistant depression*

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Purpose: Treatment-resistant depression (TRD), defined as inadequate response to appropriate courses of at least two different antidepressants (ADs) in the current depressive episode, occurs in nearly one third of patients with pharmacologically-treated major depressive disorder (MDD). TRD is associated with higher symptom severity, more comorbid conditions, poorer quality of life and higher risk for suicide compared with other forms of MDD; however, little is known about the economic burden of MDD patients with TRD in the real-world setting.

Methods: Adults with a MDD diagnosis treated with an AD (with or without an anti-psychotic [AP]) between January 1, 2010 to December 31, 2015 were identified from the Truven Commercial and Medicare Supplemental Insurance claims database. Patients were required to have at least 12 months' continuous enrollment before and after the first MDD diagnosis (index). Patients were excluded if they had a MDD diagnosis or AD/AP medication prior to the index date or were diagnosed with schizophrenia, bipolar disorder, dementia or Tourette syndrome during the study period. Patients were classified into the TRD group if they had at least 3 AD regimens within an MDD episode, which started at the date of the first MDD diagnosis given a preceding 180-day period without a MDD diagnosis and ended on the date of the last MDD diagnosis or the end of the days' supply of AD/AP medication, whichever came last. Patient characteristics were described. Generalized linear model with gamma distribution and log link function was used to compare per-patient-per-month (PPPM) all-cause healthcare costs between TRD and non-TRD groups.

Results: A total of 48,698 treated MDD patients (TRD: n equals 3,407; non-TRD: n equals 45,291) were included in the analysis. Compared with the non-TRD group, TRD patients were younger (mean 37.7 vs 39.3 years, p less than 0.01) and had longer follow-up (mean 1,164 vs 919 days, p less than 0.01). During the pre-index period, the TRD group had a higher percentage of patients with anxiety (13.0 percent vs 11.7 percent, p equals 0.02) and anti-anxiety agent use (16.8 percent vs. 14.8 percent, p less than 0.01) than the non-TRD group. Patients in the TRD (vs non-TRD) group had incurred 86 dollars higher PPPM all-cause healthcare costs (886 dollars vs 799 dollars, p less than 0.01), most of which were attributable to higher medical costs in the TRD group (728 dollars vs 670 dollars, p less than 0.01). The TRD group also incurred significantly higher PPPM mental health-related costs than the non-TRD group (215 dollars vs 125 dollars, p less than 0.01), but there was no difference in PPPM non-mental health-related costs between the two groups (dollars 671 vs 674 dollars, p equals 0.62).

Conclusion: TRD status is associated with incremental economic burden compared with non-TRD MDD patients, regardless of when the TRD event was observed during the study period. These findings highlight the need for early intervention, appropriate comprehensive disease management, and effective long-term maintenance treatment for TRD among patients with MDD.

Submission Category: Psychiatry/Neurology

Poster Type: Evaluative Study

Session-Board Number: 33-T

Poster Title: *Healthcare resource utilization, work impairment and economic burden associated with suicidal ideation among patients with major depressive disorder*

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Purpose: Patients living with major depressive disorder (MDD) disproportionately experience suicidal ideation (SI). In the US, MDD patients requiring hospitalization have an estimated 35 percent risk of suicide during their lifetimes. While the impact of SI on economic and humanistic outcomes has been established, the burden that SI has in the MDD population is unclear. To quantify the incremental burden associated with SI among MDD patients, this study compared healthcare resource utilization (HRU), work impairment and cost among MDD patients experiencing vs. not experiencing SI.

Methods: Retrospective analyses were conducted using the 2013 US National Health and Wellness Survey (NHWS), which is a nationally representative, self-administered, internet-based survey of US adults. Patients with MDD were defined as: reporting clinician-diagnosed depression and either PHQ-9 scores of 10 or higher or PHQ-9 scores between 0 and 9 and on one medication for depression. MDD patients with SI were defined by moderate-to-high scores to PHQ-9 Item 9 ("Over the past 2 weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?"). Patients with bipolar disorder or schizophrenia were excluded from analyses. Healthcare resource use, including outpatient visits, emergency room (ER) visits, and hospitalizations, was self-reported based on number of visits during the prior 6 months. Work productivity impairment was assessed using the Work Productivity and Activity Impairment questionnaire. Direct and indirect costs were estimated using Medical Expenditure Panel Survey and Bureau of Labor Statistics data, respectively. Bivariate analyses compared outcomes between SI and non-SI MDD patients.

Results: Among 75,000 NHWS respondents, 6,997 respondents met study eligibility of having MDD (9.3 percent). Of MDD respondents, 1,238 were SI patients (17.7 percent) and 5,759 were non-SI patients (82.3 percent). Average ER visits (0.58 vs 0.35, p less than 0.001), hospitalizations (0.29 vs 0.16, p less than 0.001), and outpatient visits (7.64 vs 6.84, p less than 0.01) during the prior 6 months were significantly higher for SI patients compared with non-SI patients. Average estimated direct costs were 11,692 dollars per patient per year (PPPY) for SI patients and 7,631 dollars PPPY for non-SI patients (p less than 0.001). Patients with SI reported a significantly higher proportion of lost productivity while working, or presenteeism, compared with non-SI patients (37.5 percent vs. 25.4 percent, p less than 0.001). They also reported a significantly higher proportion of missed work, or absenteeism, compared with non-SI patients (11.2 percent vs. 6.3 percent, p less than 0.001). Average estimated indirect costs were 15,937 dollars PPPY for SI patients and 9,874 dollars for non-SI patients (p less than 0.001). Average estimated annual economic burden, combining indirect and direct costs, was 27,629 dollars PPPY in SI patients and 17,505 dollars PPPY in non-SI patients.

Conclusion: MDD patients experiencing SI had greater HRU, work impairment and economic burden than non-SI MDD patients. Given the limited evidence that antidepressant treatments reduce the risk of suicide, study results highlight the need for effective treatments that may assist MDD patients also experiencing SI. Sponsorship: Funded by Janssen Scientific Affairs, LLC.

Submission Category: Psychiatry/Neurology

Poster Type: Evaluative Study

Session-Board Number: 34-T

Poster Title: *Medicaid spending burden among beneficiaries with treatment-resistant depression*

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Purpose: Recent findings in a privately insured population have shown that treatment-resistant depression (TRD) poses a substantial burden to healthcare payers. However, the impact of TRD on Medicaid beneficiaries remains unexplored. The purpose of this study was to evaluate Medicaid spending and healthcare resource utilization (HRU) in beneficiaries with TRD.

Methods: A retrospective longitudinal matched-cohort study was conducted using multi-state Medicaid claims databases to identify adults diagnosed with major depressive disorder (MDD) between 1/2010-3/2017. MDD patients were considered to have TRD after two antidepressant treatment regimens (including augmentation therapy) at adequate dose and duration and the initiation of a third. TRD beneficiaries were matched 1:1 to non-TRD MDD beneficiaries and a randomly selected group of beneficiaries without MDD (non-MDD) using propensity score and exact match methods on key demographic characteristics (i.e., age, gender, race, state, insurance type, and index year). Patients were excluded if they had a diagnosis for psychosis, schizophrenia, manic/bipolar disorder, or dementia; if they had a claim for an antidepressant during the 6-month baseline period prior to the index date (defined as the first antidepressant claim [TRD and non-TRD MDD cohorts] or randomly imputed [non-MDD]); and if they had less than 6 months of Medicaid enrollment post-index. HRU and cost outcomes were measured up to 2 years post-index date and categorized as inpatient, ED, outpatient, home care, mental-health institute, long-term care, and other visits. Per patient per year (PPPY) costs and HRU were compared respectively using ordinary least squares (p-value obtained using a nonparametric bootstrap), and negative binomial regressions adjusting for Charlson comorbidity index and baseline healthcare costs.

Results: A total of 54,405 beneficiaries with MDD were identified. Before matching, the cohorts consisted of 14,710 (26.0 percent) TRD patients and 40,235 (74.0 percent) non-TRD MDD patients. Of 1,000,000 randomly selected non-MDD patients, 224,821 (22.5 percent) met all inclusion/exclusion criteria. After matching, the cohorts were well balanced (standardized difference below 10 percent) with respect to age, gender, race, state, and index year. The mean follow-up period was 21.8, 20.6, and 17.8 months for the TRD, non-TRD MDD, and non-MDD cohorts, respectively. TRD beneficiaries had higher rates of HRU than non-TRD MDD and non-MDD cohorts (e.g., inpatient visits: vs. non-TRD MDD incidence rate ratio [IRR]: 1.41; vs. non-MDD IRR: 3.42; outpatient visits: vs. non-TRD MDD IRR: 1.35; vs. non-MDD IRR: 3.88; all Ps less than 0.05). Furthermore, TRD beneficiaries incurred significantly greater PPPY all-cause healthcare costs relative to non-TRD MDD beneficiaries (\$16,654 vs. \$12,133, adjusted cost difference: \$4,382, P less than 0.05) and relative to non-MDD beneficiaries (\$16,654 vs. \$5,812, adjusted cost difference: \$8,294, P less than 0.05). Mental health-related services accounted for 17.4 percent and 18.0 percent of the overall all-cause healthcare cost differences of TRD beneficiaries versus non-TRD MDD and versus non-MDD beneficiaries, respectively.

Conclusion: In line with the body of literature highlighting the burden of TRD, in this study of Medicaid beneficiaries, patients with TRD were observed to have higher healthcare resource use and costs compared with non-TRD MDD and non-MDD beneficiaries. TRD poses a significant economic and HRU burden to Medicaid further demonstrating the need for developing effective treatments and patient management strategies beyond those currently available for patients suffering with MDD.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 35-T

Poster Title: *Standardized intubation kit development and implementation at Summa Health*

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Purpose: A survey was conducted to identify neuromuscular blocker storage throughout the health system. Neuromuscular blockers were available in automated dispensing cabinets throughout intensive care areas and the emergency department for the purpose of refilling intubation kits. Throughout this process it was discovered intubation kits maintained by nursing staff were not appropriately stocked; documentation was incomplete and kits were found to be outdated. This was a nursing owned process within the health system. A safety initiative was undertaken by pharmacy leadership to manage stocking in an effort to decrease access to neuromuscular blockers, prevent diversion, increase standardization across the health system.

Methods: Prior to standardization, nursing staff would obtain the intubation kit from the automated dispensing cabinet, administer medications, then refill medications from automated dispensing machine stock. Various disciplines collaborated to determine appropriate medications to have available in the kit including critical care physicians, emergency room physicians, pharmacists and resuscitation committee members. Two separate intubation kits were created with different contents. One kit was developed for critical care and emergency department usage that included neuromuscular blockers and one was developed for use in the medical-surgical population that does not contain neuromuscular blockers. Each kit is labeled on the outside of the box if it is a medical-surgical kit or critical care/emergency department kit. A labeled visual of the contents is in each kit, as well as packing foam to prevent breakage and movement within the kit. Automated tray technology is utilized to ensure appropriate configuration and expiration dating.

Results: Physicians discussed best practices thus identifying medication content changes. Following approval and buy in from physician groups and committees regarding medication stock changes and need for standardization, the intubation kit was approved and implemented. Initial implementation occurred at the smaller hospital within the health system in July 2017. The remainder of the health system converted to the new intubation kits in October 2017. Neuromuscular blockers were removed from available stock in the automated dispensing cabinets in the intensive care units in November 2017. Throughout this process nursing gained time that they previously devoted to restocking the kit. Inventory of intubation kits is conducted on a daily basis by pharmacy personnel, there has been a decrease in the number of expired kits identified. Extra supplies that were stored in the emergency department kits have been removed.

Conclusion: The standardized intubation kit was implemented throughout the health system including the free-standing emergency departments. Education regarding the new process was provided to nursing and pharmacy staff. Physicians were notified of the changes during various committee meetings. The pharmacy department is now able to monitor inventory control and identify potential diversion issues. Indiscriminate access to neuromuscular blockers has been reduced.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 36-T

Poster Title: *Getting real: “medication management” in polypharmacy patients*

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Purpose: After experiencing a catastrophic injury, patients are challenged with significant lifestyle changes, including managing multiple new medications. Conclusions from a project following patients home upon discharge identified gaps in execution of adequate medication management despite extensive education as inpatients. Patients and caregivers reported that they observed medications being given in the hospital but never had the opportunity to practice medication management and administration on their own. Additional education with an interdisciplinary focus and supervised, independent pill box loading the day prior to discharge was implemented to provide a more successful transition to home.

Methods: Our inpatient pharmacy staff facilitates getting prescriptions for take-home medications filled by a community pharmacy of the patient’s choice. The medications are picked up by a caregiver or delivered to the patient’s room the day prior to discharge. Patients discharging to home on at least two medications that are filled and available prior to discharge are scheduled for an appointment with a pharmacist, pharmacist intern, nurse, occupational therapist, or speech therapist. Staff supervises the patient and available caregivers while the patient organizes and fills a pill box with the first weeks’ course of medications. Patients review name, indication, dose, and frequency of each medication, as well as strategies for organization and memory at home. Patients are assessed on level of independence based on percentage of medications accurately identified and organized. Number of medications, amount of time needed for pill box fill, and errors caught are also documented.

Results: Over twenty three weeks, ninety six out of two hundred twenty six discharged patients completed a supervised pill box load. Patients returned home on an average of nine scheduled medications and four as needed medications, taking twenty five pills per day. Seventy three percent of patients were assessed as being able to independently identify and organize medications with at least seventy five percent accuracy at the time of discharge. The average length of time to complete the pill box load was thirty five minutes. Patients left the hospital

with a clear, precise medication list and a weeks' supply of medications sorted in a pill box and readily accessible. Patients and staff incidentally identified four major errors filled by the community pharmacies.

Conclusion: Supervised pill box loading activity provides practice and a final assessment for executive functioning and activities of daily living skills for patients prior to discharge. Further study will help determine impact of supervised pill box loading after discharge.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 37-T

Poster Title: *Optimization of dosing of vasopressors by standardizing weight based dosing of IV vasopressors in ICU*

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Purpose: Vasopressors are considered high-alert drugs by the Institute of Safe Medication Practices due to their increased risk of adverse drug events. To improve patient safety with the use of vasopressors, our institution standardized the weight used for weight based dosing to the ideal body weight. There is little guidance on the appropriate weight to use for dosing these medications and there were concerns patients may reach a set maximum dose sooner without achieving their clinical goals. The primary objective of this study is to review the impact on safety after standardization to ideal body weight for dosing of IV vasopressors.

Methods: This is a pre- and post- retrospective review. All patients on an IV vasopressor over the age of eighteen who were admitted to UMass Memorial Medical Center Intensive Care Unit between January and February of 2017 and 2018 were included in this review. Patients were identified through drug utilization and infusion pump reports. The primary endpoint of this study is to determine the total number of infusion pump dose alerts and overrides for a patient's IV vasopressor regimen pre- and post- standardization to ideal body weight. Secondary end points of this study are to determine the total number of pump alerts and overrides for each drug, the total utilization of the basic infusion setting, the weights used to program the smart pump, the total number of soft and hard maximum dose alerts, the doses programmed in the pump, and the average number of vasopressors a patient was on.

Results: Infusion data for five vasopressors was reviewed for a two-month period pre- and post- standardization to the ideal body weight. The total number of alerts for Norepinephrine, Epinephrine, Dopamine, Phenylephrine, and Dobutamine were 314, 334, 16, 318, and 85 respectively for the pre- standardization phase. The number of alerts for post-standardization were 276, 1083, 3, 178, and 45 respectively.

Conclusion: Initial data shows standardizing to an ideal body weight did not increase the number of dosing alerts in the smart pump, except for epinephrine. Additional investigation is required to assess the reasons for the increase in alerts for epinephrine.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 38-T

Poster Title: *Evaluation of acute kidney injury with vancomycin therapy in adults*

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Purpose: The occurrence of acute kidney injury is a well-known risk with vancomycin therapy. Due to anecdotal concerns that the pharmacy vancomycin dosing protocol at a community hospital system was leading to acute kidney injury, an evaluation was completed in order to identify opportunities for protocol improvement and any contributing factors.

Methods: Clinical information pertaining to patients receiving vancomycin and additional encounter information was extracted from a relational database that is supported by the electronic medical record. Queries to this database included patient identifiers and demographics, vancomycin order details, concomitant nephrotoxic agents, and pertinent laboratory values. This information was the basis for a focused critical evaluation through manual data collection with data points including preliminary indication, trough goals, evaluation of hydration status, pre-existing conditions, culture data, and duration of acute kidney injury.

Results: Vancomycin order data was pulled for a 1-year time-frame that resulted in 5177 patients receiving a dose of vancomycin. Of those patients, 937 were excluded due to a lack of adequate serum creatinine documentation and 1611 only received one dose leaving 3566 patients for analysis. Only 214 patients experienced acute kidney injury resulting in an overall rate of 6.1%. Of these 214 patients, 140 randomly chosen patients were included in the critical evaluation. Pharmacists managed vancomycin dosing in 97.1% of patients in this evaluation. Patients weighing 90 kilograms or greater was found to be 58.6% of this patient population experiencing acute kidney injury. At least 1 concomitant nephrotoxic medication was used in 95.7% of patients. There was no baseline chronic kidney disease or known renal dysfunction in 76.4% of patients. The initial indication for vancomycin requiring a goal trough of 15-20 micrograms per milliliter occurred in 97.3% of patients. An initial loading dose was given to 80% of patients. Acute kidney injury occurred in the first 1 to 4 days of therapy in 70% of patients.

The initial trough was found to be greater than 20 micrograms per milliliter in 41.6% of patients.

Conclusion: Potential opportunities for improvement in vancomycin dosing include reduced dosing in obese patients or those with concomitant nephrotoxic agents. Re-evaluation of the utility of loading doses should be performed. Assessment of indications requiring the higher trough range goals is also necessary. Finally, another opportunity is to ensure frequent patient evaluation in the first 4 days of therapy with additional considerations based on findings.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 39-T

Poster Title: *Implementing a systems approach to assessing the risk of G6PD deficiency in patients receiving rasburicase therapy*

Primary Author: Kristin Tuiskula, Massachusetts General Hospital; **Email:** ktuiskul@gmail.com

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Purpose: Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a genetic condition that affects over 400 million people worldwide and mainly occurs in those of African, Southeast Asian, Indian, or Mediterranean descent. G6PD deficiency can cause methemoglobinemia and hemolytic anemia and these reactions are triggered by a limited number of medications including rasburicase. A patient at our institution experienced these hematologic reactions after receiving rasburicase and was subsequently found to have G6PD deficiency. This case prompted an evaluation of our systems and the purpose of this project is to describe the G6PD deficiency risk assessment and mitigation strategies at our institution.

Methods: A multidisciplinary group convened to conduct a root cause analysis of the rasburicase adverse drug reaction. Several root causes were identified, including lack of alerting in the computerized order entry system, lack of information in our rasburicase policy, inability to obtain G6PD laboratory test results in a timely manner, and lack of staff knowledge about G6PD deficiency risk with rasburicase. Systems solutions were identified to improve the safety of rasburicase and a standard process was developed for pharmacists to assess G6PD risk level upon receiving orders for rasburicase and intervene on those patients who are determined to be high risk. Post implementation, a review was conducted to characterize rasburicase prescribing patterns and review pharmacists screening documentation.

Results: Several strategies were implemented to improve the safety of rasburicase, including adding warning alert in the computerized physician order entry system, updating medication guidelines to help identify patients at high risk of G6PD deficiency, implementing a point of care rapid laboratory test, and multiple education sessions for physicians, nursing, and pharmacy staff. Rasburicase dispenses post implementation were reviewed to determine patient risk of G6PD deficiency and screening. Twenty patients received rasburicase after pharmacist G6PD

assessment was implemented and all patient charts had pharmacist documentation of G6PD deficiency risk assessment with appropriate risk stratification. None of the patients were identified as having a high risk of G6PD deficiency. Five of the patients were tested for G6PD deficiency; three on same day or following rasburicase administration and two patients screened prior to rasburicase administration. None of the patients were found to be G6PD deficient. Dosing strategy was reviewed and found to be in alignment with current recommendations of fixed dosing regimens. Additionally, a retrospective review of fifty patients who received rasburicase within the last six months were evaluated and use is in alignment with current tumor lysis syndrome guidelines.

Conclusion: The root cause analysis identified multiple opportunities to improve the safety of patients that have G6PD deficiency. One strategy included the implementation of a pharmacist screening process and to date, all patients screened were low risk. In the future, this model may be expanded to other medications that are identified as high risk of causing hemolytic anemia in patients with G6PD deficiency.

Submission Category: Safety/Quality

Poster Type: Evaluative Study

Session-Board Number: 40-T

Poster Title: *Retrospective review of administration patterns for intravenous (IV) hydromorphone before and after modification of pain order sets within a regional medical center*

Primary Author: Katherine Ward, Renown Health; **Email:** kward@renown.org

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Purpose: Patient exposure to opioid medications within the hospital setting has been a safety concern for many years. Focus on safe opioid prescribing, quality pain management and reviewing performance improvement data is now a Joint Commission standard for hospitals. This project is a retrospective review of dose administration patterns for intravenous (IV) hydromorphone before and after a multidisciplinary review and modification of pain order sets within a regional medical center.

Methods: In October 2016, an anesthesiologist and pharmacist led multidisciplinary team implemented evidenced-based standardization of all pain medications ordered through order sets in the electronic medical record (EMR). The primary outcome was to assess the percentage change of administered IV hydromorphone doses that were greater than or equal to 2 mg during the pre-implementation and post-implementation of the pain order set. Patients with an inpatient status during the study time frames were included. The institutional review board approved this retrospective analysis of inpatient medical administration records in the EMR for each dose of IV hydromorphone administered during the study periods. Data was analyzed for administration of IV hydromorphone between pre (July-Sep 2016) and post (Jan-Mar 2017) implementation of the order sets. Using SAS software, analysis completed included Chi-square (percentage of IV hydromorphone dose administrations greater than or equal to 2 mg, overall and by unit), Student's t-test (average dose of IV hydromorphone administrations) and Analysis of Variance (average IV hydromorphone dose administrations by units). Stratification variables included: patient gender, age, and ethnicity; administration done by traveler vs. non-traveler registered nurse; inpatient hospital department; time of day; day of week; and month of year.

Results: A total of 6,525 inpatients received 14,201 administrations of IV hydromorphone with 6948 administrations in the pre-implementation group and 7,253 in the post-implementation of the pain order sets. The percentage of inpatient dose administrations of IV hydromorphone greater than or equal to 2 mg was 18.8% in the pre-group and 12.5% in post-group ($p < 0.0001$). Of the medical care units analyzed, five out of the eight showed statistically significant decreases in the IV hydromorphone dose. The three units which did not show statistical significance, did show a decreasing trend in IV hydromorphone dose administered. The analysis of seven critical care units showed statistically significant decreases in two of the units.

Conclusion: The implementation of evidenced-based standardized pain order sets showed a statistically significant decrease in the percentage of inpatient administrations of IV hydromorphone doses greater than or equal to 2 mg. Additionally, five medical units and two critical care units showed a statistically significant decrease in dose administration size. Patient satisfaction scores, pain scores and adverse events were not analyzed for this project. There is still opportunity to increase utilization of the pain orders sets. Efforts to continue to optimize pain management is a continual process improvement project.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 41-T

Poster Title: *Telepharmacy: multidisciplinary approach to TB shelter DOT audits via Doxy.Me*

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Purpose: American Society of Health Systems Pharmacist advocates that telepharmacy be applied to pharmacy operations to improve patient outcomes, expand healthcare and enhance patient safety. In the face of healthcare reform, public health has become a primary resource for various health conditions. Budget constraints have resulted in innovative methodologies for delivery of healthcare to the most vulnerable constituents. Public Health Departments' responsibilities include evaluation of case management tuberculosis (TB) cases and suspects. Directly Observed Therapy (DOT) is an effective strategy for ensuring patient adherence and reduction of outbreaks. Recently, DOT has advanced to include telemedicine via video DOT.

Methods: Doxy.Me™ is used at Fulton County Board of Health (FCBOH) to conduct video DOT for selected clients and DOT medication audits. Through collaborative efforts, FCBOH's Pharmacy and TB outbreak response team are conducting a 6-month pilot program utilizing Doxy.Me. Monthly medication audits utilizes the "DOT BAG/Medication/Documentation Audit Tool". This tool is divided into two categories: "Medications & Med Boxes" and "Documentation". The Medication & Med Boxes category has 7 criteria: 1) correct client's name, address, phone number; 2) current medication order present in med bag; 3) DOT sheet dated with current month; 4) DOT sheet match current PE orders; 5) Medications ordered match medications in med bag; 6) Expiration date current on each medication; and 7) at least 3 doses remaining.

Results: Preliminary results from July-September 2017 (N= 89 clients) of the 7 criteria and/or addressed by the pharmacist are the following: correction of addresses, (10/89); closure notifications, (6/89); DOT sheet was not dated with current month, (5/89); DOT log did not match PE sheet, (4/89); and med bag not present at audit, (3/89).

Conclusion: Telepharmacy is an innovative approach providing solutions to healthcare delivery when staffing is limited.

Submission Category: Safety/Quality

Poster Type: Descriptive Report

Session-Board Number: 42-T

Poster Title: *Evaluation of high-alert medication event rate and safeguards at a comprehensive cancer center*

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Additional Author(s):

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Purpose: Medication events involving high-alert medications are associated with a higher likelihood of patient harm. At Memorial Sloan Kettering Cancer Center, chemotherapy and infusions (narcotic, insulin, anticoagulant, and sedative) are considered as high-alert medications. We devote significant amount of resources to ensure safe chemotherapy practice (e.g. interdisciplinary chemotherapy practice committee, more than 3,000 electronic order sets), compared to other high-alert medications. The project was designed to compare the actual and harmful event rates between different classes of high-alert medications, evaluate the established safeguards, and identify opportunities to improve medication safety.

Methods: The first step in the project was to retrieve medication event information from the well-established institutional electronic event reporting system. All events related to high-alert medications voluntarily reported between January 2015 and June 2017 were collected and categorized based on the medication involved, event severity, location, and type. Actual events are defined as any medication events that reached patient, and harmful events are actual events that caused patient harm. Actual event and harmful event rates for each class of high-alert medication were calculated using the number of events divided by the total number of orders placed. The second step was to evaluate our current practice for narcotic infusions, which involved identifying safeguards currently built for narcotic infusions, and assessing the possibility of applying chemotherapy safeguards to narcotic infusions. Medication event causes, Institute for Safe Medication Practices recommendations, The Joint Commission standards, and published literature were used to evaluate our current practices and to identify opportunities to improve the safe use of narcotic infusions. The last step was to initiate quality improvement projects and create additional safeguards based on identified gaps.

Results: During the study period, 721,412 chemotherapy orders were placed, and the actual event and harmful event rates for chemotherapy were 0.0452% and 0.0019%, respectively. The incidence of chemotherapy event was higher in inpatient than in outpatient care. Narcotic infusions had the highest event rates compared to other high-alert medications. With 32,357 orders placed, the actual and harmful event rates were at 0.6923% and 0.0927%. Those rates for all non-chemotherapy high-alert medications were 0.5824% and 0.0781%. After analyzing our current medication management process for narcotic infusions with the Chief of Anesthesiology Pain Service, an Ishikawa diagram listed thirty-five safeguards built for narcotic infusion was created. Chemotherapy safeguards were not always applicable to other high-alert medications, and safeguards unique to narcotic infusion were identified, including differently sized patient-controlled analgesia (PCA) bags for different concentrations, automated logic to assist with transition between fentanyl patches and PCA, and alerts during epidural prescribing for prior anticoagulant and opioid use. More than ten potential opportunities were identified that could improve the narcotic infusion safety, including establishing a standard process to determine the patient's opioid status before prescribing; the use of continuous pulse oximetry to monitor patients receiving continuous intravenous opioids; and standardizing fentanyl infusion titration instruction.

Conclusion: Although our event rates for high-alert medication are very low overall, the event rate of narcotic infusions is significantly higher than that of chemotherapy. Comparing the event rates was helpful in identifying the class of medication requiring further evaluation in order to enhance the safety of medication management process. Opportunities identified in this project were also evaluated for practicality in collaboration with physicians, nurses, and hospital informatics.

Submission Category: Small and/or Rural Practice

Poster Type: Evaluative Study

Session-Board Number: 43-T

Poster Title: *TIRES II: multicenter study to evaluate the benefits of technology-assisted workflow on IV Room efficiency, costs and safety in small, community hospitals - medication errors*

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Purpose: ISMP Guidelines recommend that barcode-scanning of base solutions and ingredients should now be considered the minimum requirement for pharmacy IV admixture services. Previous studies in large hospitals have found that IV Room technology is associated with reduced errors. There are significantly more community hospitals in the US than large hospitals; however, little research has been published on medication errors in community hospitals. This study aims to compare the frequency of IV sterile compounding errors identified in small, community hospitals (

Methods: Sites with TAWF ran the intercepted errors and rejected dose detail by technician report, removing any identifiers and duplicates. These reports allowed for the error rate and error categories to be determined. Non-TAWF sites utilized a manual error collection form that needed to be completed when an error was detected during the process of sterile compounding. Error categories from the manual collection were cross-walked with the report from the TAWF system, allowing for comparison across institutions. Each site collected detected medication errors in the IV room for a 12-week period. Two of the sites that participated in the study currently utilize TAWF (Baxter DoseEdge) in their IV Rooms: St. David's Georgetown Hospital (Georgetown, TX- 111 beds) and Heart Hospital of Austin (Austin, TX- 58 beds). Two of the sites that participated did not have any TAWF implemented at the time of data collection: Angel Medical Center (Franklin, NC- 56 beds) and Vidant Roanoke- Chowan Hospital (Ahoskie, NC- 114 beds).

Results: The total number of reported intercepted errors in hospitals less than 200 beds were 187 for the TAWF sites and 3 reported intercepted errors for the non-TAWF sites. The total number of doses processed through the TAWF during the study period was 4,944 doses and the total number of doses in the IV room in non-TAWF hospitals was 2,269. The combined frequency of intercepted errors in the preparation of sterile products detected by workflow type were 3.78% for the TAWF sites and 0.13% for the non-TAWF sites. The frequency average for the top three error reporting categories for the TAWF sites were incorrect medication (72.83%), incorrect preparation/wrong amount (16.30%), and product is expired (6.52%). The frequency average for the top three error reporting categories for the non-TAWF sites were incorrect medication (33.33%), incorrect base fluid volume (33.33%), and incorrect base fluid (33.33%).

Conclusion: The use of a TAWF system detected 29 times more errors in hospitals less than 200 beds than were identified via manual workflow alone. This does not mean that those systems were not more error-prone, but probably due to the increase in detection potential arising from technology. It appears that there is an under-reporting of errors in compounding sterile products when not utilizing TAWF systems, and the potential for these errors reaching the patient is higher in these organizations since they are not being detected at the same rate.

Submission Category: Small and/or Rural Practice

Poster Type: Evaluative Study

Session-Board Number: 44-T

Poster Title: *TIRES II: multicenter study to evaluate the benefits of technology-assisted workflow on IV Room efficiency, costs and safety in small, community hospitals - turn-around time*

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Purpose: First dose medication turn-around times can have significant implications toward patient care in an inpatient setting. The delay in therapy that results from extended time periods may result in worse patient outcomes, especially if the medication is needed acutely. Additionally, longer turn-around times in the IV Room may cost more money when factoring in the time spent on pharmacist and pharmacy technician salaries per prescription compounded. This study aims to compare the turn-around time of IV sterile compounding products in medical centers that utilize technology-associated workflow (TAWF) system (Baxter DoseEdge) compared to hospitals that have not implemented it.

Methods: Two of the sites that participated in the study are centers that currently utilize TAWF in their IV Rooms: St. David's Georgetown Hospital (Georgetown, TX- 111 beds) and Heart Hospital of Austin (Austin, TX- 58 beds). Two of the sites that participated did not have any TAWF implemented at the time of data collection: Angel Medical Center (Franklin, NC- 56 beds) and Vidant Roanoke- Chowan Hospital (Ahoskie, NC- 114 beds). A data collection protocol was designed and utilized for both the TAWF and non-TAWF sites. The sites with TAWF ran the turn-around time by technician report, removing any identifiers and duplicates. These reports allowed for the time to complete each workflow step to be determined. The non-TAWF sites recorded turn-around time data by stop-watch for the three time points: preparation, compound, and check. Both TAWF and non-TAWF sites created a medication use process map to outline their procedure for compounding sterile products.

Results: The average preparation, compounding, and verification times for the TAWF sites were 1.057 minutes, 1.413 minutes, and 9.626 minutes respectfully. The average combined time to complete all three time points was 12.097 minutes for the TAWF sites. The average time to complete all three time points for the non-TAWF site was 20.167 minutes. It is important to note that the verification time for the TAWF sites includes the amount of time that the prescription sat before the pharmacist checked it, while the non-TAWF site total time includes the time that the prescription sat from order to preparation start, from preparation completion to compounding initiation, and from compounding completion until the pharmacist checked it.

Conclusion: It appears that non-TAWF sites have a longer length of turn-around time per first-dose intravenous medication than sites with TAWF, and the potential for delays in therapy are higher in these organizations since the drug is potentially taking longer to reach the patient. A future sub-analysis of the medication types and cost of salary and wastes is needed to determine the potential monetary benefit of TAWF for an IV Room.

Submission Category: Toxicology

Poster Type: Case Report

Session-Board Number: 45-T

Poster Title: *Acute on chronic Fanconi syndrome induced by tenofovir compounded by tacrolimus toxicity*

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Purpose: This report describes a patient who developed Fanconi syndrome while on tenofovir with possible worsening due to tacrolimus toxicity. A 64-year-old female presents to the emergency department (ED) with primary complaint of sporadic, intractable nausea and vomiting, abdominal pain, constipation, and headache; worsening over a 2-week period. History reveals numerous ED visits over the past year, for the same. She reports a twenty-pound weight loss over four months. Her past medical history is significant for heart transplant due to dilated cardiomyopathy, chronic immunosuppression, hypertension (HTN), chronic kidney disease (CKD) stage III, chronic pain, bipolar, and exposure to human immunodeficiency virus (HIV) from her significant-other. She uses daily marijuana. She is negative for HIV and hepatitis B. Medications prior to admission include clonidine, emtricitabine/tenofovir, lidocaine patch, mycophenolate, oxymorphone, potassium chloride, pravastatin, quetiapine, and tacrolimus. A venous blood draw in the ED revealed bicarbonate (HCO_3) 8, anion gap (AG) 19, potassium 3.3, magnesium 1.2, beta hydroxybutyrate 2.8, creatinine 1.9, and a normal lactate and glucose. Urinalysis (UA) revealed proteinuria. She was hemodynamically stable upon arrival and was transferred to the medical floor where she received a normal saline (NS) infusion that improved her acute kidney injury (AKI) to creatinine 1.5. Venous blood gas (VBG) on day 2 revealed: pH 7.085, HCO_3 8.8, carbon dioxide partial pressure (pCO_2) 31, and oxygen partial pressure (pO_2) 102. Patient was transferred to the intensive care unit (ICU) and nephrology consulted. Review of her records from the past year include, serum creatinine increase to 1.4 baseline, tacrolimus levels 12.3-25.1, and persistent metabolic acidosis, hypokalemia, hypomagnesemia, and glucosuria in face of euglycemia. Tacrolimus level on day 2 of admission was 14.1, serum phosphorus 1.1, and serum calcium 8.0. The nephrologist ordered to hold tacrolimus and tenofovir, while arranging a plan with transplant and infectious diseases (ID) team. Sodium bicarbonate intravenous (IV) infusion 150 meq over 12 hours to continue until HCO_3 greater than 14, was initiated. ICU electrolyte replacement protocol for calcium,

potassium, phosphorus, and magnesium was also ordered. Patient was transferred out of ICU on day 3. During the course of her 10-day hospital stay, electrolyte replacement oscillated between IV and various oral formulations. Tacrolimus level was 6.8 on day 3 and the drug was restarted at a reduced dose. Patient states she believes she may have been taking tacrolimus at a dose higher, in error, than what was recommended by her transplant physicians. Labs on the basic metabolic panel (BMP) were within normal limits by day 6 and patient stated she was feeling back to baseline. Patient's discharge plan included oral sodium bicarbonate, magnesium, potassium, and phosphorus. She was recommended to follow up with ID for an alternative to tenofovir since this was the main culprit in Fanconi syndrome. Fanconi syndrome is a relatively uncommon adverse event. A literature search on tenofovir-induced Fanconi syndrome in HIV prophylaxis revealed limited information. Tertiary resources list Fanconi syndrome as an adverse drug reaction based on postmarketing/case reports. Tacrolimus can cause kidney injury. Periodic renal function tests, medication dose adjustments, and surveillance of concomitant nephrotoxic agents are essential to mitigate risk of drug-induced kidney damage.

Submission Category: Transplant/Immunology

Poster Type: Evaluative Study

Session-Board Number: 46-T

Poster Title: *Therapeutic monitoring of tacrolimus: identifying opportunities for process improvement*

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Purpose: Tacrolimus is the cornerstone of antirejection therapy for solid organ and allogeneic hematopoietic stem cell transplantation. Therapeutic drug monitoring of tacrolimus is a standard of care for all recipients. The aims of this evaluation were to evaluate the clinical acumen applied to tacrolimus blood level ordering and interpretation and to gauge the impact of therapeutic tacrolimus monitoring on clinical outcomes.

Methods: Adult patients admitted to hospital during the period of observation from January 1, 2017 through June 30, 2017 who received inpatient orders for tacrolimus therapy were identified. From these, 24 inpatients were randomly selected and their electronic medical records were examined.

Results: Among adult transplant recipients on newly initiated or chronic immunosuppressive therapy with tacrolimus, 78 percent of patients had orders for tacrolimus blood level measurements to be performed every morning while hospitalized. Among 74 tacrolimus blood levels evaluated, 34 percent were performed on blood drawn an average of more than 60 minutes after tacrolimus dose administration. Of the remaining levels drawn prior to tacrolimus dose administration, average sampling time was 107 minutes before the next scheduled dose. Three percent of blood samples for tacrolimus blood level testing were taken within the desired time of less than 30 minutes before the next dose. Ranking of documented skillfulness applied to blood level interpretation and subsequent adjustment of tacrolimus dose intensity averaged 1.6 on a scale of 0 to 4. Accurately documented, skillful intuitive interpretation of tacrolimus levels was identified in 14 percent of testing events evaluated. Despite certain sampling and interpretive inconsistencies, tacrolimus blood levels tended to stabilize during hospitalization and overall patient outcomes were generally positive.

Conclusion: Issues related to ordering practices, sampling, use intensity, and interpretive skill applied to tacrolimus blood level testing indicate need for reeducation and increased attention to detail in order to judiciously use these levels as a means to improve patient care. Steps toward this goal will likely involve multifaceted efforts to increase discernment in application of tacrolimus monitoring and to reduce repetitive laboratory testing.