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ABSTRACTS

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ORIGINAL RESEARCH

ADR/Drug Interactions

1 | Paliperidone-induced hyponatremia: Report of a fatal case with analysis of cases reported in the literature and to The US Food and Drug Administration Adverse Event Reporting System (FAERS)

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Introduction: Hyponatremia, as a result of the syndrome of inappropriate antidiuretic hormone secretion (SIADH), is well known with the use of nearly all antipsychotics. Information available about the risk of hyponatremia associated with paliperidone is limited.

Research Question or Hypothesis: To report a fatal case of hyponatremia secondary to SIADH associated with the use of paliperidone, systematically review the literature for the association of hyponatremia/ SIADH with paliperidone and to quantify in reporting risk for this association in FAERS.

Study Design: Retrospective case/non-case analysis

Methods: Case data was collected during routine pharmacovigilance activity. A systematic literature search for paliperidone-induced Hyponatremia/ SIADH was carried out in the MEDLINE and EMBASE databases. Case/non-case analysis of the FAERS database concerning paliperidone-induced hyponatremia/SIADH was conducted. Reporting risk was quantified by a measure of disproportionality using the reporting odds ratio (ROR) while adjusting for sex, age and concomitant medications associated with hyponatremia/ SIADH.

Results: A 39-year-old female patient with an 8-year history of bipolar disorder recently started on Paliperidone presented in an unconscious state with hypothermia, and asystole. Biochemical analysis and family history patient had primary polydipsia, projectile vomiting and secondarily developed hyponatremia. Emergent cerebral computed tomography scan was evident for marked cerebral edema and signs of transtentorial herniation. The patient died after 48-hours of the presentation. Literature search detected six cases in which paliperidone use was associated with hyponatremia/ SIADH. Analysis of the FAERS database retrieved 70 cases of Paliperidone suspect Hyponatremia/SIADH. The adjusted ROR for the association between paliperidone and hyponatremia was 1.34 (95% confidence interval 1.09-1.51).

Conclusion: Clinicians should be aware of the probable association between paliperidone use and hyponatremia/SIADH. In patients treated with paliperidone, development of polydipsia, nausea and vomiting should not be underestimated and should be assessed thoroughly, since these might be the early symptoms of hyponatremia/SIADH that may lead to more serious complications such as brain edema and even death.

2 | Incidence and management of bevacizumab-induced proteinuria at an academic cancer infusion center

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Introduction: Bevacizumab is a monoclonal antibody that inhibits vascular endothelial growth factor and is used in the treatment of various solid tumor malignancies. Due to its anti-angiogenic effects, a common adverse effect seen is proteinuria.

Research Question or Hypothesis: What is the incidence, management, and disease specific risk factors associated with bevacizumab-induced proteinuria in patients treated at an outpatient infusion center?

Study Design: A retrospective cohort study.

Methods: Patients 18 years or older who received at least one dose of bevacuzimab between June 1, 2014 and June 1] 2017 were included in the study. Patient demographics, type of malignancy, dosing of bevacizumab, point-of-care (POC) urinalysis at baseline, 3 months, 6 months, and 12 months of treatment were collected and analyzed. The rates of proteinuria and demographic variables were summarized descriptively. Univariate logistic regression analysis was used to determine significant predictors of high grade proteinuria. The outcome variable was defined as having high grade proteinuria at any visit.

Results: ± 12.3 years, 74% were female, 56% were White, and the most prevalent cancer type was gynecologic (44%). A majority of patients (80%) experienced proteinuria, with 27 (15%) experiencing high-grade proteinuria. A majority of patients (n = 16, 59%) did not have treatment held when high-grade proteinuria was identified. An increased risk of experiencing high-grade proteinuria was found in patients who had a previous diagnosis of hypertension (OR = 2.56, P = 0.04) or an elevated serum creatinine at baseline (OR = 29.9, P = 0.001).

Conclusion: The need for POC urinalysis at infusion visits should be reconsidered and a focus on educational efforts and resources regarding adherence to a proteinuria management protocol is necessary. Patients with a history of hypertension or elevated serum creatinine at baseline should be more closely monitored for proteinuria during treatment with bevacizumab.

Adult Medicine

3 | Evaluation of the safety and efficacy of metformin use in hospitalized, non-critically ill patients

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Introduction: The American Diabetes Association recommends insulin as first-line therapy for inpatient glycemic control. Contraindications and precautions to metformin limit its inpatient use and limited evidence exists evaluating metformin in this patient population. This study aims to determine the safety and efficacy of inpatient metformin use.

Research Question or Hypothesis: Metformin use is safe in hospitalized, non-critically ill patients and is effective for inpatient glycemic control.

Study Design: Retrospective, cohort, single-center study

Methods: Adult patients admitted to non-intensive care units between June 2016 and May 2018 with type II diabetes and received at least one dose of metformin were included. The primary endpoint was to identify hospitalized patients using metformin with at least one contraindication or precaution against use. Secondary endpoints included assessing efficacy of glycemic control with metformin, characterizing adverse outcomes of inpatient metformin use, and comparing metformin-containing regimens. Categorical and continuous data were analyzed with the Chi-square and Kruskal-Wallis tests, respectively.

Results: Two hundred unique patient encounters were included. There were 111 patients (55.5%) with 126 cases of potentially unsafe metformin use. The most common reasons were: 94 (47%) age ≥ 65 years, 15 (7.5%) heart failure diagnosis, and 12 (6%) metformin given within 48 hours of contrast. Metformin was contraindicated in two patients (1%) with an eGFR <30 mL/minute/1.73 m^2. The median daily blood glucose in the overall population was 146 mg/dL (IQR 122-181). Patients were then divided into three groups: metformin monotherapy, metformin plus non-insulin therapy, and metformin plus insulin. The median daily blood glucose readings were: 129 mg/dL (IQR 110-152), 154 mg/dL (IQR 133-178), and 174 mg/dL (IQR 142-203) (P < 0.001), respectively. Two patients (1%) developed acute kidney injury and no patients developed lactic acidosis.

Conclusion: Hospitalized patients receiving metformin had limited adverse outcomes and achieved goal blood glucose levels. These results support the potential for metformin use in hospitalized, non-critically ill patients.

4 | Comparison of anti-Xa levels between two enoxaparin venous thromboembolism prophylaxis dosing strategies in severely obese patients

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Introduction: Hospitalized patients are at risk for developing venous thromboembolism (VTE). Common prevention strategies include the low molecular weight heparin enoxaparin prophylaxis, with evidence-based recommendations for dosing in patients with a BMI ≥40 during hospitalization. Some experts recommend anti-Xa monitoring with a goal of 0.2-0.5 IU/mL in this population.

Research Question or Hypothesis: Common strategies for VTE prophylaxis in obesity include enoxaparin 40 mg SC twice daily and enoxaparin 0.5 mg/kg SC daily based on studies comparing these doses to enoxaparin 40 mg SC daily, however these regimens have never been compared to each other. The primary purpose of this study was to determine if either regimen results in more frequent goal anti-Xa levels.

Study Design: This was a prospective, multi-center study utilizing a convenience sample.

Methods: Patients with a BMI ≥40 and CrCl ≥30 mL/min receiving enoxaparin VTE prophylaxis were recruited from two hospitals; one hospital routinely prescribes the twice-daily regimen and one routinely prescribes the weight-based regimen. Anti-Xa levels were ordered and compared using a two-sample t-test assuming equal variances. Safety and efficacy endpoints were also collected.

Results: Forty patients were recruited from each arm. The mean age was 55.63 in the enoxaparin 40 mg SC twice daily and 58.93 in the 0.5 mg/kg SC daily group and 30% were male in both groups. There was no difference in the proportion of patients achieving goal anti-Xa levels between arms (P = 0.89). No patients experienced bleeding or thrombotic events.

Conclusion: Both escalated-dose enoxaparin regimens resulted in similar goal anti-Xa level achievement. Future studies are needed to determine if clinically meaningful benefits exist for either regimen.

5 | Clinical pharmacist-led impact on inappropriate albumin utilization and associated costs in general ward patients

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Introduction: Overall and inappropriate albumin use in clinical practice has been increasing over recent years. The major challenge facing institutions is promoting appropriate albumin use and reducing unwarranted costs associated with inappropriate indications.

Research Question or Hypothesis: The purpose of this study was to evaluate the clinical and economic impact of a novel clinical pharmacist-led intervention program on albumin utilization in adult general ward patients.

Study Design: Retrospective, cohort study.

Methods: Patients were identified through the hospital electronic medical record database who received albumin over a 2-year period. All patients ≥18 years administered albumin during their admission hospital stay were considered for inclusion. Albumin administration in the intensive care units, outpatient clinics and emergency department were not evaluated. Clinical pharmacists were responsible for enforcing institutional albumin use guidelines. The primary endpoint was to compare inappropriate utilization of albumin administered in the general ward population before and after pharmacist intervention implementation. Secondary analyses compared albumin use overall as well as adjusted for hospital admissions and patient-days. Mortality, length of stay, and albumin-related costs between study periods were also compared.

Results: A total of 1971 patients were evaluated. The clinical pharmacist intervention period was associated with a significant reduction in overall (42.5%) and inappropriate (86.0%) albumin utilization compared to baseline ($P < 0.001$). The inappropriate albumin rate was 62.2 ± 12.3 and 8.6 ± 5.2 grams per 1000 patient-days in the pre- and post-implementation periods, respectively ($P < 0.001$). Over a 7-fold reduction in the inappropriate rate adjusted for admissions was demonstrated after clinical pharmacist interventions compared to before (57.5 ± 34.2 vs. 415.3 ± 83.2 grams per 100 admission, respectively, $P < 0.001$). Overall annual cost-savings was $421,455 with a reduction of $341,930 associated with inappropriate indications. No differences in clinical outcomes were observed.

Conclusion: Clinical pharmacists significantly reduced overall and inappropriate albumin costs in the general ward patient populations.

6 | Impact of medication adherence on emergency department visits in patients with COPD in a single tertiary hospital in Saudi Arabia

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Introduction: There is a very limited information and studies on the impact of adherence to choric obstructive pulmonary disease (COPD) medications in Saudi Arabia. We hypothesized that the adherence to COPD medication in our tertiary hospital is poor and can lead to frequent ED visits and longer hospitalization stays.

Research Question or Hypothesis: The purpose of this study was to assess the impact of medication adherence in patients with COPD on emergency department (ED) visits.

Study Design: A single center retrospective observational study in a tertiary teaching hospital in Jeddah, Saudi Arabia.

Methods: Adult patients with a confirmed diagnosis of COPD using ICD-10 codes were included. The primary outcome was the number of ED visit in one year. Secondary outcome was the total hospital length of stay. Medication adherence was evaluated by using an 8-scale Moriscky Medication Adherence Scale (MMAS-8). Patients with score of 6 or more were classified as high-adherent group while patients with score 5 or less were on low-adherent group.

Results: A total of 66 patients enrolled in the study. Of those 66 patients, 37 patients were on high-adherent group and 29 were on low-adherent group. The mean adherence score in our study using MMAS-8 scale was 6.02 (± 2.2). There was a significant difference between the high-adherent group and low-adherent group in the mean ED visit in one year 0.56 (± 0.79) vs 2.96 (± 1.61), $P < 0.001$. However, there was no significant difference between the two groups in the total hospital length of stay.

Conclusion: Among patients with COPD, there was a significant increase in ED visit per one year among patients with low adherence compared to patients with high adherence. This study highlights the importance of improving the medication adherence in patients with COPD.

7 | Evaluation of the efficacy and safety of direct oral anticoagulants in the treatment of portal vein thrombosis

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Introduction: Direct oral anticoagulants (DOACs) have emerged as agents of choice in the treatment of venous thromboembolism in typical locations in most patients, but their use is less well-defined in portal vein thrombosis (PVT) and other venous thromboembolisms of atypical locations. Existing literature has examined PVT recanalization

rates with DOAC treatment as opposed to recurrent thromboembolism, and few have utilized control groups with other anticoagulants.

Research Question or Hypothesis: DOACs are as effective and safe as warfarin in the treatment of PVT.

Study Design: Single center, retrospective.

Methods: Adult patients admitted from July 2014 to September 2018 initiated on a DOAC or warfarin for the treatment of a new PVT were included. Patients receiving full-dose anticoagulation for an indication other than PVT or with active hepatocarcinoma were excluded. The primary failure outcome was the absolute difference in recurrent thromboembolic events 90 days following initiation of a DOAC versus warfarin for PVT treatment. The primary safety outcome was the absolute difference in bleeding events 90 days following initiation of a DOAC versus warfarin. Descriptive statistics, Fisher's Exact, and Student's t-tests were utilized as appropriate.

Results: Thirty-three patients were included. Thirteen (39.4%) patients received a DOAC, and 20 (60.6%) received warfarin. No patients receiving a DOAC experienced a primary failure event compared to four receiving warfarin ($P < 0.001$). No patients receiving a DOAC experienced a primary safety event versus one receiving warfarin ($P < 0.001$). Ten (30.3%) patients had a previous diagnosis of cirrhosis (DOAC n = 5, warfarin n = 5), and none of these patients experienced a primary failure or safety outcome within 90 days of initiating anticoagulation.

Conclusion: DOACs appear to be effective and safe in the treatment of PVT and in preventing the recurrence of thromboembolic events. Future studies with larger sample sizes are warranted to confirm DOACs' efficacy in the treatment of PVT.

8 | Evaluation of an antibiotic graded challenge guideline in the hospital setting

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Introduction: Evidence has shown that about 10% of the population report being allergic to penicillin, but 90% of these are not true allergies. Drug challenge is considered gold standard to establish tolerance to an antibiotic in patients unlikely to have true allergies.

Research Question or Hypothesis: The goal of this study is to describe use of the antibiotic graded challenge at an academic hospital and to evaluate use of medications for adverse reactions.

Study Design: Retrospective cohort study of hospitalized adults who received an antibiotic graded challenge at Oregon Health & Science University Hospital between January 1, 2017 and May 31, 2019.

Methods: Data were collected from a repository of electronic health record data. We identified antibiotic challenge orders using low dose antibiotic orders or the recently approved order set. Antibiotic allergies were obtained from patient reported allergy records. Reactions were identified by using the medication administration record to quantify use of intravenous diphenhydramine, famotidine, hydrocortisone, or epinephrine.

Results: A total of 60 antibiotic graded challenges were performed. The mean age was 56.6 years and 33 (55%) were female. The median number of antibiotic allergies per patient was 1 (interquartile range 0-2). Thirty (50%) of the challenges used amoxicillin, and the majority of orders (88%) were for a penicillin or cephalosporin antibiotic. A total of 17 (28%) orders were for antibiotics not included in the order set. Twenty-three (38.3%) of the patients were treated for a reaction during the index admission with diphenhydramine (26.1%), famotidine (21.7%), or hydrocortisone (52.2%).

Conclusion: The implementation of a policy and order set has increased the use of antibiotic graded challenges to establish antibiotic tolerance and remove associated allergies from the patient chart. The majority of challenges have occurred with amoxicillin in those with a listed penicillin allergy and have been well tolerated without serious sequelae.

9 | Calcitonin for osteoporotic fracture pain in hospitalized patients: A retrospective cohort study

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Introduction: Pain management in elderly patients with an osteoporotic fracture often presents a treatment challenge where opioids and nonsteroidal anti-inflammatory drugs should be used with caution. Effective analgesics with better safety profiles are highly desired. Calcitonin has demonstrated efficacy in reducing osteoporotic fracture pain, however the data is limited.

Research Question or Hypothesis: Calcitonin added to standard pain management is associated with lower pain scores in hospitalized patients with an osteoporotic fracture when compared to standard pain management alone.

Study Design: Quantitative research

Methods: This was a single-center, retrospective cohort study of patients hospitalized from January 1, 2010 to December 1, 2018 with an osteoporotic or osteopenic fracture. Patients were included if they were greater than 18 years old, admitted to an internal medicine service, and hospitalized for at least 72 hours. The intervention cohort received calcitonin by nasal or subcutaneous route for at least 2 doses, in addition to standard analgesic therapy. The control cohort received standard analgesic therapy only. The primary outcome was to determine if calcitonin added to standard analgesic therapy was associated with lower pain scores and was assessed using a two-sample t-test. Analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC).

Results: Among the 154 patients included, 42 (27%) were in the standard therapy cohort and 112 (73%) were in the calcitonin cohort. Mean (SD) pain scores in the standard therapy vs. calcitonin cohort were 4.1 (2.1) vs. 4.9 (1.8) (two-sample t-test $P = 0.02$). Mean (SD) pain scores pre- vs. post-calcitonin administration in calcitonin patients only were 5.4 (2.0) vs 4.9 (1.8) (paired t-test $P = 0.01$).
Conclusion: Calcitonin was not associated with lower pain scores when added to standard therapy for pain management following an osteoporotic fracture. In the patients for which calcitonin was utilized, pain scores decreased following administration.

Ambulatory Care

10 | Assessing the use of a novel mobile application to improve blood pressure and medication adherence in patients the hypertension

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Introduction: Hypertension is a major public health problem that affects over 70 million Americans. Mobile applications may help improve patient outcomes in individuals with uncontrolled chronic disease.
Research Question or Hypothesis: The purpose of this study is to determine the effectiveness of a custom-designed app for 3 months to improve blood pressure (BP) and promote adherence to antihypertensive medications.
Study Design: This is a prospective, multicenter, randomized controlled trial.
Methods: Continuous outcome measures investigated were systolic/diastolic BPs and refill history, using the cumulative medication gap (CMG) score. Statistical analysis comparing median for BPs and CMGs between groups was conducted using Wilcoxon signed-rank and Mann-Whitney U tests.
Results: 55 patients were enrolled, 35 patients completed the study with no missing data. Baseline BPs for the control and intervention groups were 135/83 and 136/83 mmHg, respectively versus 124/77 and 124/78 mmHg at 3-month follow-up. CMG scores for the control and intervention groups were 0.42 and 0.25 at baseline, 0.21 and 0.19 at 3-month follow-up, and 0.18 and 0.23 at 3-month post-follow-up. Statistical significance was only seen in systolic BP between the baseline and final for the intervention group, $P = 0.01$.
Conclusion: Although a significant decrease in systolic BP was noted for the intervention group, the numerical similarities to the control group indicate limited clinical significance. The trend towards improved follow-up CMG in the intervention group during app usage with subsequent deterioration upon app discontinuation suggests a benefit of app usage. However, improvements in the overall study population are similar.

11 | Controlling hypertension through interdisciplinary group education

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Introduction: Hypertension effects one-third of all adults in the United States with only 48% meeting blood pressure targets associated with a decreased risk of complications. A hypertension group education program was created to improve patient health outcomes through engaging a multidisciplinary health professional team. The 6-hour group curriculum was created with a focus on nutrition, lifestyle, and medication approaches to hypertension management, while incorporating personally identified behavior change goals and barriers.
Research Question or Hypothesis: Attendance at group hypertension education classes will improve blood pressure control, with further control seen by engaging in an individual follow-up visit.
Study Design: Retrospective, chart review.
Methods: Eligible patients were contacted regarding participation in a group hypertension class between February 2017 and October 2018 and had a medical record within the health system. Patients were categorized to one of three groups: eligible but did not participate, attended group classes, or attended group classes with individual follow-up. For each patient, basic demographic information was collected along with baseline clinical measures (systolic blood pressure (SBP), diastolic blood pressure (DBP), weight, and BMI). Clinical measures were collected at 3-, 6-, and 12-months following attendance or screening. Comparisons of each measure were evaluated using a mixed ANOVA analysis along with post-hoc tests to aid in result interpretation.
Results: Program participants demonstrated immediate and sustained improvements in blood pressure. Of the 103 patients for whom baseline and 3-month data were obtained, patients who either attended group classes alone (n = 31) or who also had individual follow-up (n = 37) had greater decrease in SBP than those who did not participate (n = 35) (-12.4, -16.8, -1.1, respectively, $P < 0.01$, P-interaction <0.01). Diastolic blood pressure approached significance (P-interaction = 0.07) and BMI was essentially unchanged (P-interaction = 0.86).
Conclusion: Group hypertension education classes are an effective way to improve blood pressure control, while utilizing an innovative educational delivery model that is sustainable over time.

12 | Patient and provider satisfaction with a physician-pharmacist collaborative management hypertension clinic

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Introduction: Over the last decade, physician-pharmacist collaborative management (PPCM) has been shown to positively impact blood pressure (BP) control for hypertensive patients. In the context of increasing demands to physician schedules, PPCM may provide value in the delivery of patient-centered care. Understanding patient and provider attitudes towards this care model is imperative to its success in the long term.

Research Question or Hypothesis: To evaluate patient and provider satisfaction of the Pharmacy Hypertension Management Service (PHMS)

Study Design: Cross-sectional qualitative surveys

Methods: The Pharmacy Hypertension Management Service (PHMS) was established in June 2018 as a PPCM program aimed to improve BP control for primary care patients. Patients enrolled had uncontrolled HTN and were referred by their primary care physician (PCP). Patients who had at least two visits were offered a satisfaction survey, as were their referring provider.

Results: 21 patients and 12 providers completed the survey for a response rate of 70% and 29%, respectively. The vast majority of patients reported being happy to be enrolled in the program (86%) and 90% reported making changes to their diet as a result of PHMS counseling. The majority of providers also responded favorably with all 12 reporting that if given the opportunity, they would refer their patients to PHMS again. 92% of providers reported that PHMS helps their workflow and 73% noted that the program helped improve their patients' BP control.

Conclusion: One year since the implementation of PHMS, survey results showed that the majority of patients are satisfied with the program and have made lifestyle modifications as a direct result of the counseling they received in clinic. Results also demonstrated that most providers surveyed are satisfied with the program and that the program not only improves patient care but also helps their workflow.

13 | Workload evaluation of clinical pharmacists in the ambulatory care setting (WORK-AC)

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Introduction: There is evidence that clinical pharmacists improve patient outcomes in ambulatory care settings; however, the specific activities that contribute to such improvements are not well described. Evaluations of the time required for individual workload activities and processes for the delivery of care by ambulatory clinical pharmacists are lacking.

Research Question or Hypothesis: What is the distribution of time spent on daily activities that comprise the workload of a clinical pharmacist in an ambulatory care setting?

Study Design: A prospective, ethnographic, observational study at six pharmacist-integrated multidisciplinary ambulatory care clinics.

Methods: Nine clinical pharmacists were each observed for up to three nonconsecutive clinic workdays. Participant demographics, site characteristics, and self-reported engagement in direct patient care activities were collected. Workload was assessed through direct observation of time spent on daily clinical and operational activities and measurement of time allocated, visit type, number of disease states assessed, and use of clinical support staff during each visit. Results were stratified based on participant engagement in targeted, dual, or comprehensive medication management (CMM) visits, in which 1, 2, or 3 or more disease states were assessed, respectively. The primary outcome was analyzed using descriptive statistics.

Results: Of prespecified workload activities, clinical pharmacist participants spent the most time documenting care activities, spending a mean (SD) of 6.6 (6.7), 8.0 (8.2), and 7.6 (7.7) minutes after targeted, dual, and CMM visits, respectively. There was large variation in the distribution of workload activities among participants. Covariates, such as years of practice experience, postgraduate training, board certification(s), duration of practice at the clinical site, and site characteristics did not affect the distribution of time spent on activities ($P > 0.05$).

Conclusion: This evaluation articulates the daily activities that contribute to the workload of ambulatory care clinical pharmacists and may serve as the foundation to perform more comprehensive evaluations of their contributions to patient outcomes.

14 | Pharmacist-clinician collaborative visits following hospital discharge and impact to cost of care

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Introduction: Several pharmacist interventions following hospital discharge have shown reductions in hospital readmissions, however few have explored cost impact. Cost has not been evaluated for pharmacist-clinician collaborative visits (PCC) in primary care.

Research Question or Hypothesis: Total cost of care including inpatient readmissions, emergency department visits and outpatient care utilization will be significantly reduced for PCC visits compared to usual care (UC) over 30, 60 and 180 days.

Study Design: Retrospective cohort study of adult patients from July 26, 2013 to April 1, 2016.

Methods: Through review of the electronic health record, 496 PCC and 500 UC patients on at least 10 total medications, including at least one frequently associated with adverse events leading to hospital readmission, were evaluated. PCC patients met with a pharmacist and clinician each for 30 minutes, while UC patients met with a clinician only for 30 minutes. Clinicians were physicians or advanced care providers. Cost data was retrieved from the study institutions cost data warehouse, which included all billed services provided to all institutional patients. Costs were compared using a quantile regression to assess the potential heterogeneous impacts of the PCC intervention across different parts of the cost distribution.

Results: All outcomes were adjusted for differences in baseline characteristics. At 30 days post index discharge there was a significant decrease in total cost at the 10^{th} and 90^{th} quantiles in the PCC cohort compared to UC, with a non-significant decrease in the 25^{th}, 50^{th} and 75^{th} quantiles. The difference was significant at the 75^{th} and 90^{th} quantiles at 60 days, and 25^{th}, 50^{th} and 75^{th} quantiles at 180 days. At all quantiles and time periods a gross reduction in cost was found.

Conclusion: Medically complex patients had a significantly lower total cost of care in approximately half of the cost quantiles 30, 60 and 180 days after hospital discharge when they had a PCC visit.

15 | Evaluation of medication therapy management services for patients referred by social workers due to medication cost

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Introduction: In July 2017 pharmacists became an integral part of the One Call social work program at Anne Arundel Medical Center (AAMC). The purpose of One Call is to provide the appropriate community healthcare resources to vulnerable patients. Social workers refer patients to the ambulatory care pharmacists who have trouble affording their medications. The pharmacists conduct medication therapy management (MTM) to determine the necessary interventions to reduce cost.

Research Question or Hypothesis: Determine the cost savings to the patients referred by One Call social workers to ambulatory care pharmacists for MTM services

Study Design: Retrospective, single-center, chart review

Methods: Participants were referred by One Call social workers and had an MTM encounter with a pharmacist between July 1, 2017 to April 1, 2019. Data obtain through chart review included: age, gender, insurance type, disease state, medication class, type of intervention made, and pharmacist calculated savings. Chesapeake Regional Information System was used to determine 6 month pre- and post-intervention emergency department visits. Descriptive statistics were used to evaluate the data.

Results: A total of 59 patients were included in this study. Thirty-nine percent were Medicare patients and 24% were uninsured. The majority were referred because of problems affording diabetes (34%), COPD/Asthma (27%), and cardiovascular (19%) medications. Common pharmacist interventions included therapeutic substitution, patient assistance programs, pharmacy discount lists, and medication coupon websites/apps. The median thirty-day medication cost savings was $73(IQR $50 - $162). In the Medicare population there were 26 ED visits in the 6 months prior to the intervention and 18 ED visits in the 6 months after the intervention.

Conclusion: This study shows that ambulatory care pharmacists working collaboratively with social workers can reduce the cost of medications in a vulnerable patient population. Further studies should be conducted on how a pharmacy technician could be integrated into the referral process.

16 | Characterization of risk factors for genitourinary infections with sodium-glucose cotransporter-2 inhibitors (CORGI-SGLT2i)

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Introduction: Previous research details that sodium-glucose cotransporter-2 inhibitor (SGLT2i) are associated with an increased risk of genitourinary infections (GUI). It is unknown which factors may predispose patients to an increased risk of developing a GUI.

Research Question or Hypothesis: Does A1c management prior to SGLT2i initiation predict an increased risk of developing a GUI in patients with type 2 diabetes mellitus (T2DM)? What additional factors such as age, body mass index (BMI), eGFR, fasting plasma glucose, and serum creatinine, sodium or potassium levels serve as indicators of increased risk in developing GUI with SGLT2i use?

Study Design: Retrospective, multicenter cohort analysis was conducted utilizing patients receiving care within the Advocate Medical Group south region.

Methods: Patients prescribed a SGLT2i were identified from an electronic medical record generated report. Subjects were included if they had T2DM, were prescribed a SGLT2i from January 1, 2013 to October 31, 2018 and completed therapy for at least seven days. Patients were excluded if they did not have an A1c laboratory value within one year of SGLT2i therapy initiation, a history of GUI prior to SGLT2i therapy, or contraindications to SGLT2i use. Firth Logistic Regression was utilized to detect differences in baseline characteristics and a paired t-test was utilized only for those patients with a GUI when comparing to baseline.

Results: Seven-hundred thirty-nine patients were prescribed SGLT2i therapy and 584 patients were included for analysis. Only 30 of the 584 patients included experienced a GUI on SGLT2i therapy, and eGFR was the only variable that was significantly differed between groups ($P = 0.0228$). A1c management at baseline did not show a significant different in risk of GUI ($P = 0.4239$).

Conclusion: The incidence of GUI with SGLT2i use was lower than suggested in clinical trials, with a lower eGFR being the only predictor for increased GUI risk in this patient population.

17 | Effect of a standardized pharmacist transitions of care intervention on chronic obstructive pulmonary disease outcomes

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Introduction: Pharmacists play an integral role in transitions of care (TOC) for disease states that require complex medication regimens and have a high risk of 30-day readmission, specifically COPD. Development of a standardized model for TOC COPD pharmacist services is crucial for patient care, however evidence for inpatient TOC models is lacking.

Research Question or Hypothesis: What is the effect of a standardized TOC pharmacist program for patients with COPD and does its effectiveness vary by MEDCOINS score?

Study Design: Prospective cohort study.

Methods: The study population was patients hospitalized with COPD. Intervention patients received TOC pharmacist services and control patients were randomly sampled from those who did not. Outcomes were 30-day all-cause, COPD, and COPD-related readmissions. We estimated the effect of the TOC pharmacist intervention overall and stratified by MEDCOINS score. Risk ratios (RRs) with 95% confidence intervals (CIs) were estimated using inverse-probability-weighted (IPW) log-binomial regression models to account for differences between groups.

Results: The cohort of 375 patients (mean age 69 years, 58.4% women) included 88 intervention and 287 control patients. The IPW RRs (95%CI) were 1.16 (0.75-1.79) for all-cause, 1.08 (0.47-2.50) for COPD, and 0.67 (0.30-1.49) for COPD-related readmissions. The effect of the pharmacist intervention on all-cause readmission was similar across subgroups defined by the MEDCOINS score (*P*-value for effect modification = 0.94). For those with a MEDCOINS score of 6, there was a lower but non-significant COPD readmission risk (RR = 0.76, 95%CI 0.19-3.10) when compared with a score of less than 6 (RR = 2.19, 95%CI 0.71-6.75, *P*-value for effect modification = 0.22).

Conclusion: Pharmacist intervention did not have a strong overall effect on readmissions, though there was some evidence that the intervention was effective in patients with a MEDCOINS score of 6. Future research should focus on other outcome measures, such as outpatient follow-up and quality of life, that more closely relate to pharmacist intervention.

18 | Evaluation of COPD metrics for underinsured internal medicine clinic patients

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Introduction: Chronic obstructive pulmonary disease (COPD) leads to significant disability, burdens healthcare systems, and disproportionately affects patients of low socioeconomic status. Despite guideline recommendations patients infrequently receive recommended care. Identifying gaps in practice can aid in initiating changes for these patients.

Research Question or Hypothesis: What gaps exist in the process of care for COPD seen in the Mercy JFK Clinic, an internal medicine clinic serving uninsured and underinsured patients?

Study Design: Single-center, retrospective, quality improvement project.

Methods: Patients between 18 and 90 years of age with COPD listed on medical record problem list, prescribed a long-acting muscarinic antagonist inhaler, and who were seen by their primary care provider between 9/1/2017 and 9/30/2018 were included. Patients with concomitant asthma were excluded. The primary outcome was percentage of patients with spirometry at diagnosis. Secondary outcomes included symptom assessment, tobacco status and cessation counseling, administration of influenza and pneumococcal vaccinations, and frequency/severity of exacerbations. Descriptive statistics were used to assess all outcomes.

Results: Of 239 with COPD identified, 71 patients met inclusion criteria. Baseline characteristics were: mean 61.5 years, Caucasian 88.7%, female 64.8%, and current or former tobacco use 98.6%. An average 4.4 office visits per patient occurred during the study time frame. Only 39 (54.9%) received spirometry at diagnosis. Administration of influenza and pneumococcal vaccination-23 before age 65 occurred in 67.6% and 69% of patients, respectively. COPD symptoms were assessed in 88.7% during the study time frame, but only in 46% of office visits. Inhaler technique counseling was provided to 39.4% of patients, and 46.5% and 38.0% of patients were seen by a pharmacist or pulmonologist, respectively. COPD related hospitalizations occurred in 12.7% and a prednisone burst was prescribed in 26.8% of patients.

Conclusion: Significant gaps occurred across multiple GOLD recommendations for care. Suggested methods for improving the process for COPD care will be presented.

19 | Patient characteristics associated with meaningful primary care pharmacist management

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Introduction: In systems with limited resources, it is imperative that clinical pharmacist time be used effectively. Understanding the characteristics of patients who most benefit from medication management services can maximize pharmacist impact. This study examines the characteristics of patients seen by clinical pharmacists in a safety net health system and determines the association of patient characteristics with the highest number and most severe medication related problems (MRPs) identified and resolved.

Research Question or Hypothesis: What is the association between patient characteristics and meaningful primary care pharmacist management as defined by the number and severity of medication related problems identified and resolved?

Study Design: Prospective observational cohort study

Methods: Data was collected for patients seeing a pharmacist in 9 primary care clinics in the San Francisco Health Network between February 2018 to March 2018. Pharmacists collected data on patient characteristics and MRPs identified and resolved in each visit. Primary outcomes included total number of MRPs and the presence of the most severe MRP defined as level 1 (prevention of hospitalization or death).

Results: Pharmacists documented 449 encounters in this older (mean = 62 years), Non-Hispanic (70%), and Asian/other ethnicity (72.4%) population. A total of 835 MRPs were identified (mean = 1.85 MRPs/patient). A small number were classified by the pharmacist as level 1 (n = 41). Patients with significantly more MRPs had elevated blood pressure, elevated A1c, diabetes, COPD, PUD, took high number of medications, went to the ED or hospital in the past year, and were non-adherent to their medications. Patients with significantly more level 1 MRPs had elevated blood pressure, DM, PVD, and went to the ED or hospital in the past year.

Conclusion: The results of this study provide guidance for health systems to identify patients who would have the highest impact from scheduling visits with a pharmacist on a primary care healthcare team.

20 | Implementation of comprehensive medication management review (CMR) in the ambulatory care setting

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Introduction: CMR has been shown to be of benefit in high-risk populations. This project's purpose was to standardize the evaluation of pharmacotherapeutic management of patients in the outpatient setting. A CMR program was implemented at select ambulatory care sites within our healthcare system. This review identified and addressed medication-related concerns in order to optimize disease state management and attain positive patient outcomes.

Research Question or Hypothesis: Can pharmacists make a positive impact on health outcomes for geriatric patients at risk for polypharmacy through the CMR process?

Study Design: This prospective review included patients 80 years or older with polypharmacy concerns, categorized as having greater than or equal to 10 medications. Patients were excluded if they expired before pharmacist intervention or were on hospice.

Methods: The primary outcome was the number and type of interventions identified through CMR. Secondary outcomes included percent of recommendations accepted, reasons for rejection, types of recommendations, and disease states intervened on. The evaluation assessed for therapeutic duplications, potential interactions, side effects, inappropriate medications in the elderly, pharmacoeconomic issues and adherence concerns. All data was collected through the outpatient electronic health record.

Results: Out of a total of 222 patients, 52 patients did not require any interventions and 250 recommendations were made to the providers on the 170 remaining patients. Currently 82% of recommendations were accepted by providers, with 17% still pending provider acknowledgement, and 1% being rejected. A large majority, 141 recommendations, were made in regards to high risk medications. Interventions on gastric reflux disease consisted of 54 recommendations followed by pain management with 45 recommendations.

Conclusion: CMR was shown to be effective in identifying appropriate medication interventions in order to optimize patient care. This study provided the framework to move pharmacists into other outpatient sites in the healthcare setting to assist in targeting inappropriate prescribing in the elderly.

21 | Strategies to ensure consistent delivery of comprehensive medication management within an at-home patient population

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Introduction: Geisinger at Home, a new program targeting 5% of high-utilizers within the health system, aims to deliver care to the patient's home via a multidisciplinary team. Pharmacists, as part of the team, identify patients who would benefit from comprehensive

medication management (CMM). Consistent delivery of CMM is important to ensure a common understanding around the care delivered and to communicate essential elements of the service to patients, providers, and payers. However, effective strategies to increase fidelity and ensure consistency to the CMM patient care process are not well described.

Research Question or Hypothesis: How to ensure consistency in delivery of CMM across clinical pharmacists within an at-home patient population?

Study Design: Prospective implementation and quality assurance process

Methods: Several strategies were deployed to ensure fidelity to CMM. First, a standardized CMM note was developed based upon the CMM patient care process with the inclusion of smart data elements. Training included readings, completion of competency exams, shadowing, and mentored care by other trained pharmacists. Clinic documentation reviews were conducted for quality assurance (QA) initially by leaders, and later by peer-reviewers. Measurement of fidelity was documented through a standardized QA rubric and pharmacists' completion of the CMM self-assessment tool. Fidelity results were shared with pharmacists during quarterly fidelity review sessions.

Results: Five pharmacists began delivering CMM within three at-home regions in the summer of 2018. Clinical documentation QA reviews over a six month period resulted in increased consistency in documentation across practitioners and identified areas of improvement. Quarterly fidelity self-assessments found improved fidelity over time. Descriptive statistics will be included.

Conclusion: These strategies were found to be effective in increasing fidelity of CMM and consistency in clinical documentation. Multiple strategies might need to be employed to ensure consistency to the CMM patient care process over time. Ongoing monitoring of fidelity can help to identify practitioner drift, adaptions, and areas of improvement.

22 | Association between antidepressant dosing regimen and severe asthma exacerbations in patients with generalized anxiety and/or major depressive disorder

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Introduction: Generalized anxiety disorder (GAD) and major depressive disorder (MDD) are prevalent in patients with asthma and are correlated with reduced asthma control. Optimal doses of antidepressants have been established for treatment of MDD and demonstrate utility in gauging treatment of GAD. The effect of optimal versus suboptimal antidepressant regimens on asthma outcomes is unknown.

Research Question or Hypothesis: Does risk and number of severe asthma exacerbations differ among GAD and/or MDD patients prescribed optimal versus suboptimal doses of antidepressants?

Study Design: Retrospective, cohort study

Methods: Adults with asthma and newly diagnosed GAD and/or MDD initiated on antidepressants were included. Patients were established in clinic ≥1 year prior to antidepressant initiation and maintained on therapy for ≥1 year. Baseline characteristics included: age, race/ethnicity, BMI, diagnosis of GAD and/or MDD, asthma regimen, tobacco use, and diagnosis of allergic rhinitis. Antidepressant dose, number of severe exacerbations the year prior to, and 1-2 years following antidepressant initiation, were recorded. A severe exacerbation was a composite outcome of systemic corticosteroid use; increased inhaled corticosteroid dose for ≥3 days; asthma-related hospitalization, emergency room/urgent care visit. Log-binomial regression was used to compare the risk of severe exacerbations, and ANCOVA was used to compare the number of severe exacerbations and other asthma-related outcomes between treatment groups.

Results: Sixty-one patients [suboptimal dose (N = 24), optimal dose (N = 37)] met inclusion criteria. Baseline characteristics were similar between treatment groups. ï¿¼The risk of severe exacerbations was significantly less in the optimal dose group compared to suboptimal dose group at 1- and 2-year follow-up after adjusting for confounders [RR = 0.46, 95% CI (0.26-0.82) and RR = 0.50, 95% CI (0.30-0.82), respectively]. The number of severe exacerbations was significantly less in the optimal compared to suboptimal dose group at the 1- and 2-year follow-up after adjusting for confounders.

Conclusion: Severe asthma exacerbations were significantly less among GAD and/or MDD patients prescribed optimal versus suboptimal doses of antidepressants.

23 | A pharmacist role in statin quality measure performance within primary care

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Introduction: Evidence has shown improvement in performance measurements with the use of quality scorecards on preventative care and best practices. There is a lack of literature evaluating the use of medication scorecards on quality measures, including statin therapy. Pharmacists in population health are uniquely situated to use medication scorecards to drive performance change.

Research Question or Hypothesis: Does the use of practice level and provider level statin quality measure scorecards improve statin performance metrics?

Study Design: Prospective, pre-post interventional study

Methods: A data management and analytics platform was used to determine eligible statin cases based on the Centers of Medicare and Medicaid Services quality measure definition. Practice level and provider level statin composite scorecards were developed for nine Primary Care practices. Each practice was educated by the pharmacist monthly on the statin measure criteria, departmental goal, and tools to assist with statin prescribing. Statin measure compliance was compared at baseline and 3 months.

Results: Out of 15,299 patients who were statin eligible, 70% were receiving statin therapy at baseline. The statin measure compliance at baseline based on indication was: 76% diabetes, 74% clinical atherosclerotic disease (ASCVD), and 46% LDL ≥190 mg/dL. During the intervention, duplicate data was identified as a source of measurement error and deleted resulting in a reduction in the number of patients. Out of the subsequent 11,568 statin eligible patients, 68% were receiving a statin after 3 months. The statin compliance after 3 months based on indication was: 73% diabetes, 76% ASCVD, 53% LDL ≥190 mg/dL.

Conclusion: The use of a practice and provider level statin quality measure scorecard does not improve the overall statin performance measure over a 3 month period. Statin prescribing improved in patients with ASCVD or LDL ≥190 mg/dL. Similar to results of performance-based scorecards, a longer duration of up to 2 years may be necessary.

24 | Evaluation of medicare beneficiaries perception of annual wellness visits

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Introduction: An annual wellness visit (AWV) is a Medicare benefit that focuses on preventive care services. National utilization of Medicare's Annual Wellness Visits (AWVs) benefit is low and there have been few studies evaluating how beneficiaries perceive this service.

Research Question or Hypothesis: What are Medicare beneficiaries' perceptions, values, and barriers to receiving Annual Wellness Visits (AWV)?

Study Design: Semi-structured focus groups.

Methods: Medicare beneficiaries ages 65 and older were recruited from assisted-living facilities, senior housing, and primary care offices in urban, suburban and rural communities. Participants were eligible for this study if they were 65 years and older, spoke English, had active Medicare Part B status, and had an established PCP. Investigators developed a facilitator question guide for semi-structured, 60-minute focus group interviews. Questions targeted beneficiaries' perception of preventive healthcare services, awareness of AWVs, value of AWV services, perceived barriers and facilitators to receiving AWVs.

Results: Four focus groups were conducted. The average age of participants was 78.6 years (SD 8.4 years). Fifteen (50%) participants were Caucasian and 15 (50%) were African American, while 25 (83.3%) were female. Qualitative thematic analysis of the focus group responses revealed that preventive healthcare was valued, but access to quality preventive care remains an issue for patients. Most participants did not know about AWVs and reported confusion over the terminology "wellness visit" compared to a check-up or physical. Medicare beneficiaries are not commonly aware of AWVs. Identified barriers include travel to physician offices, perceived cost, ambiguity in the terminology, desire to address acute complaints, and knowledge of the existence of the service.

Conclusion: This study shows the awareness and perception gap between expectations beneficiaries have with wellness visits. Identifying patient expectations and priorities at the beginning of the visit will be important to ensure patient satisfaction.

25 | Adherence to guideline-recommended basal insulin therapy in patients with type 2 diabetes and HbA1c ≥10%

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Introduction: While metformin is first line for type 2 diabetes (T2D), guidelines recommend adding basal insulin when hemoglobin A1c (HbA1c) ≥10%. To our knowledge, no study has reported data on national insulin use in T2D in recent years, which can help gauge adherence to guideline recommendations and ultimately appropriate care.

Research Question or Hypothesis: The primary objective was to compare insulin use between patients with T2D based on HbA1c values <10% and ≥ 10%.

Study Design: This was a cross-sectional study using data from the 2016 National Ambulatory Medical Care Survey (NAMCS).

Methods: Included patients were ≥ 18 years old with T2D and then stratified by HbA1c <10% and ≥ 10%. The primary endpoint was the proportion of patients with a documented prescription for basal insulin. The secondary endpoint was the proportion of patients provided diabetes education. Insulin use and diabetes education were compared between groups using the chi-square test. Predictors of insulin use including age, sex, and HbA1c ≥10% were assessed using multivariable logistic regression.

Results: A total of 27,070,814 outpatient visits were included. Eighty-nine percent had an HbA1c <10%. Patients with HbA1c ≥10% were

more often female (65% vs. 43%, $P < 0.0001$) and younger (median age 58 vs. 65 years, $P < 0.0001$). Basal insulin was documented for 10% of patients with HbA1c <10% and 8% of patients with HbA1c ≥10% ($P < 0.0001$). Diabetes education between groups was 31% and 22% for HbA1c <10% and ≥ 10% ($P < 0.0001$), respectively. Male sex was the only significant predictor of insulin use (OR 1.05, 95% CI 1.04-1.05).

Conclusion: This study highlights a large proportion of patients with HbA1c ≥10% who are not receiving guideline-recommended insulin therapy. Insulin and diabetes education should be more strongly considered in order to help patients with HbA1c ≥10% reach goal and improve health.

26 | Ready? Set. Go!: Applying and exploring readiness for implementing medication management services

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Introduction: Interest in reducing implementation variability has been fueled by the lack of conclusive outcomes produced by medication optimization interventions. Planning for the systematic delivery of services begins with assessing and building readiness. Nine sites (seven health system/clinics and two community pharmacies) participated in a 9-month readiness building phase as part of a larger medication management service integration initiative.

Research Question or Hypothesis: The purpose of this study was to (1) describe application of the R = MC^2 readiness process to pharmacy; and (2) understand the sites' experience with this process.

Study Design: This mixed methods exploratory study used data collected as part of a process evaluation to understand feasibility and application of the R = MC^2 readiness process for pharmacy practice.

Methods: Implementation of the readiness process was informed by multiple data sources including sites' action plans, readiness surveys, coaching logs, and project team notes. Interviews were conducted with six of the sites, to understand their experience with the R = MC^2 framework.

Results: Overall, sites indicated high levels of initial readiness, with the lowest scores being availability of resources and needing to build interprofessional relationships. Readiness building strategies ranged widely from enhancing leadership buy-in to planning for service integration. Key facilitators of readiness included having a program champion and motivated team, easy access to the readiness tools, and support from a coach. Competing priorities, lack of resources, and timing of the readiness process were cited as barriers. The importance of interprofessional communication, aligning the readiness process with the service scope, and the usefulness of having a structured readiness process emerged as lessons learned.

Conclusion: The R = MC^2 framework was operationalized for pharmacy practice, resulting in critical insights for future applications. As a key precursor to implementation, assessing and building readiness should be incorporated into any medication optimization implementation effort.

27 | Using improvement cycles as a strategy to accelerate implementation of a pharmacy service: Feasibility and lessons learned

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Introduction: Improvement cycles can facilitate purposeful changes to implementation of any service. Improvement cycles were one of the strategies used as part of a broader implementation system to facilitate integration of CMM within 40 primary care practice sites with embedded pharmacists.

Research Question or Hypothesis: The purpose of this study was to (1) understand the feasibility using improvement cycles with pharmacist-led teams; and (2) highlight lessons learned to facilitate future applications.

Study Design: This exploratory mixed methods feasibility study makes use of survey and interview data collected as part of the "CMM in Primary Care" grant. Implementation feasibility was defined as the extent to which a service can be conveniently and successfully carried out in real-world settings.

Methods: Understanding feasibility of using improvement cycles was informed by survey results measuring the following concepts: appropriateness, acceptability, practicality, usability, intent to continue using, and perceived benefits. Interviews were conducted with 15 team representatives to understand lessons learned.

Results: Overall, 44 survey respondents indicated high levels of satisfaction with the improvement cycles process, which they found valuable and worth recommending to others. They indicated agreement that the process was appropriate, acceptable, practical, and usable, with intent to continue using it in their practice and examples of concrete results (eg, increased confidence). Lessons learned included: the importance of sharing ideas and gaining buy-in early in the process, the need to invest in a committed team, appreciation for having a structured process despite the time and resources needed to carry out the process, the need to start small to experience early success, and the importance of being prepared for the tested change to not produce the expected outcome.

Conclusion: The improvement cycles process is a feasible strategy for pharmacist-led teams implementing CMM. Future use of the process be will refined based on lessons learned.

28 | Rural respiratory antibiotic prescribing appropriateness in outpatients

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Introduction: The Infectious Disease Society of America (IDSA) published early antimicrobial stewardship recommendations in 1997. Translating these ideas from major academic centers to underserved rural populations has only been published for the past 5-7 years, and activities relating to outpatient antibiotic prescribing are limited.

Research Question or Hypothesis: What is the rate of inappropriate respiratory antibiotic prescriptions for a healthy outpatient rural adult cohort? Does prescribing appropriateness differ by provider type or specialty, or patient age, gender, or condition treated?

Study Design: Retrospective cohort performed via manual electronic medical record (EMR) review.

Methods: Two consecutive months of outpatient levofloxacin and azithromycin prescriptions were extracted from the EMR. Prescriptions were excluded for non-respiratory indications, emergency room, had no EMR documentation, patient age under 18, had COPD or asthma, or were immunocompromised. Manual note review for remaining patients determined prescription appropriateness. Appropriate indications for antibiotics were defined as: Pneumonia with positive chest radiograph, Group A strep. Positive pharyngitis, Bronchitis with positive pertussis, and rhinosinusitis with symptoms lasting 7 days or severe symptoms lasting 3 days. The primary outcome was rate of inappropriate antibiotic prescriptions. Secondary outcomes included rate of inappropriate antibiotic prescriptions by provider type, provider specialty, antibiotic selected, and patient age. SPSS 24 (Chicago: IBM Corporation) was used for analysis.

Results: Two hundred ninety (290) antibiotic prescriptions were extracted from the EMR. One hundred ninety-two (66.2%) were excluded primarily for age under 18, chronic respiratory illness, or non-respiratory indication. Of the 98 patients whose charts were manually reviewed, 72 (73.4%) of antibiotic prescriptions were inappropriate. Antibiotic appropriateness did not differ significantly between MDs and other provider types ($P = 0.468$), provider specialty ($P = 0.236$), antibiotic prescribed ($P = 0.54$), or patient age ($P = 0.073$).

Conclusion: The rate of inappropriate outpatient respiratory antibiotic prescriptions is persistently high overall and across provider type, specialty, antibiotic selected, and patient age.

29 | Assessing ambulatory pharmacy practice through routine use of a modified nationally standardized patient satisfaction survey

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Introduction: Sufficient clinical and economic outcome evidence exists to support ambulatory pharmacy services, however, patient satisfaction is not routinely captured. Within a patient-centric care model, regular capture of patient-reported satisfaction is essential to evaluate and improve ambulatory pharmacy practice.

Research Question or Hypothesis: Can a modified medical practice survey provide meaningful feedback on patient satisfaction to pharmacists practicing in ambulatory settings?

Study Design: Continuous cross-sectional post-visit survey

Methods: Geisinger deployed a modified Medical Practice Survey (MPS), from Press Ganey Associates, Inc. to evaluate patient experience for ambulatory pharmacists embedded in primary care sites beginning in January 2019. All patients seen in-person by a Geisinger ambulatory pharmacist in a primary care setting are eligible. Up to 17 paper surveys/month/pharmacist are mailed to patients with additional patients receiving an e-survey if they have an e-mail address on file and did not receive a survey in the previous 90 days. Collated de-identified comments are returned weekly to pharmacy leadership to facilitate service recovery and performance improvement and regularly detailed reports provide benchmark comparisons and key drivers for improvement. An interactive portal is available for real-time and custom reporting.

Results: We collected 2,122 survey responses (21.2% response rate) from across 38 clinics and 46 ambulatory pharmacists from January-May 2019. Significant variation in patient satisfaction exists at both a clinic and pharmacist level, allowing for data-driven quality assessment and improvement efforts. Weekly comments from surveys provided to platform leadership indicate areas of strength and opportunities for improvement.

Conclusion: Standardized patient satisfaction surveys delivered to patients after in-person ambulatory pharmacy encounters are feasible and provide valuable qualitative and quantitative feedback on an overall program, individual clinics, and providers and is another tool to

help ensure high quality patient-centric care. Adoption by other healthcare systems will improve generalizability of findings. Future research should explore the ways this information can be used to improve patient care.

30 | Use of validated COPD Assessment Test (CAT) to improve care for patients with chronic obstructive pulmonary disease (COPD) in a primary care setting

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Introduction: The COPD Assessment Test (CAT) is a validated tool for the management of patients with COPD (chronic obstructive pulmonary disease). An established workflow would be beneficial to ensure patients with COPD receive the CAT. Developing a process at a family medicine residency program clinic could help ensure patients with COPD are receiving care consistent with current evidence-based guidelines.
Research Question or Hypothesis: A sustainable process for administering the CAT would improve administration numbers at a clinic from 0% to 40%.
Study Design: Continuous quality improvement project.
Methods: Using the problem list, medical assistants (MAs) identified any diagnosis of "COPD" and administered a CAT to the patient. A five-week pilot was performed with a small subset of MAs. Various plan-do-study-act (PDSA) cycles were implemented to improve the administration process, including ongoing MA and provider education. The process was then implemented clinic-wide; data was collected for four weeks. Primary outcome included the percentage of eligible patients receiving the CAT. Secondary outcomes included CAT scores and number of COPD-related hospitalizations.
Results: During the pilot, six (17%) patients of an eligible 36 patients received the CAT. During the clinic-wide implementation, 13 (22%) patients of an eligible 60 patients received the CAT. For the pilot and clinic-wide implementation, average CAT scores were 22.5 (range 11-35) and 22.2 (range 6-35), respectively. In the pilot, 50% of patients reported more than one hospital admission in the last year, compared to 20% during clinic-wide implementation. Factors determined to improve reliability of administration were health maintenance reminders in the electronic health record and regular training of staff.
Conclusion: A sustainable process for CAT administration increased the percentage of CATs given to eligible patients. This process could be implemented at other primary care clinics to improve care for patients with COPD.

31 | Success rate of statin rechallenge after the initiation of vitamin D supplementation in statin intolerant patients

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Introduction: Statins are first-line in lipid management, although many patients are unable to tolerate statins due to adverse drug reactions (ADRs) such as myalgia. Previous studies have demonstrated a positive association between low vitamin D levels and muscle-related statin ADRs.
Research Question or Hypothesis: Does initiation of vitamin D supplementation improve statin continuation rates when rechallenging a statin in patients with a previously documented muscle-related statin ADR(s) while vitamin D deficient?
Study Design: Single-center, retrospective cohort study of patients within a Veterans Affairs health care system
Methods: Eligible patients were those rechallenged on a statin between January 1, 2008 and October 1, 2017 after experiencing a muscle-related ADR while vitamin D deficient (< 30 ng/mL). Patients were divided into two groups - those who received vitamin D supplementation prior to statin rechallenge and a control group of those who did not receive supplementation. Data was collected at baseline, during the time of presumed statin exposure, and at 6- and 12-months post-statin rechallenge.
Results: A total of 47 patients in each group were included in the study. There was no difference in statin continuation rates at 6 and 12 months between those supplemented with vitamin D prior to statin rechallenge and those who were not (76.6% versus 85.1%, $P = 0.294$ and 68.1% versus 78.7%, $P = 0.243$, respectively). Furthermore, statin continuation rates with respect to baseline vitamin D levels, statin dosing, or statin intensity were similar between groups. During the 12-month study period, 8 patients in the vitamin D supplementation group reported a muscle-related ADR compared to 4 patients in the group without vitamin D supplementation.
Conclusion: In patients with a muscle-related statin ADR while vitamin D deficient, there was no difference in the rates of successful statin rechallenge between those initiated on vitamin D supplementation and those without vitamin D supplementation.

32 | Evaluation of a pharmacist-driven post-stroke transitions of care clinic on 30 and 90-day hospital readmission rates

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Introduction: Stroke impacts 800,000 people annually and is a leading cause of long-term disability. The risk of recurrent stroke and hospital readmission is increased exponentially following an initial stroke event. Due to increased morbidity and mortality associated with secondary events, a pharmacist-driven post-stroke transitions of care clinic (PSTCC) was created at Methodist University Hospital to provide risk factor modification in an effort to decrease stroke recurrence and hospital readmissions.

Research Question or Hypothesis: Does a pharmacist-driven transitions of care clinic impact readmissions in a post-stroke population?

Study Design: Retrospective, matched-cohort study conducted between 9/1/2017 and 1/31/2019

Methods: Inclusion criteria: age ≥ 18 years, discharged to home, PSTCC visit within 14 days of hospital discharge. Patients were matched based on age ± 3 years, race, gender, and type of stroke (ischemic vs. hemorrhagic) to those who did not receive pharmacist interventions (NPI) in the same time period. The primary endpoint was 30-day all-cause hospital readmission. Secondary endpoints included 90-day readmission, 30 and 90-day emergency department visits. Type and quantity of pharmacist interventions was also assessed. Statistics were analyzed with SPSS version 23.

Results: 188 patients were included in the analysis (n = 94 PSTCC, n = 94 NPI). Significant differences in baseline demographics included history of TIA, stroke severity, and insurance status. No significant difference in 30-day hospital readmissions was observed between the cohorts (3.2% PSTCC vs. 8.5% NPI, $P = 0.12$). There were five 90-day readmissions in the PSTCC group compared to twenty readmissions in the NPI group (5.3% PSTCC vs. 21.3% NPI, $P = 0.001$). No significant difference in 30 day (13.8% PSTCC vs. 14.9% NPI, $P = 0.84$) or 90 day (27.7% PSTCC vs. 26.6% NPI, $P = 0.87$) emergency department visits was identified. Pharmacists made a mean of 3.5 interventions per visit.

Conclusion: A pharmacist-driven post-stroke transitions of care clinic significantly decreases 90-day hospital readmission rates.

33 | The impact of a multidisciplinary controlled substance committee on reducing opioid prescribing

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Introduction: At a Federally Qualified Health Center (FQHC), a controlled substance inter-disciplinary committee (CSIC), led by clinical pharmacists, was established to catalyst a shift in controlled substance prescribing practices. The CSIC accomplished this goal by way of making patient-specific recommendations to the patient's primary medical provider, along with episodic follow up. Although previous literature demonstrates the success of similar committees, this FQHC has a unique population with a high prevalence of substance abuse and HIV disease.

Research Question or Hypothesis: Determine the effectiveness of CSIC by measuring the reduction in oral morphine equivalents (OMEs) for patients that had recommendations to taper or discontinue opioids.

Study Design: This was an investigator initiated, single center, pre-post, retrospective cohort study.

Methods: Patients with new referrals to CSIC between July 1st, 2017 and June 30th 2018 were evaluated. Subjects were excluded if they did not have consistent follow up with a medical provider following CSIC evaluation. A retrospective chart review was completed for 69 patients from time of initial CSIC recommendation through a six month follow up period. Of the patients evaluated, a reduction in opioid usage was recommended for 41 eligible patients. To estimate the reduction in OMEs, we calculated the percent change (delta) in OMEs from starting dose to dose at six months. We then conducted one-sample t tests on the delta to test that the reduction in dose was greater than zero.

Results: There was a significant reduction in dose at six months. The average decrease in dose at six months was 59.39% ($\sigma = 35.8$) (95% CI = (46.7, 72.0), P-value <.001).

Conclusion: A pharmacist-led multidisciplinary controlled substance committee demonstrated a significant reduction in OMEs in a population with high rates of HIV disease and substance abuse. Further investigation on the durability of this impact and potential adverse events is warranted.

34 | Improved urine drug screen monitoring on long-term controlled substances: an interprofessional approach

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Introduction: Urine drug screen (UDS) monitoring is a risk mitigation tool that can be used to improve safety and attenuate risks for patients on controlled substances. Although guidelines recommend UDS monitoring to improve safety on long-term controlled substances, adherence to this practice in primary care remains subpar. Furthermore, best practices to promote use of UDS monitoring are undefined.

Research Question or Hypothesis: Can an interprofessional team-based approach to quality improvement (QI) improve UDS monitoring for patients on long-term controlled substances in a resident-run internal medicine clinic with an embedded clinic pharmacist?

Study Design: Quasi-experimental pre-post intervention study utilizing two "Plan-Do-Check-Act" cycles.

Methods: The percentage of patients on long-term controlled substances (>3 continuous months or recurrent use >6 months) with a UDS obtained was compared at baseline and 5 and 10 weeks after implementation of interprofessional interventions to improve monitoring. The clinic pharmacist helped identify patients meeting monitoring criteria and educated medical residents, providers, and staff to ensure a UDS was obtained during patient visits. The outcome was percentage of UDS obtained for eligible patients. MedCalc® was used for statistical analysis.

Results: We included 213 patients (21 pre-QI, 90 five-weeks post-QI, and 102 ten-weeks post-QI); controlled substance medication did not differ between groups. Prior to QI initiatives, 23% of eligible patients had a UDS completed. Five weeks after implementation of QI, 60% of patients had a UDS completed (OR 4.8, 95% CI 1.6 - 14.3, $P = 0.0048$ versus pre-intervention). The proportion increased to 73% of patients at 10 weeks (OR 9, 95% CI 3 - 26.6, $P = 0.0001$ versus pre-intervention).

Conclusion: This study demonstrated improved UDS monitoring for patients on long-term controlled substances. The odds of a completed UDS were 9 times higher after the second PDSA cycle, demonstrating the benefit of the team-based approach with a clinic pharmacist.

Cardiovascular

35 | Evaluation of hyperkalemia risk in heart failure patients on spironolactone with estimated glomerular filtration rate < 30 mL/min

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Introduction: Spironolactone is not recommended in heart failure (HF) patients with estimated glomerular filtration rate (eGFR) < 30 mL/min due to the concern for higher risk of hyperkalemia.

Research Question or Hypothesis: To evaluate the risk of hyperkalemia in HF patients on spironolactone with an eGFR <30 mL/min compared to those with eGFR ≥30 mL/min in a tertiary care hospital

Study Design: A retrospective, single-center cohort study

Methods: HF patients older than 18 years taking spironolactone were included. Patients receiving dialysis were excluded. The primary outcome was the incidence of hyperkalemia (serum potassium >5.0 mmol/L). The incidence rates of the first hyperkalemia event per 1000 person-years were calculated and compared between patients with eGFR <30 mL/min and those with eGFR ≥30 mL/min. The first-year hyperkalemia event rate was also calculated. Multiple logistic regression analysis was performed to calculate the adjusted odds ratio of the first-year hyperkalemia events. The significant level was set at 0.05.

Results: The incidence rates of overall hyperkalemia were 288.8 and 243.8 cases/1000 person-years in the eGFR <30 mL/min group (n = 39) and in the eGFR ≥30 mL/min group (n = 81), respectively (risk ratio = 1.18; 95% CI = 0.68 to 2.01, $P = 0.53$). The first-year hyperkalemia event rate was 35.9% in the eGFR <30 mL/min group and 25.9% in the eGFR ≥30 mL/min group (risk ratio = 1.60; 95% CI = 0.70-3.64, $P = 0.26$). The multiple logistic regression analysis results showed that the adjusted odds ratio of the first-year hyperkalemia events between patients with eGFR <30 mL/min and ≥ 30 mL/min was 1.04 (95% CI = 0.39-2.81, $P = 0.93$).

Conclusion: The use of spironolactone in heart failure patients with eGFR <30 mL/min was not significantly associated with higher hyperkalemia risk compared to those with eGFR ≥30 mL/min.

36 | Impact of diuretic changes on readmission rates following transcatheter aortic valve replacement

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Introduction: Readmission rates for heart failure following transcatheter aortic valve replacement (TAVR) are as high as 18%. Prior studies have shown an increase in readmission rates when patients with heart failure are not stabilized on an oral diuretic regimen prior to discharge. Diuretic dose requirements following TAVR are unpredictable, and patients are often discharged without being stabilized on a diuretic regimen. This study aims to evaluate how changes in discharge diuretic regimens affect readmission rates in patients undergoing TAVR.

Research Question or Hypothesis: In patients on a stable outpatient diuretic dose and admitted for TAVR, do changes in diuretic dose at discharge impact 30-day readmission rates?

Study Design: Retrospective cohort study

Methods: Data were retrospectively collected for patients receiving loop diuretics undergoing TAVR at an academic medical center. Pre-TAVR diuretic doses were compared to discharge diuretic doses post-TAVR. Patients were allocated to one of two arms based on whether they were discharged on the same diuretic dose (SDD) or a different diuretic dose (DDD) from admission. Data on 7-, 30-, and 90- day readmissions were collected, as well as frequency of diuretic dose titrations.

Results: A total of 58 patients were included in the SDD arm and 58 in the DDD arm. The primary endpoint occurred in 17.4% of patients and 13.9% of patients in the SDD and DDD groups, respectively ($P = 0.4$). Seven-day readmissions were more common in the SDD group (8.7% v 2.6%; *P*-value 0.01). The most common reasons for readmission were heart failure and mechanical fall. A total of 23 and 19 diuretic dose titrations occurred in each arm in the first 30 days, respectively.

Conclusion: Our study did not find a correlation with discharge diuretic dosing and readmission rates following TAVR. Diuretic dose titrations following discharge were common in both groups and highlight the need for close follow-up.

37 | Incidence of symptomatic hypotension requiring changes to medical therapy after initiating sacubitril/valsartan: A retrospective review

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Introduction: The use of sacubitril/valsartan can lead to significant hypotension in some patients. It would be beneficial to know if sufficient monitoring is being provided and whether changes to medical therapy are effective at addressing hypotension in a real world setting.

Research Question or Hypothesis: The use of sacubitril/valsartan in HF clinic patients causes symptomatic hypotension that necessitates a change in medical therapy.

Study Design: This was a single-center, retrospective chart review of patients enrolled in the HF clinic at an academic medical center.

Methods: The primary objective was to determine the incidence of symptomatic hypotension requiring changes to medical therapy in HF clinic patients after initiating sacubitril/valsartan. The secondary objective was to determine if changes to medical therapy would allow continued use of sacubitril/valsartan. Inclusion criteria: 18-89 years old, enrolled in the HF clinic, prescribed sacubitril/valsartan, and attended a subsequent HF clinic visit. Exclusion criteria: prisoners, pregnant, or not compliant with taking sacubitril/valsartan. The electronic health record was used to complete a retrospective chart review. The objectives were analyzed using descriptive statistics.

Results: A total of 89 charts were reviewed with 56 patients meeting inclusion criteria. Hypotension that required a change in medical therapy occurred in five patients (8.9% incidence). All five of the patients were able to continue using sacubitril/valsartan after a change in medical therapy (100% continuation rate). The most common adjustment to medical therapy was changing carvedilol to metoprolol succinate (66.7%). Empiric adjustments to medical therapy at the time of initial sacubitril/valsartan prescribing occurred with 17 patients (30.4%).

Conclusion: The incidence of symptomatic hypotension in the HF clinic was lower than previously reported in literature. Empiric adjustments to medical therapy at the initial prescribing of sacubitril/valsartan may have helped to decrease hypotensive episodes. Current clinic practices appear to be effective at managing hypotension so that sacubitril/valsartan can be continued.

38 | Absence of compelling indications in patients with hypertension prescribed beta-blockers

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Introduction: Beta-blockers are no longer recommended for hypertension in patients without a compelling indication since the publication of the Eighth Joint National Committee (JNC 8) in 2013. However, the prevalence of beta-blocker use in patients without compelling indications is unknown.

Research Question or Hypothesis: Beta-blockers are commonly prescribed for hypertension in patients without compelling indications.

Study Design: Cross-sectional.

Methods: Medical and pharmacy claims data from the 12 million member IQVIA™ Community Database were used to identify non-pregnant adults (≤65 years) with hypertension who were prescribed beta-blockers. Compelling indications included coronary artery disease, atrial fibrillation, heart failure, cirrhosis, migraines, hyperthyroidism, or essential tremor. Descriptive statistics included demographic and clinical characteristics of beta-blocker users and the proportion without compelling indications. Binomial logistic regression was used to assess the association of patient and beta-blocker characteristics (eg, vasodilatory beta-blockers: carvedilol, labetalol, nebivolol) with the absence of a compelling indication.

Results: A total of 218,948 adults with hypertension were prescribed beta-blockers. Of these, 66.4% (n = 145,449) did not have a compelling indication. In those with a compelling indication, coronary artery disease (21.7%) and atrial fibrillation (6.9%) were the most common. Compared to patients with a compelling indication, those without were more likely to be younger, female, receiving a beta-blocker combination antihypertensive product, and less likely to have diabetes or chronic kidney disease. Patients without a compelling indication were also less likely to be on a vasodilatory beta-blocker. Atenolol (24.5% vs. 13.8%) was more frequently prescribed in those without a compelling indication whereas carvedilol (9.0 vs. 19.7%) and metoprolol tartrate (18.0 vs. 26.5%) were less common.

Conclusion: Beta-blockers are more frequently prescribed in patients without a compelling indication than in those with one and may represent an opportunity for intervention. Exchanging beta-blockers for more effective antihypertensive medications may improve blood pressure control and efficacy of hypertension management.

39 | Non-vitamin K oral anticoagulants compared to warfarin for early anticoagulation of atrial fibrillation with bioprosthetic valves

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Introduction: Atrial fibrillation (AF) occurs frequently following bioprosthetic valve replacement (BVR). Subgroup analyses of the ARISTOTLE and ENGAGE AF-TIMI 48 trials demonstrate the efficacy and safety of non-vitamin K oral anticoagulants (NOACs) for atrial fibrillation (AF) with history of BVR.[2,3] Neither study including patient with recent BVR and as a result data are lacking for NOACs in the immediate post-operative period.

Research Question or Hypothesis: To evaluate the safety and efficacy of NOACs compared to warfarin for atrial fibrillation in patients with recent BVR.

Study Design: Multicenter, retrospective cohort study of cardiovascular surgery patients within the Indiana University Health System.

Methods: Patients admitted from 08/01/2014 to 07/31/2018 were included if they had AF, aortic or mitral BVR, were discharged on a NOAC or warfarin, and had documented follow up. The primary endpoint was the composite incidence of stroke or systemic embolism (SE) at post-operative day 30. Secondary endpoints included stroke or SE at day 90, bleeding at days 30 and 90, and 30-day readmission. Analysis included student's *t*-test, χ^2, Fisher exact, and Mann-Whitney tests as appropriate using Minitab Statistical Software.

Results: 183 patients were included with mean age 70. The primary endpoint occurred in 1.2% (1/81) of patients in the NOAC group and 2.0% (2/102) (P = 1) of patients in the warfarin group. There was no difference in the incidence of stroke or SE at post-operative day 90 (0 vs. 2, P = 0.50), major bleeding at post-operative day 30 (3 vs 1, P = 0.32) or day 90 (1 vs 0, P = 0.44), or 30-day readmission rate (13.6% vs. 11.8%, P = 0.69).

Conclusion: The efficacy and safety of NOACs for early anticoagulation of BVR in patients with AF is consistent with other studies after remote BVR, suggesting NOACs may be a reasonable option in this patient population. Further trials are necessary to definitively conclude safety and efficacy for early anticoagulation.

40 | Effectiveness and safety of dabigatran and rivaroxaban in non-valvular atrial fibrillation patients with prior exposure to warfarin

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Introduction: Several studies had demonstrated the effectiveness and safety of dabigatran and rivaroxaban among non-valvular atrial fibrillation (NVAF) patients. However, they were mostly focused on new users. Little is known about whether prior long-term use of warfarin would affect the outcomes after they shift to dabigatran or rivaroxaban.

Research Question or Hypothesis: Would prior exposure to warfarin affect the clinical outcomes of dabigatran and rivaroxaban use among patients with non-vavular atrial fibrillation?

Study Design: This was a quantitative, retrospective cohort study.

Methods: This study was conducted on data from nationwide insurance claims in Taiwan. Patients with NVAF who received warfarin, dabigatran, or rivaroxaban were included. Patients with prior warfarin exposure were defined as those who were prescribed warfarin for at least 365 days before the index date. The date of first prescription of dabigatran or rivaroxaban was defined as index date. For warfarin group, index date was assigned by matching the warfarin prescription date to the index date of each comparison group according to age and gender. Propensity score matching was used to balance the covariates, and Cox-proportional hazard models were applied to compare the outcomes between each group.

Results: Our study included 1,172 paired groups of dabigatran users and 741 paired groups of rivaroxaban users. Compared to warfarin users, dabigatran users were associated with a reduced hazard of intracranial hemorrhage (HR: 0.36, 95% CI: 0.15-0.84, P < 0.05). Treatment with rivaroxaban was associated with lower risk of intracranial hemorrhage than warfarin (HR: 0.28, 95% CI: 0.08-0.96, P < 0.05). However, risks of gastrointestinal bleeding, ischemic stroke, venous thromboembolism, and transient ischemic attack did not significantly differ between warfarin and dabigatran or rivaroxaban users.

Conclusion: Dabigatran and rivaroxaban could reduce the risk of intracranial hemorrhage even if shifting from long-term use of warfarin. This was consistent with the findings from phase III clinical studies regarding direct oral anticoagulant users.

41 | Trends in antihypertensive medication regimens among US adults with treated hypertension,NHANES 2005-2016

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Introduction: Achieving blood pressure (BP) control often requires taking more than one antihypertensive medication class.

Research Question or Hypothesis: Among US adults with treated hypertension, what are the trends in the antihypertensive medication regimens used (ie, number and distinct combinations)?

Study Design: Serial cross-sectional

Methods: We analyzed data from the National Health and Nutrition Examination Surveys 2005-2016 to determine the number and distinct combinations of antihypertensive medication classes taken by US adults. We studied US adults age ≥ 20 years with a diagnosis of hypertension taking at least one antihypertensive medication.

Participants who were pregnant or were missing medication or BP information were excluded. Single-pill combinations were classified into individual compounds, and each compound was categorized by class. We assessed trends in the uses of combinations across time, defined in four-year calendar periods, applying sampling weights to obtain nationally-representative prevalence estimates.

Results: Among 8,120 eligible participants, from 2005-2008 to 2013-2016, the number of medication classes in antihypertensive regimens did not change (1 class, 39.5% to 40.4%; 2 classes, 37.9% to 38.3%, and ≥ 3 classes, 17.6% to 16.5%; each $P_{trend} > 0.05$). Statistically significant trends in medication classes included: increased use of angiotensin-converting-enzyme inhibitor (ACEI) or angiotensin II receptor blocker (ARB) monotherapy (18.9% to 24.4%, $P_{trend} = 0.003$); decreased use of beta-blocker monotherapy (9.0% to 6.0%, $P_{trend} = 0.004$); decreased use of diuretic monotherapy (6.6% to 4.9%, $P_{trend} = 0.058$); decreased use of beta-blocker and diuretic dual-therapy (5.9% to 3.8%, $P_{trend} = 0.004$); and decreased use of ACEI or ARB, beta-blocker, and diuretic triple-therapy (7.7% to 5.7%, $P_{trend} = 0.025$).

Conclusion: From 2005-2016, there was no evidence that the total number of antihypertensive medication classes used in US adults with hypertension changed, and monotherapy persisted as the most common antihypertensive medication strategy. Consistent with guideline recommendations, beta-blocker use, alone and in combinations, is decreasing.

42 | The effect of aspirin on patients with aortic aneurysm after aneurysm repair

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Introduction: Aortic aneurysm (AA) is one of a leading cause of death with highly mortality upon rupture. Aspirin, as secondary prevention of cardiovascular disease, may play a role in AA by interfering with blood clotting and inflammatory process. However, the clinical evidence on the effects of aspirin for postoperative AA patients is still lacking.

Research Question or Hypothesis: To investigate the association between aspirin and all-cause mortality, risk of reoperation and rehospitalization for AA among postoperative AA patients.

Study Design: Population-based, retrospective cohort study

Methods: All patients diagnosed with AA via ICD-9-CM (441.1-441.7, 441.9) and underwent AA operation during 2004-2012 were identified from National Health Insurance Research Database in Taiwan. Patients without computed tomography examination within 1 year after diagnosis and died within 30 days after operation were excluded. The primary outcome was a composite outcome of all-cause mortality, reoperation and rehospitalization for AA. The Cox hazards model was employed to evaluate the associations between aspirin use and outcomes. To minimize potential bias, additional sensitivity analyses were conducted. *P* values were 2-sided and considered significant if $P < 0.05$. All data analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC)

Results: Among study population (n = 1633), 307 (18.8%) patients were aspirin users. Aspirin was associated with lower risk of primary composite outcome with adjusted hazard ratio (HR): 0.736 (95%CI: 0.619-0.875). The adjusted HR for composite outcome was 0.404 (95%CI: 0.306-0.533) and 0.995 (95%CI: 0.808-1.225) when MPR > 80% with and without immortal time as well as lag time taken into account, respectively. Aspirin was associated with lower risk of all-cause mortality (adjusted HR: 0.422, 95%CI: 0.314-0.566), while no significant difference on risk of rehospitalization and reoperation for AA.

Conclusion: Aspirin was associated with lower risk of all-cause mortality for postoperative AA patients in current cohort. Further large studies are still needed to evaluate the efficacy of aspirin among patients undergoing AA repair.

43 | MicroRNA-223 elevated by ticagrelor predicts postoperative bleeding and transfusion in off-pump coronary artery bypass grafting patients

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Introduction: MicroRNA-126 and microRNA-223 are platelet-derived microRNAs, but whether these microRNAs can be modulated by antiplatelet drugs still remains unknown.

Research Question or Hypothesis: To investigate the influence of $P2Y_{12}$ receptor antagonists on platelet-derived microRNAs and whether these microRNAs can predict postoperative bleeding in off-pump coronary artery bypass grafting (OPCABG) patients.

Study Design: A prospective observational study enrolling 59 coronary artery disease (CAD) patients who were prepared to undergo OPCABG from January 2018 to December 2018 in Zhongshan Hospital, Fudan University.

Methods: All patients received dual antiplatelet therapy with aspirin (ASA) and a $P2Y_{12}$ antagonist prior to admission. Thirty-two patients took clopidogrel and 27 took ticagrelor. $P2Y_{12}$ receptor antagonists were discontinued for >5 days before OPCABG following our center's routine protocol. Platelet functions were tested and plasma miRNA-126 and miRNA-223 levels were measured before discontinuing $P2Y_{12}$ receptor antagonists. Postoperative bleeding defined as chest tube drainage (CTD) volume and blood products transfusion were recorded. Higher values of bleeding were defined as CTD volumes within 12 hours postoperatively of more than 500 mL.

Results: Compared with clopidogrel, ticagrelor decreased platelet aggregation (P = 0.002) and increased plasma miRNA-223 (P = 0.029) but not miRNA-126. The incidence of higher bleeding (27.3% vs 6.7%, P = 0.058) and postoperative blood products transfusion (36.4% vs 12.9%, P = 0.055) in ticagrelor group tended to be higher than those in clopidogrel group although the differences were not significant. Multivariate analyses indicated that levels of circulating miR-223 (OR = 1.463, P = 0.018) and BMI (OR = 0.609, P = 0.014) were independent predictors of postoperative transfusion and levels of circulating miR-223(OR = 1.700, P = 0.012) was an independent predictor of higher values of bleeding.

Conclusion: Ticagrelor had stronger platelet inhibition effect and enhanced plasma miRNA-223 levels in CAD patients compared with clopidogrel, leading to an increased bleeding tendency after OPCABG. And circulating miR-223 was an independent predictor of postoperative bleeding and blood products transfusion.

44 | Evaluation of sacubitril/valsartan initiation in an acute care setting

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Introduction: Sacubitril/valsartan (SAC/VAL) has shown to improve outcomes in patients with heart failure with reduced ejection fraction (HFrEF) compared to angiotensin-converting enzyme inhibitors (ACE-I) and angiotensin receptor blockers (ARB) when initiated in an outpatient setting. Studies evaluating SAC/VAL initiation in an acute care setting vary in their targeted outcomes.

Research Question or Hypothesis: What are efficacy and safety outcomes of SAC/VAL initiation in an acute care setting compared to ACE-I/ARB?

Study Design: Multi-center, retrospective, comparative, cohort study.

Methods: Patients with HFrEF were included if SAC/VAL was initiated during admission or if an ACE-I/ARB was initiated or continued. Patients were excluded if they were taking SAC/VAL prior to admission. Primary endpoints compared 30-day readmissions and length of stay (LOS) between groups. Secondary endpoints compared renal function, hyperkalemia, and episodes of hypotension.

Results: 104 patients were included in the study (SAC/VAL n = 52; ACE-I/ARB n = 52). HF exacerbation was the primary admission diagnosis in 42.3% of the SAC/VAL group and 90.4% of the ACE-I/ARB group (P < 0.0001), and myocardial infarction was the primary admission diagnosis in 21.1% and 3.8% (P = 0.02). Other baseline characteristics were similar between both groups. The 30-day readmission rate was 25.5% (n = 12) and 15.4% (n = 8) in SAC/VAL and ACE-I/ARB arm, respectively (P = 0.21). The median LOS was 5.1 days and 4.5 days, respectively (P = 0.55). Hypotension was greater in the SAC/VAL arm compared to the ACE-I/ARB arm (P = 0.01), leading to discontinuation of SAC/VAL in 11.5% (n = 6) of patients. Other secondary endpoints did not differ.

Conclusion: Initiation of SAC/VAL did not result in a statistically significant difference in 30-day readmissions compared to ACE-I/ARB. Hypotension rates were greater in the SAC/VAL arm; however, LOS did not statistically differ between the groups. This study defined the pattern of SAC/VAL initiation in acute care setting, highlighting its use in HFrEF.

45 | Clinical outcomes after switching between P2Y12 inhibitors post-acute coronary syndrome or percutaneous coronary intervention

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Introduction: Dual antiplatelet therapy with aspirin and a P2Y12 inhibitor is the mainstay of treatment following an acute coronary syndrome (ACS) or percutaneous coronary intervention (PCI). Despite the 2017 expert consensus statement on switching between P2Y12 inhibitors, there is limited clinical evidence available, and widespread adoption is unknown. This may present a safety concern as inappropriate dosing can lead to bleeding or thrombotic events.

Research Question or Hypothesis: To determine if switching between P2Y12 inhibitors during or after hospitalization is associated with an increased hospital readmission rate.

Study Design: Retrospective cohort

Methods: A sample of patients who received ticagrelor and a left heart catheterization during November 1, 2017 to April 30, 2019 was reviewed. Inclusion criteria was receipt of a ticagrelor 180 mg loading dose for ACS and/or PCI. Patients were excluded if they required a mechanical circulatory support device or died before discharge. Patients were grouped based on continuation of ticagrelor or switching to a different P2Y12 inhibitor. The primary outcome was 30-day readmission, including all-cause, or due to an ischemic event, bleed, or stent thrombosis. A secondary outcome was adherence to the consensus recommendations. Chi-squared tests were utilized to compare outcomes between groups.

Results: Of the 350 patients included, 99 (28.3%) were switched from ticagrelor and 251 (71.7%) remained on therapy. Thirty-day all-cause readmission occurred in 30 (30.3%) vs. 36 (14.3%) patients for the two groups, respectively (P = 0.0006). Readmission occurred due to ischemic (6.1% vs. 2.0%; P = 0.049) and bleeding (2.0% vs. 2.4%; P = 0.835) events for the two groups, respectively, while only a single case of stent thrombosis was detected during the time frame. Less

than 10% of the patients switched were done so according to the consensus document.

Conclusion: Patients switched from ticagrelor had a higher rate of 30-day readmission (both all-cause and ischemic), suggesting a greater risk for adverse events, possibly due to inappropriate switching between agents.

46 | Specialty review improves heart failure care among co-managed and primary care managed patients at VA Portland Health Care System

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Introduction: Heart failure (HF) patients are managed by primary care providers alone or co-managed with cardiology specialists. Veterans Health Administration is a fully integrated healthcare system and has established connection between primary and specialty care. Optimal communication among primary care and specialty providers is essential for successful implementation of guideline-directed medical therapy (GDMT).

Research Question or Hypothesis: To identify opportunities to improve coordination of HF care between primary and specialty care providers by leveraging telehealth technology.

Study Design: Retrospective, cross-sectional study

Methods: HF patients from the panels of 16 primary care physicians (PCP) were identified by ICD-10 codes. Patients with ejection fraction less than 40% were included for a detailed review. Patient vitals, laboratory values, medications, comorbidity, devices, and medical history data were reviewed by a pharmacist, physician assistant and cardiologist to identify opportunities to optimize GDMT. Specific medication, laboratory, and/or device recommendations were sent to PCPs via a brief note in the electronic medical record. Categorical data were analyzed using the Fisher's exact test.

Results: A total of 156 patients met the inclusion criteria, 143 patients have been reviewed. Opportunities for improvement in care were identified in 76 patients, and 128 recommendations were made. Most recommendations centered on changes in HF medication therapy (n = 36), followed by updated procedures and labs (n = 20), and cardiology consults (n = 15). The proportion of patients who received recommendations were similar among co-managed patients (50%, 95% CI 0.40-0.60) and PCP managed patients (59%, 95% CI 0.45-0.72) (P = 0.3822). So far 101/128 (79%) recommendations have been accepted.

Conclusion: A high acceptance rate of recommendations suggests that cardiology specialty review may be an effective strategy for optimizing management of HF patients.

47 | Direct oral anticoagulants compared to warfarin after Watchman device implantation

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Introduction: Patients with non-valvular atrial fibrillation (NVAF) are at an increased risk of stroke and often require anticoagulation; however, not all are good candidates. The Watchman™ device is a treatment alternative for patients with NVAF and contraindications to long-term anticoagulation. Warfarin is used post-procedure to allow for device endothelialization and is currently the only approved anticoagulant after implantation; however, its drug interactions, narrow therapeutic index, and INR monitoring can make treatment challenging. As a result, direct oral anticoagulants (DOACs) may be a convenient alternative, though clinical data is limited.

Research Question or Hypothesis: What is the efficacy and safety of DOACs compared to warfarin in patients with NVAF after Watchman™ device implantation?

Study Design: IRB-exempt, single center, retrospective chart review

Methods: Data was analyzed for patients receiving the Watchman™ device from January 2016 through July 2018. Eligibility included a diagnosis of NVAF and Watchman™ device implantation. The primary composite efficacy endpoint was stroke, systemic embolism, or cardiovascular (CV) or unexplained death within 6 months of device implantation. The primary safety endpoint was major bleeding within 6 months of device implantation.

Results: 83 patients were analyzed for baseline characteristics, primary efficacy endpoint, and safety endpoints. There were 4 events within the data collection timeframe (4.8%), all within the warfarin arm; however, there was no statistical difference compared to DOACs (P = 0.57). Major bleeding occurred in 13.2% of patients, with no statistical difference found between warfarin and DOACs (15.4% vs. 5.6%, P = 0.44).

Conclusion: This was the first study to evaluate DOACs versus warfarin after Watchman™ device implantation. Though no differences were found, this study was limited by the small sample size and retrospective design. A prospective study with a larger population is warranted to determine if there is both a statistical and clinically significant difference among anticoagulants in this patient population.

48 | Evaluating use of direct oral anticoagulants in patients with cardiac thrombus

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Introduction: The use of direct oral anticoagulants (DOACs) in patients with an intracardiac thrombus is not recommended as first line treatment in national guidelines and has not been extensively studied. This study evaluated the safety and efficacy of DOACs compared to warfarin in patients with intracardiac thrombus.

Research Question or Hypothesis: DOACs are as safe and effective compared to warfarin in patients with an intracardiac thrombus.

Study Design: This was an Institutional Review Board approved retrospective study that was conducted at an academic medical center. Chart review was performed on patients between the ages of 18 and 89 years who had a cardiac thrombus diagnosed by an echocardiogram and discharged on an oral anticoagulant.

Methods: Data collected using the hospital's electronic medical record was used to evaluate the efficacy of DOACs for thrombus resolution. The safety of DOACs compared to warfarin was assessed by evaluating minor and major bleeding. Nominal data was evaluated using Chi-squared test and continuous data was analyzed using the Student's *t* test.

Results: A total of 168 patients met inclusion criteria, 50 in the DOAC group and 118 in the warfarin group. The efficacy outcome occurred in 69% of DOAC patients, as compared to 82% of warfarin patients who were readmitted within 12 months ($P = 0.16$). Rates of bleeding were similar in the two groups. Major bleeding occurred in 14% of DOAC patients, as compared with 11% of warfarin patients ($P = 0.64$), while minor bleeding occurred 5% of DOAC patients, as compared to 3% of warfarin patients ($P = 0.59$).

Conclusion: DOACs were noninferior to warfarin for the treatment of cardiac thrombus and were not associated with more bleeding.

49 | Implementation of a thromboelastography (TEG) based blood and factor product algorithm in cardiac surgery

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Introduction: Cardiac surgery accounts for 10 to 20% of blood transfusions in the United States. Viscoelastic hemostatic assays, such as thromboelastography (TEG), have been used to develop hemostatic algorithms for trauma patients, which have demonstrated decreases in mortality, blood utilization and overall costs. As such, TEG could potentially impact coagulation management and transfusion practices in the cardiac surgery population.

Research Question or Hypothesis: Does TEG use during cardiac surgery cases reduce blood and factor-based product utilization, need for surgical re-exploration, and mortality?

Study Design: Single-center before-after study of blood product and factor usage in patients undergoing cardiac surgery procedures pre- and post-implementation of a TEG-guided blood and factor replacement algorithm. Pre-implementation blood product and factor usage was generated from the Society of Thoracic Surgeons Adult Database. This report identified all cardiac cases between September 2016 and August 2018 at our institution. Patients were included if they were 18 years or older undergoing a cardiac case during the designated study time frame.

Methods: A TEG-algorithm was developed using existing literature in cardiac surgery cases and tailored to institutional and provider practices. Roll-out was completed in two phases to systematically introduce the routine use of TEG in all surgical cases and then use of the algorithm. It was ultimately up to the surgeon/anesthesiologist to follow the algorithm based on clinical judgement.

Results: A total of 104 patients underwent surgery following TEG algorithm implementation. There was statistically significant decrease in blood product units during the study period (Pre: RBC 3.3, FFP 3.0, PLT 2.3, CRYO 2.6, Post: RBC 1.4, FFP 1.3, PLT 2.1, CRYO 1.2, $P < 0.05$). There were no differences in factor use, surgical re-exploration, or in-hospital mortality.

Conclusion: A TEG-guided algorithm resulted in a statistically significant reduction of peri-operative blood product use in cardiac surgery cases. Routine utilization of TEG offers the opportunity to reduce unnecessary blood product use without compromising patient safety.

50 | Evaluating discharge diuretic regimens and all-cause thirty-day readmission rates in heart failure exacerbation

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Introduction: Clinical guidelines offer limited guidance on discharge diuretic management in patients hospitalized for heart failure (HF) exacerbation. Additionally, all-cause thirty-day readmission rates post-HF admission can impact hospital reimbursement by the Centers for Medicare and Medicaid Services.

Research Question or Hypothesis: An escalation of prior to admission (PTA) diuretic regimen decreases all-cause thirty-day readmission rates in patients with HF exacerbation.

Study Design: Retrospective cohort.

Methods: Patients eighteen years or older with a primary diagnosis of HF exacerbation receiving a PTA loop diuretic were included. The primary outcome was to compare all-cause thirty-day readmission rates between patients with no escalation versus an escalation in PTA diuretic regimen on discharge. Key secondary outcomes included readmission rates by discharge disposition, HF readmission rates and comparison of a change in diuretic agent, increase in dose of the same diuretic, and percentage change in diuretic dose for patients readmitted versus not readmitted within thirty days of discharge.

Results: A total of 296 patients with an average age of 69.6 ± 13.2 years were included (no escalation, n = 147; escalation, n = 149). Of those included, 29.7% (n = 88) had reduced ejection fraction. The median PTA versus discharge furosemide equivalent was 40 mg vs. 40 mg ($P = 0.289$) in the no escalation group and 40 mg vs. 80 mg ($P = <0.001$) in the escalation group. No difference in all-cause thirty-day readmission rates was found between the no escalation versus escalation groups (20.4% vs. 18.7%; $P = 0.726$). Readmissions due to HF were also similar between groups (7.5% vs. 7.4%; $P = 0.974$). Patients discharged to a facility were more likely to be readmitted than patients discharged home (34.5% vs. 16.2%; $P = 0.002$). Change in diuretic agent, increased dose of the same diuretic, and percentage change in diuretic dose at discharge had no effect on readmission rates.

Conclusion: In patients hospitalized for HF exacerbation, an escalated diuretic regimen upon discharge did not result in a reduction of all-cause thirty-day readmission rates.

51 | Low LDL-C levels and statin intensities for secondary prevention after an ASCVD event

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Introduction: The 2018 American College of Cardiology/American Heart Association cholesterol guidelines recommends the use of high-intensity statins among all patients with an atherosclerotic cardiovascular disease (ASCVD) event regardless of their LDL-C as a secondary prevention.
Research Question or Hypothesis: With limited data in patients with low LDL-C, we aimed to evaluate the use of different statin intensities in patients with low LDL-C and established ASCVD.
Study Design: This is a retrospective cohort of patients seen at Loma Linda University Medical Center between March 2013 and March 2018. Inclusion criteria: adults ≥18 year of age, previous ASCVD event, and LDL-C < 100 mg/dL. Exclusion criteria: pregnancy, prisoners, and patients >89 years of age.
Methods: Collected data include primary outcomes: all-cause mortality at one-year, and secondary outcomes: hospitalization at one-year, myopathy, and rhabdomyolysis. For statistical analysis: mean, standard deviation, and ANOVA were used for continuous data, and numbers, percentages and X^2 test were used for categorical data.
Results: Of 54 patients, 29 (54%) were male with a mean age of 67 years (+/- 14.5). The mean baseline LDL-C was 65.8 mg/dL (+/- 18.4). High, moderate, and low intensity statins were utilized in 9 (16.7%), 27 (50 %), and 18 (33.3 %) respectively. Patients who received high, moderate, and low intensity statins had a one-year mortality rate of 0.0%, 13%, and 3.7% respectively (P = 0.019). Hospitalization for a secondary ASCVD event at one-year occurred in 5.6%, 27.8%, and 7.4% among the high, moderate, and low intensity statin groups, respectively (P = 0.033). Also, there is no difference seen on myopathy and rhabdomyolysis.
Conclusion: High intensity statins are associated with the lowest rate of mortality and hospitalization at one-year compared to moderate and low intensities without increasing safety risks. Thus, high intensity statins are recommended even in patients with low LDL-C for a secondary prevention from an ASCVD event.

52 | Influence of sodium-containing antibiotics for bacterial infections on morbidity in patients with heart failure

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Introduction: Infection can exacerbate heart failure (HF). Many antibiotics used to treat infections contain sodium, which could potentially worsen HF. Although sodium restriction is beneficial in HF, there is limited data assessing the influence of sodium-containing antibiotics on the morbidity of hospitalized patients with HF.
Research Question or Hypothesis: To determine whether sodium-containing antibiotics influence the morbidity of HF patients who are hospitalized with bacterial infections, compared to HF patients receiving non-sodium-containing antibiotics.
Study Design: Single-center, retrospective cohort of HF patients from a level 1 trauma center treated for a bacterial infection.
Methods: Adult patients admitted to the coronary care unit receiving ≥48 hours of antibiotics were included. Patients were identified via ICD-9 codes for HF and bacterial infections. The primary endpoint was difference in length of stay (LOS) between patients receiving sodium-containing antibiotics, compared to patients receiving non-sodium-containing antibiotics. Secondary endpoints included comparison of diuretic dosing, development of acute decompensated HF, and time to transition from intravenous to oral diuretics. Descriptive and inferential statistics were used for each comparison. LOS was analyzed using a two-way ANOVA. Statistical analyses were performed with SAS v9.4 with the *a priori* alpha set at 0.05.
Results: Mean (SD) LOS was 8.2 (5.9) days in the sodium-containing antibiotic group (n = 97) compared to 7.5 (5.0) days in the non-sodium-containing antibiotic group (n = 99), (P = 0.302). In patients who received a sodium-containing antibiotic, frequency of diuretic use (P = 0.005) and frequency of diuretic dose escalation (P = 0.015) were each higher in the sodium-containing antibiotic group.
Conclusion: No difference in LOS was found in hospitalized patients with HF receiving sodium-containing antibiotics, compared to patients receiving non-sodium-containing antibiotics. Patients who received sodium-containing antibiotics were associated with significantly more frequent diuretic use, as well as more frequent requirement of diuretic dose escalation.

53 | Potentially harmful medication use among medication therapy management patients with congestive heart failure

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Introduction: Identifying inappropriate medication use among patients with congestive heart failure (CHF) may reduce unnecessary health care costs.

Research Question or Hypothesis: What characteristics are associated with inappropriate medication use among patients with CHF?

Study Design: Retrospective cross-sectional analysis of an MTM provider database for calender year 2018.

Methods: Medicare-eligible patients with CHF were included. Prescription claims were assessed for harmful medications based on evidence from randomized and nonrandomized studies. Relationships between characteristics and medication use were evaluated via: chi-square; Mann Whitney U, and logistic regression.

Results: Analysis included 14062 patients. Patients were predominately female (58%), between the ages of 65 and 84 (67%), and used a median of 12 (Interquartile Range (IQR) 9-15) medications daily. The majority (53%) of patients used inappropriate medications; the most common classes identified were nonsteroidal anti-inflammatory drugs (25%), dipeptidyl peptidase-4 inhibitors (23%), and non-dihydropyridine calcium channel blockers (7%). Each additional medication increased the odds of harmful use by 6% ($P < 0.001$). Adults over 85 versus those less than 65 years were 0.82 times less likely to have inappropriate medication use ($P < 0.001$). Females were 1.23 times more likely to have inappropriate medication use than males ($P < 0.001$). Individuals residing in areas (based on zip codes) where more than 30% of residents lived below the poverty line were 1.45 times more likely to have harmful medication use than those living in areas with less than 10% of individuals below the poverty line ($P < 0.001$). Patients eligible for MTM for 4 years versus those qualified for only 1 year were 1.60 times more likely to incur harmful medication use ($P < 0.001$).

Conclusion: More than half of chronic heart failure patients utilized inappropriate medications. Female gender, younger age, poverty, polypharmacy, and length of MTM eligibility were associated with harmful medication use. Targeted efforts are warranted to mitigate use of these potentially harmful medications.

54 | Utilization and predictors of renin-angiotensin-aldosterone antagonists and beta blockers after transcatheter aortic valve replacement for severe aortic stenosis

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Introduction: Neurohormonal antagonists, renin-angiotensin-aldosterone system (RAAS) antagonists or beta-blockers, promote cardiac reverse remodeling. The role for neurohormonal antagonists post-TAVR is unclear due to an absence of prospective evidence documenting clinical benefit. RAAS antagonists have been associated with reduced mortality and heart failure hospitalizations after transcatheter aortic valve replacement for severe aortic stenosis (AS). This study compared neurohormonal antagonist use pre- and post-TAVR and assessed predictors of neurohormonal antagonist use after TAVR.

Research Question or Hypothesis: Neurohormonal antagonist use will decrease after TAVR.

Study Design: Single-center, retrospective chart review.

Methods: Patients ≥18 years who received TAVR for severe AS from January 2016 to August 2018 were included in the study. Exclusion criteria included: endocarditis, pregnancy, death prior to discharge, and TAVR for aortic insufficiency or regurgitation. Data was retrieved from the Society of Thoracic Surgeons and American College of Cardiology Transcatheter Valve Therapy registry forms and electronic medical records. The primary endpoint was a comparison of neurohormonal antagonist use pre- and post-TAVR. The secondary endpoint assessed the effect of neurohormonal antagonist on 30-day mortality or re-hospitalizations. Predictors of neurohormonal antagonist use post-TAVR were evaluated by logistic regression. Nominal data was analyzed with the Chi-square test. Continuous data was analyzed with the Mann Whitney U test. Bonferroni correction adjusted for inflation of predictors in the logistic regression analysis.

Results: 66 patients were included in the analysis. Use of neurohormonal antagonists (78.8% vs 60.6%; $P = 0.008$) and ACE-i/ARBs alone (40.9% vs 19.7%; $P = 0.001$) significantly decreased post-TAVR. 30-day mortality or rehospitalization was not significantly different between groups. Comorbidities and post-procedure acute kidney injury were not predictive of neurohormonal antagonist use after TAVR.

Conclusion: Neurohormonal antagonist use declined post-TAVR. 30-day post-TAVR clinical outcomes were unaffected by neurohormonal antagonist use. Clinical characteristics did not predict medication use after TAVR.

55 | Statin therapy provides direct vascular benefits in type 2 diabetes via reduction of MCP-1

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Introduction: Atorvastatin and simvastatin are among the top five prescribed drugs in the US. Although highly effective at lowering risks of CVD events, statins have been associated with an increase in the risk of developing Type 2 Diabetes (T2D). However, statins remain recommended for CVD risk reduction in patients with diabetes. The positive vascular effects of statins and their diabetogenic potential must be evaluated to optimize their usefulness. Therefore, we investigated the vascular effects of statins on normal and diabetic heart cells.

Research Question or Hypothesis: We hypothesize that atorvastatin and simvastatin retain anti-inflammatory effects in the presence of hyperglycemia (i.e. lowers MCP-1 levels).

Study Design: Cell culture.

Methods: Human Microvascular Endothelial Cells of Cardiac Origin (HMVECC) and Human Coronary Artery Endothelial Cells (HCAEC), (Lonza; Walkersville Inc, Walkersville, MD, USA) were seeded at an approximate density of $2.5x10^4$cells/cm^2. Cell treatment groups included: atorvastatin (ATV 10 mM), simvastatin (SMV 1 mM), glucose (200 mg/dL), ATV + GLU, and SMV + GLU. N = 3. MCP-1 protein production and mRNA expression were measured via ELISA and RT-PCR respectively. ANOVA with Sidak's multiple comparison's test was used to analyze data, *P*-value<0.05.

Results: The anti-inflammatory effects of ATV 10uM and SMV 1uM were suggested by significant reductions of MCP-1 production in both endothelial cell models (60% with ATV and over 20% with SMV, $P < 0.05$). These modulatory effects remained observable even in the presence of 200 mg/dL glucose levels. The mRNA expression results corroborated the protein production data with statins significantly ($P < 0.05$) reducing MCP-1 mRNA expression.

Conclusion: In our vascular models, MCP-1 gene expression and protein levels are significantly reduced by ATV and SMV in the presence of 200 mg/dL of glucose. These results support the clinical observation that statins still provide CVD risk reduction in individuals with T2D, despite the diabetogenic potential of statins. Our study suggests that anti-inflammatory properties of statins may provide direct vascular benefits to T2D patients.

Clinical Administration

56 | PCSK9 inhibitor prescribing in Massachusetts: Evaluation of utilization

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Introduction: Proprotein convertase subtilisin/kexin type 9 inhibitors (PCSK9i) are a novel class of medications proven to effectively lower LDL when lifestyle modifications and statins are insufficient. However, PCSK9i cost ~$14,000/yr, causing insurance companies to place them on high tiers, and prescription rates are low.

Research Question or Hypothesis: Are patients able to obtain PCSK9i when an FDA approved indication is identified?

Study Design: Prospective formulary review and web-based provider survey.

Methods: PCSK9i accessibility/utility assessed via insurance company formulary data and web-based survey of specialist providers. Insurance company data obtained included: prescription formulary and tiers, policies/criteria for approval, additional prerequisites for medication acquisition. A 20 question web-based survey was sent to lipid-specialists to determine their experience with PCSK9i prescribing.

Results: All PCSK9i agents at the five largest insurers in Massachusetts required a prior-authorization (PA). Criteria for PA approval in all plans were stricter than current FDA clinical indications. Survey results (n = 15) of 13 MD, 1 NP, and 1 PA revealed >90% (n = 10) experienced issues with prescribing PCSK9i, including PA process (n = 9), insurance claim rejection (n = 7), specialty pharmacy (n = 3), high co-payment (n = 6), and formulary tier restriction (n = 2). Half of respondents stated that 50% or less of their PCSK9i prescriptions were able to be filled by patients. Respondents stated that private insurance companies were more likely to approve PCSK9i prescriptions. Identified patient barriers included: cost of medication (n = 10), subcutaneous injection (n = 3), adverse effects (n = 2), and patient adherence (n = 1).

Conclusion: Insurance PA approval criteria for PCSK9i were more stringent than FDA indications and differed amongst payers. The rate of patients prescribed PCSK9i and received them was <50%, even if prescribed for FDA-approved indications. Reported patient barriers highlighted complex approval process and high cost. Most prescribers indicated that recent reduction in price of PCSK9i and the 2018 AHA/ACC guidelines will impact future prescribing patterns, which may lead to increased prescriptions and improved patient health.

57 | Timeliness of WIR immunization data entry by Wisconsin pharmacies

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Introduction: Community pharmacies immunize a large number of individuals but often experience issues interfacing with state immunization information systems (IIS). These noted IIS interface issues prompted an examination of Wisconsin pharmacy timeliness in Wisconsin Immunization Registry (WIR) data entry.

Research Question or Hypothesis: Are pharmacies entering immunization data into the WIR in a timely fashion and what factors are associated with timeliness?

Study Design: This retrospective records study collected data for immunizations administered by pharmacies in Wisconsin between 2012 and 2017 collected from WIR.

Methods: The variables of submission method, year of immunization administration, immunization type, and recipient age were analyzed through multivariate logistic regression to determine if they had any significant relationship to pharmacy timeliness. An immunization was

considered timely if it was entered into the WIR within 7 days of immunization administration.

Results: The timeliness of 2,040,248 immunizations, including 1,691,795 influenza immunizations, were included. Influenza immunizations are significantly less likely to be timely than non-influenza immunizations (OR 0.766, 95% CI 0.759-0.773). Immunizations administered to individuals >18 years old are less timely than immunizations administered to individuals ≤18 years of age (OR 0.982, 95% CI 0.966-0.998). Flat file submission is less likely to be timely than manual entry of immunization data (OR 0.496, 95% CI 0.490-0.502). HL7 submission, however, is much more likely to be timely than manual entry (OR 1.995, 95% CI 1.978-2.012). With each successive year, starting from 2012 through 2017, immunizations were entered in a less timely manner (OR 0.981, 95% CI 0.979-0.983).

Conclusion: From this study we learned that pharmacy timeliness of WIR data entry was associated with entry method, age of the immunized individual, immunization type, and year of vaccine administration. With these findings and upcoming pharmacy survey data, we hope to identify ways to help pharmacies improve entry of immunization data into the WIR.

58 | Validation and verification of clinical applicability of therapeutic drug monitoring with levetiracetam using dried blood spot in children

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Introduction: Levetiracetam (LEV) is the second-generation anticonvulsant, which is widely used in clinical practice due to its high safety and indications for various types of seizures. Therapeutic drug monitoring (TDM) of LEV is especially needed in children with epilepsy since serum concentrations of drug and clinical outcomes are related. Dried blood spot (DBS) method requires only a very small amount of blood as it uses DBS paper for TDM or analyzing drug concentration.

Research Question or Hypothesis: The LEV in the plasma and DBS have a linear correlation that is mutually convertible.

Study Design: A clinical validation of DBS method of LEV in healthy volunteers. **Methods**: LEV using fluconazole as the internal standard (IS) was analyzed by LC-MS/MS. The DBS samples were stored at room temperature and -20°C for 0, 3, 7, 14 days and analyzed. The relevance of LEV in plasma and DBS, coefficient of determinations (r^2) were examined using linear regression.

Results: Validation of accuracy and linearity at 0.5-64 μg/mL met criteria of FDA Bioanalytical Method Validation Guidance for Industry. Valid linearity was observed between LEV in plasma and DBS (r^2 = 0.9968). The accuracy of 98.3% (± 7.79%) for plasma and 101.6% (± 6.90%) for DBS were obtained. DBS samples maintained high linearity (r^2 > 0.99) and accuracies (100% ± 15%) for 14 days, regardless of whether they were stored at room temperature or -20°C.

Conclusion: The LEV in plasma can be quantified through the concentration of LEV in DBS, which has higher stability than plasma, using validated LC-MS/MS method and equation in practice.

59 | Gender distribution among recipients of the Harvey A.K. Whitney award and John W. Webb lecture award

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Introduction: The Harvey A.K. Whitney Award and John W. Webb Lecture Award are among the most prestigious awards for pharmacists involved in healthcare administration. Although pharmacy is primarily a female driven profession, it is currently unknown if a gender gap exists within pharmacy leadership positions and leadership award recognition.

Research Question or Hypothesis: The purpose of this study was to quantify if a gender gap exists among the recipients of the Whitney Award or Webb Lecture Award.

Study Design: Retrospective

Methods: The list of award recipients were obtained from the internet via www.harveywhitney.org and www.ashp.org. The gender of the award recipients was categorized based on objective or subjective criteria. Gender was defined objectively when gender-specific pronouns were used to describe the recipient in their award lecture or profile on the award's corresponding internet page, their institution's website, American Society of Health-System Pharmacist webpage, or LinkedIn. Subjective criteria was used to identify recipients in absence of objective criteria from the above sites, and included names typically associated with one gender or appearance. Any *P* values <0.05 were considered significant and determined through Fisher's Exact Test.

Results: There were significantly fewer women recipients of the Whitney [14 (20.3%) vs 55 (79.7%), *P* < 0.001] and Webb Lecture [6 (25%) vs 28 (75%), *P* < 0.001] awards. With both awards, the time to first woman recipient was 5 years. With the Whitney Award, there have only been 3 back-to-back female recipients and the longest stretch of time between female recipients was 12 years. There have been no back-to-back female recipients of the Webb Lecture Award, and twice there have been 7 year gaps between female recipients.

Conclusion: Significantly more men have been recipients of the Harvey A.K. Whitney and John W. Webb Lecture Awards. Pharmacy organizations should do more to support the development and recognition of the women leaders in our profession.

60 | Women in New England Hospital Pharmacy leadership positions

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Introduction: Gender gaps have been identified within healthcare leadership positions. Gender gaps within pharmacy have only been assessed within academia. In 2016, the American Society of Health-System Pharmacists (ASHP) created a steering committee on women in leadership which suggests there may be gender imbalances within our profession.

Research Question or Hypothesis: The purpose of this study was to quantify if a gender gap exists within post-graduate year 1 (PGY1) pharmacy residency program directors (RPD) and/or director of pharmacy (DOP) at PGY1 hospital practice sites in the New England region.

Study Design: Retrospective

Methods: On September 1, 2018, the ASHP online residency program directory was assessed to obtain the PGY1 RPD and DOP for hospitals in the New England region. The gender of the RPD and DOP was categorized based on objective or subjective criteria. Gender was defined objectively when gender-specific pronouns were used to in the individual's profile at their institution's website, ASHP webpage, or LinkedIn. Subjective criteria was used to identify recipients in absence of objective criteria from the above sites, and included names typically associated with one gender or appearance. Any *P* values <0.05 were considered significant and determined through Fisher's Exact Test.

Results: A total of 50 hospitals were included and the majority of the PGY1 hospital sites were in Massachusetts (n = 22). There were significantly more female than male RPDs [33 (66%) vs 17 (34%), *P* = 0.033]. There were no difference in gender among DOPs [20 (40%) vs 30 (60%), *P* = 0.202]. Significantly fewer institutions had women in both DOP and RPD positions [12 (24%) vs 38 (76%), *P* = 0.001].

Conclusion: In New England hospitals, significantly more women than men hold PGY1 RPD positions and no significant gender differences were observed among DOPs. ASHP should formally track gender of RPD and DOP in order to best identify if a gender gap exists within pharmacy leadership positions.

Community Pharmacy Practice

61 | Assessment of an intensive education program on the treatment of tobacco-use disorder for pharmacists using OSCE (objective structured clinical examination)

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Introduction: Tobacco use is considered a public health threat in Qatar. Evidence has proven that pharmacists have a pivotal role in health promotion including tobacco cessation. However, pharmacists in Qatar are not actively involved in tobacco control.

Research Question or Hypothesis: Is an intensive education program on tobacco-use treatment effective on Qatar's community pharmacists' knowledge, skills, attitudes and self-efficacy toward tobacco cessation?

Study Design: Prospective randomized controlled trial

Methods: This study compares an intensive tobacco-related education program versus non-tobacco-related training for randomly selected community pharmacists in Qatar. Consenting participants were randomly allocated to intervention or control groups. Pharmacists' tobacco-related knowledge and skills were assessed using a survey and Objective Structured Clinical Examination (OSCE) respectively. Six-station OSCE was completed by participants in both groups. OSCE case scenarios targeted smoking in adults, pregnant women and adolescents, relapse prevention, smoking in cardiac patients, and pre-contemplating smokers. Each participant was allocated 10 minutes for each case to interact with a standardized patient. Performance of participants was assessed using validated assessment checklists.

Results: A total of 54 and 32 participants in intervention and control group respectively completed the OSCE. Overall, pharmacists in intervention group performed better in analytical and global assessment sections than those in control group. For example, for case 1, mean scores for developing rapport, data gathering and management were 2.76 vs 0.97 (*P* < 0.001), 5 vs 2.81 (*P* < 0.001) and 3.5 vs 2.25 (*P* = 0.001) respectively, while for case 2, mean scores were 2.65 vs 0.75 (*P* < 0.001), 6.18 vs 2.47 (*P* < 0.001) and 2.15 vs 0.44 (*P* < 0.001) respectively for the intervention group compared to the control group. Mean total analytical scores were 12.06 vs 6.4 (*P* < 0.001) and

11.81 vs 3.78 ($P < 0.001$) for cases 1 and 2 respectively for intervention compared to the control group. Furthermore, mean global assessment scores were 3.19 vs 2.41 ($P = 0.009$) and 3.56 vs 2.42 ($P < 0.001$) for cases 1 and 2 respectively for intervention compared to the control group.

Conclusion: The findings of this study suggest that this program results in improved pharmacists' skills toward tobacco cessation interventions.

62 | Evaluation of naloxone access and pricing in community and outpatient pharmacies across Tennessee

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Introduction: Tennessee has the third-highest rate of opioid prescribing rate (94.4 per 100 persons) in the U.S. The opioid overdose death rate per 100,000 in Tennessee, 19.3, is well above the national rate of 14.9. Given the widespread use of opioids in this state and increasing mortality rate due to opioid overdose, access to naloxone is critical. However, barriers to naloxone access enumerated in the literature are concerning, and previously published studies have not explored naloxone access issues in Tennessee.

Research Question or Hypothesis: Objectives were to (1) identify percentage of pharmacies that stock naloxone in the state's most populous counties and those counties with the highest rates of opioid prescriptions; (2) examine pricing of naloxone; and (3) identify barriers to naloxone dispensing.

Study Design: Cross-sectional survey

Methods: A telephone survey was conducted with all community and outpatient pharmacies in select counties in the Western, Middle and Eastern divisions of Tennessee. The most populous county in each division, as well as the five counties with highest opioid prescription rate, were selected. The survey included questions concerning availability of naloxone products, price of products, and barriers to naloxone distribution. Data analysis included descriptive statistics.

Results: In the Western division, response rate was 61.8% (110 of 178 eligible pharmacies). The majority of these pharmacies (70.4%) participate in the state's opioid-related statewide protocol. Narcan is available at 93.6% of pharmacies, with mean cash price of $131.67 (SD = $25.50). The most commonly reported barriers to naloxone access are cost (reported by 69.1% of pharmacies), issues with prior authorization (52.7%), and lack of insurance coverage (48.2%). Results for the Eastern and Middle divisions of Tennessee will also be presented.

Conclusion: Although naloxone, is widely available, issues pertaining to cost act as barriers to access. Future studies should develop and evaluate strategies to reduce barriers to naloxone access.

63 | Pharmacist-provided direct patient care services in Idaho: Current practices, capacity, and barriers

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Introduction: Pharmacists are one of the most accessible but underutilized healthcare providers in the community. They are medication experts and have limited authority to independently prescribe in Idaho (Rules 27.01.04). Through the provision of direct patient care services, pharmacists have an expanding opportunity to impact chronic disease prevention and management across the state. However, current practices surrounding pharmacist-provided direct patient care services are unknown.

Research Question or Hypothesis: What are current practices, capacity, and barriers to pharmacist-provided direct patient care services for Idaho community and ambulatory care pharmacists?

Study Design: Cross-sectional survey

Methods: The survey was developed by Idaho State University College of Pharmacy faculty members in partnership with the Idaho Department of Health and Welfare and reviewed by five external practicing pharmacists. The 20-minute survey included 63 questions, although not all participants answered every question due to survey logic. A link to the final web-based survey (Qualtrics, Provo, UT) was emailed to all Idaho-based pharmacists registered with the Board of Pharmacy (n = 1,595) on April 25, 2019. Two additional email reminders were sent to eligible participants before survey promotion ended on May 24, 2019. Survey responses were exported from Qualtrics and analyzed using descriptive statistics.

Results: The survey was completed by 243 community and ambulatory care Idaho pharmacists with 90% (n = 219) reporting that their work sites currently offer direct patient care services. Medication therapy management and patient medication self-management services were the most common services provided. Pharmacists most often prescribed naloxone (n = 106), devices for patients with diabetes (n = 78), and medications for cold sores (n = 67). The top three barriers to offering direct patient care services were dispensing load, point-of-care devices, and patient interest.

Conclusion: Idaho community and ambulatory care pharmacists currently offer direct patient care services to patients across the state, but face barriers in providing and increasing services offered.

Critical Care

64 | Oseltamivir (Tamiflu) is associated with bradycardia in critically ill patients

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Introduction: Oseltamivir is the primary therapy for influenza. Experimental studies indicate that it may block cardiac sodium channels and recent case reports associate it with bradycardia.

Research Question or Hypothesis: Is oseltamivir associated with bradycardia in critically ill patients with presumed influenza.

Study Design: Retrospective cohort study.

Methods: Chart audit of 70 critically ill adults with presumed influenza receiving at least 2 doses of oseltamivir. The primary outcome assessed was the occurrence of bradycardia, defined as a heart rate ≤ 59 beats per minute (bpm) or a decrease of 20 bpm (compared to the lowest heart rate obtained within 12 hours of the first dose of oseltamivir). Hemodynamic variables were collected every six hours. Univariate and multivariate analyses compared those with vs. without bradycardia.

Results: Twenty-seven (38.6%) patients developed bradycardia; 14 had a heart rate ≤ 59 bpm, seven had a decrease in heart rate greater than 20 bpm, and six had both criteria. Time to bradycardia from the first dose was 40.2 ± 25.3 hours. No significant differences were found between those with vs. without bradycardia in terms of patient parameters, baseline hemodynamic variables, hospital characteristics, laboratory values, oseltamivir dosage characteristics, or other medications. The number of patients positive for influenza was greater in the bradycardia group (77.8% vs. 51.2%, $P = 0.027$). Doses of oseltamivir were 30 mg (n = 10), 75 mg (n = 55), or 150 mg (n = 5). Other hemodynamic variables, cardiac rhythm, and clinical outcomes (length of stay, mortality) were similar between groups.

Conclusion: Bradycardia in critically ill patients receiving oseltamivir occurred frequently but risk factors for bradycardia could not be delineated since groups were similar. Further investigations are needed to confirm these results and identify potential risk factors and causes of bradycardia in critically ill patients receiving oseltamivir. The use of oseltamivir in this patient population warrants close monitoring of heart rate.

65 | Impact of oral clonidine on duration of opioid and benzodiazepine use in mechanically ventilated children: A randomized, double-blind, placebo-controlled study

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Introduction: Extensive use of opioids and benzodiazepines as sedative agents are associated with important untoward effects in pediatric ICU (PICU). Clonidine is increasingly being used in pediatrics with established sedative effects. Our goal was to study clonidine addition to total doses of fentanyl and midazolam and duration of ventilation in pediatric ICU (PICU).

Research Question or Hypothesis: Clonidine addition can decrease total dose of opioids and benzodiazepines.

Study Design: This randomized, double-blind, and placebo-controlled trial was conducted in PICU of Mofid Children Hospital, Tehran, Iran. Hundred children aged from 2 to 15 years were randomized in 1:1 ratio to receive 5 μg/kg oral clonidine every 6 hours or placebo plus 1-5 μg/kg/hr IV fentanyl and 0.05- 0.1 mg/kg/hr IV midazolam.

Methods: Daily use of fentanyl and midazolam were measured. Ramsay sedation score was used for evaluation of sedation. X^2 test was used to study differences between groups and we used repeated measures ANOVA for changes within the groups. Level of 0.05 was statistically significant. The study was registered at Iranian Registry of Clinical Trials (IRCT20170920036296N1).

Results: A total of 96 patients were studied. Patients in placebo group received more midazolam and fentanyl compared with patients in intervention group. Mean total dose of midazolam was 4.3 ± 2.2 mg in the placebo group and 2.7 ± 2.9 mg in the intervention group ($P < 0.05$). Mean total dose of fentanyl was 34.4 ± 23.1 μg in the placebo group and 18.9 ± 10 μg in the intervention group ($P < 0.01$). No significant differences were observed in duration of ventilation and length of ICU stay. No case of severe adverse events was seen.

Conclusion: This trial showed a reduction in total doses of midazolam and fentanyl given in ventilated children who were administered clonidine as add-on therapy. Clonidine addition had no effect on duration of mechanical ventilation.

66 | National survey of therapeutic diuresis practices within the intensive care unit

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Introduction: Data have highlighted an association between mortality and 72-hour fluid balance in the critically ill. However, there are limited data on diuresis administration to correct positive volume status (de-resuscitation) within the intensive care unit (ICU), potentially resulting in varied de-resuscitation practices. A better understanding of these practices is essential for future implementation of standardized de-resuscitation protocols.

Research Question or Hypothesis: What is the role of pharmacist and their perception regarding diuresis practices in the ICU?

Study Design: Multicenter, cross-sectional, web-based survey over a two-month period

Methods: Investigators developed a 25-item survey distributed to clinical pharmacists in the American College of Clinical Pharmacy Critical Care Practice and Research Network. The survey was designed to assess pharmacists' approach to diuresis initiation, follow-up, and modification, as well as perceptions regarding safety and efficacy of diuresis in the ICU. Survey responses were reported in descriptive statistics and Pearson's Correlation was used to evaluate test-retest reliability.

Results: A total of 2291 surveys were distributed, with a 4.1% response rate. Test-retest reliability was demonstrated (correlation coefficient, 0.854; $P < 0.001$). Two-thirds of the cohort did not have a standardized approach to diuresis initiation and 62.5% stated pharmacists were not typically or never involved. Signs of edema (82%) and difficult mechanical ventilation wean (93%) were the most frequent initiation indications. Over 44% of the cohort stated the majority of patients achieved a net-negative fluid balance after 72 hours post-shock resolution. Several potential barriers to diuresis were identified, namely lack of awareness of fluid overload harm and appropriate follow-up.

Conclusion: A standardized approach to de-resuscitation in the critically ill is rare and pharmacist involvement is limited. Development of a de-resuscitation protocol, with assistance from clinical pharmacists, could assist in standardization of practices across ICU settings and improve patient care.

67 | The impact of body habitus on resuscitation practices and clinical outcomes in critically ill adults with sepsis and shock

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Introduction: A minimum 30 mL/kg of initial crystalloid resuscitation within the first 3 hours is recommended in sepsis. Due to safety concerns of large volume resuscitation, it is possible that overweight or obese patients are less likely to get the recommended treatment, and the impact on outcomes is unknown.

Research Question or Hypothesis: Overweight and obese patients with sepsis are less likely to receive the guideline recommended 30 mL/kg of initial fluid resuscitation than under or normal weight patients based on total body weight (TBW).

Study Design: Single center, retrospective cohort study.

Methods: Adult patients admitted with severe sepsis or shock to an intensive care unit (ICU) between October 2015 and December 2017 were eligible for inclusion. The cohort was dichotomized based on body mass index (BMI) into under/normal weight (UNW), defined as BMI under 30 kg/m^2, or overweight/obese (OO) with BMI at least 30 kg/m^2. The primary outcome was the percentage of patients that received at least 30 mL/kg based on TBW within 3 hours. Secondary outcomes included vasopressor use, incidence of fluid overload, and all cause in-hospital mortality.

Results: Eighty-five patients were analyzed, with 51 (60%) in the OO group and 34 (40%) in the UNW group. The OO group had a higher severity of illness, ejection fraction, and history of hypertension at baseline. Incidence of receiving at least 30 mL/kg at 3 hours was similar between the OO and UNW groups, 12% and 18% ($P = 0.45$), respectively. Fluid overload was less frequent in the OO group, 27% vs. 44%, though not significant ($P = 0.11$). OO patients were more likely to receive at least two vasopressors, 63% versus 41%, ($P = 0.05$). Being UNW was an independent predictor of mortality after controlling for severity of illness (OR: 3.81; 95% CI 1.31-11.10).

Conclusion: OO patients had similar likelihood of receiving the recommended 30 mL/kg initial crystalloid resuscitation as UNW patients.

68 | Hemodynamic effects of propofol during targeted temperature management after cardiac arrest

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Introduction: Published protocols from hypothermia trials allow midazolam or propofol to be used for sedation based on the patient's hemodynamic profile. The suggestion that propofol worsens hemodynamic instability in the setting of targeted temperature management (TTM) has not been established.

Research Question or Hypothesis: Does propofol cause a significant change in hemodynamic profile during TTM?

Study Design: Single-center, retrospective cohort study

Methods: Adults who received propofol by infusion for at least 30 minutes during TTM were evaluated. The primary outcome was the change in cardiovascular Sequential Organ Failure Assessment (cvSOFA) score 30 minutes after propofol initiation. Secondary outcomes included change in systolic blood pressure (SBP), mean arterial pressure (MAP), heart rate (HR), and vasopressor requirements (VR) as norepinephrine equivalents at 30-, 60-, 120-, 180-, and 240 minutes after propofol initiation. A multivariable linear regression was performed to assess the influence of propofol and body temperature on MAP, while controlling for vasopressor dose and cardiac arrest hospital prognosis (CAHP) score.

Results: The cohort included 40 patients with a median CAHP score of 197. The goal temperature was 33 degrees for all patients. There was no significant change in cvSOFA score 30 minutes after propofol initiation (P = 0.96). SBP and MAP reductions were the greatest at 60 minutes (17 mmHg and 8 mmHg; P < 0.05 for both). The median HR at 120 minutes was reduced by 9 beats/minute from baseline. This reduction was sustained through 240 minutes (P < 0.05). No change in VR were seen at any time point. In multivariate regression, body temperature was the only characteristic independently associated with changes in MAP (coefficient 4.95, 95% CI 1.6-8.3).

Conclusion: Administration of propofol during TTM did not affect cvSOFA score. The reductions in SBP, MAP, and HR did not have a corresponding change in VR and are likely not clinically meaningful.

69 | Impact of body habitus on the development of fluid overload in critically ill patients

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Introduction: Use of intravenous fluids for maintenance and resuscitation in the intensive care unit (ICU) can contribute to fluid overload (FO), which is associated with poor clinical outcomes. Currently, no standardized approach exists to dosing fluids in resuscitation, and little information on associated weight-related outcomes is available.

Research Question or Hypothesis: Does body habitus influence the risk of fluid overload?

Study Design: A multi-center, retrospective cohort study was conducted between January 2017 and April 2018.

Methods: Adults admitted to an ICU for ≥72 hours were included. The cohort was divided into two groups based on obesity, defined as BMI ≥30 kg/m2. The primary outcome was the incidence of FO, defined as a positive fluid balance at 72 hours producing weight gain >10%. Secondary outcomes included daily fluid intake per kilogram body weight and mortality. Discrete and continuous data were analyzed with the Î§^{2} and Mann Whitney U tests, respectively. Binary logistic regression was applied to the primary outcome.

Results: One hundred forty-nine patients were included: 52 obese and 97 non-obese. Groups were similar at baseline, except for weight (obese 107 vs 68 kg, P = <0.001). Incidence of FO was similar between obese and non-obese patients (17% vs 19%, P = 0.850). Fluid intake on days 1-3 was also similar (6770 vs 7053 mL, P = 0.796). Fluid intake per kilogram total body weight was lower in obese patients (64 vs 103 mL/kg, P < 0.001), but was similar when based on ideal or adjusted body weights. Mortality was similar between groups (12% vs 18%, P = 0.323). In binary logistic regression controlling for demographic variables, severity of illness, and fluid intake, BMI was not associated with fluid overload.

Conclusion: The study was limited by small sample size, retrospective design, and imperfect definition of FO. Although obese patients received less weight-based fluid, the incidence of FO was similar between groups.

70 | Utility of NephroCheck® in Predicting Acute Kidney Injury (AKI) among sepsis patients with vancomycin and beta-lactam exposure

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Introduction: Urine concentrations of TIMP-2*IGFBP7 (NephroCheck®) are novel biomarkers used to predict and identify the presence of AKI. While its use in populations such as post-cardiac surgery or patients pending intravenous contrast exposure has been reported, its role in predicting and mitigating AKI in patients with antibiotic exposure is less clear. Nephrotoxic antibiotic exposure may contribute to AKI in septic populations; therefore, NephroCheck® may be valuable in predicting clinical AKI.

Research Question or Hypothesis: We hypothesize that elevated NephroCheck® values in septic patients receiving vancomycin and beta-lactam antibiotics will predict clinical AKI.

Study Design: This quality improvement, retrospective chart review identified septic patients with NephroCheck® values and vancomycin plus beta-lactam exposure.

Methods: Patients with elevated NephroCheck® values were compared with patients with negative values in regards to the incidence of clinical AKI. Specificity, sensitivity, positive predictive value (PPV), and negative predictive value (NPV) were then applied to these results.

Results: Fifty-one patients met inclusion criteria; 24 patients with an elevated value and 27 patients with a value ≤0.3. In patients with positive NephroCheck®,18/24 (75%) developed AKI versus 13/27 (48%) in the negative group (P = 0.05). NephroCheck® values provided a sensitivity and specificity of 58% and 70% respectively. The elevated baseline NephroCheck® values were associated with a significant increase in the incidence of AKI with a PPV of 75%, but the NPV was only 52%. Overall, only 9/31 (29%) of patients with clinical AKI had elevated vancomycin trough concentrations. The elevated NephroCheck® cohort had a numerically higher incidence of patients with septic shock, but there were no other significant differences between the cohorts, including vancomycin and piperacillin/tazobactam combinations or antibiotic duration.

Conclusion: Baseline NephroCheck® values after sepsis diagnosis and antibiotic exposure are strongly predictive of an AKI. With a low false positive rate and good PPV, elevated NephroCheck® values should prompt pharmacy interventions to minimize nephrotoxic drug exposure.

71 | Clinical pharmacist-led impact on inappropriate albumin utilization and associated costs in the critically ill

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Introduction: Albumin utilization has increased over recent years with substantial financial consequences among adult hospitalized patients. Inappropriate albumin utilization rates have exceeded 50%. Unfortunately, no published reports have described clinical pharmacist interventions strategies in the intensive care unit (ICU) aimed at reducing albumin inappropriate use.

Research Question or Hypothesis: The purpose of this study was to evaluate the clinical and economic impact of a novel clinical pharmacist-led intervention program on albumin utilization in adult ICUs.

Study Design: Retrospective, cohort study

Methods: Patients were identified through the hospital electronic medical record database who received albumin over a 2-year period. All patients ≥18 years administered albumin during their admission hospital stay were considered for inclusion. Institutional guidelines were developed with clinical pharmacists targeting appropriate albumin use in their daily responsibilities. The primary endpoint was to compare inappropriate utilization of albumin administered in the ICU before and after pharmacist intervention implementation. Secondary analyses compared the overall albumin use in the ICU and all hospitalized patients between study periods. In-hospital mortality, length of stay, and albumin-related costs between study periods were also compared.

Results: A total of 4419 patients consisting of 2448 (55.4%) critically ill were included. The pharmacist-led strategy resulted in a 50.9% absolute reduction of inappropriate albumin (grams) utilization in the ICU (P < 0.001). The rate of inappropriate use of albumin in the ICU was 44.3 ± 10.5 and 5.5 ± 2.9 grams per ICU patient-day in the pre- and post-implementation periods, respectively (P < 0.001). Interventions resulted in a reduction of 38.6% and 40.6% in the total and inappropriate amount of albumin administered in all hospitalized patients (P < 0.001). Total annual cost-savings was $355,393 in the ICU and $776,848 for the entire hospital. No differences in clinical outcomes were found.

Conclusion: Pharmacists reduced overall and inappropriate albumin use in the ICU as well all hospitalized patients without negatively impacting clinical outcomes.

72 | A survey of prothrombin complex concentrates management amongst critical care pharmacists in the United States

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Introduction: Prothrombin complex concentrates (PCCs) are indicated for urgent reversal of anticoagulation from vitamin K antagonists. Despite expense and the risk of thromboembolic adverse events, prothrombin complex concentrates (PCCs) are used off-label.

Research Question or Hypothesis: To elucidate practices and perceptions of using PCCs across the US.

Study Design: Survey.

Methods: A validated 26-question survey was e-mailed twice to 1170 US-based pharmacists at institutions identified as having an ICU. Questions addressed hospital and pharmacy characteristics, use of PCCs, and perceptions of effectiveness and safety.

Results: 429 (37.9%) of 1133 eligible institutions completed the questionnaire. Median hospital census was 280 (IQR, 168-423). PCCs were used several times per month to several times per week (64.6%). While 66.4% of respondents indicated an order set was routinely or

always used to direct PCCs usage, many medical disciplines may order PCCs. Four-factor PCCs were preferred by 93.1% of institutions. The most common perceived indications were hemorrhage related to warfarin (92.1%) or oral Xa inhibitors (81.8%), intracranial hemorrhage (78.4%), trauma hemorrhage (66.2%), surgical hemorrhage (61.1%), and refractory hemorrhage (57.3%). The most common perceived contraindications were heparin-induced thrombocytopenia (42%), disseminated intravascular coagulopathy (39.2%), and thromboembolism (38.9%). Most institutions consider patient weight (78.9%), indication (77.6%), and INR (76.9%) when dosing PCCs. 25.2% of institutions base the dose on a set number of vials. Compared to standard blood products / procoagulants, respondents believed PCCs acted more rapidly, were less likely to cause volume issues, and were more expensive. Respondents were neutral as to whether PCCs acted longer or were more effective at preventing or treating hemorrhage.

Conclusion: While off-label use of PCCs is common, practices vary considerably. This may relate to differing perceptions surrounding indications, contraindications, and comparisons to standard blood products / procoagulants. Additional studies are needed to better define the nonproprietary indications and safety profiles of PCCs.

73 | A comparison of insulin doses for the treatment of hyperkalemia in patients with renal insufficiency in the intensive care unit

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Introduction: Acute treatment of hyperkalemia with intravenous (IV) insulin shifts potassium intracellularly, however, may result in hypoglycemia. We aimed to compare rates of hypoglycemia between two insulin doses, 5 units and 10 units, for acute treatment of hyperkalemia in the intensive care unit (ICU).

Research Question or Hypothesis: A decreased dose of insulin (5 units) for acute treatment of hyperkalemia in patients with renal insufficiency in the ICU is associated with decreased hypoglycemia compared to a 10 unit dose.

Study Design: Retrospective cohort study at a large academic medical center.

Methods: Adult patients with chronic kidney disease stages III-V, end stage renal disease, and/or acute kidney injury who received IV insulin in the ICU for the treatment of hyperkalemia from March 2008 to September 2018 were assessed for inclusion. The primary outcome was rate of hypoglycemia (blood glucose <70 mg/dL) within 6 hours after insulin administration. Secondary outcomes included change in serum potassium and rate of severe hypoglycemia (blood glucose <40 mg/dL) within 6 hours after insulin administration. Nominal data were analyzed using $\chi 2$ or Fisher's exact when appropriate, and continuous data were analyzed using Student t test. Nonparametric data were analyzed using the Mann-Whitney U test. An a priori *P*-value <0.05 was selected as the threshold for statistical significance.

Results: There were 174 patients included. The primary outcome, rate of hypoglycemia within 6 hours after insulin administration, occurred in 8 of 87 patients (9.2%) in the 5 unit group and 17 of 87 patients (19.5%) in the 10 unit group ($P = 0.052$). There was no difference between groups in rates of severe hypoglycemia or change in serum potassium.

Conclusion: In the acute treatment of hyperkalemia in the ICU, 5 units versus 10 units of IV insulin resulted in similar rates of hypoglycemia and similar potassium lowering effects.

74 | Influence of left ventricular ejection fraction on early resuscitation in critically ill adults with sepsis and shock

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Introduction: Aggressive fluid resuscitation in patients with reduced left ventricular ejection fraction (R-LVEF), who are at heightened risk of fluid overload, may negatively impact patient outcomes. It is unknown if patients with R-LVEF are resuscitated differently and its impact on clinical outcomes.

Research Question or Hypothesis: We hypothesize that patients with R-LVEF receive less crystalloid resuscitation when diagnosed with sepsis or shock.

Study Design: Single-center, retrospective study

Methods: Patients admitted to an intensive care unit (ICU) for sepsis or shock were evaluated. They were divided into two groups for comparison based on the presence of reduced or preserved left ventricular ejection fraction, R-LVEF and P-LVEF, respectively. R-LVEF was defined as an LVEF ≤40%. The primary outcome was the volume of crystalloid received (mL/kg) per total body weight at three hours. Secondary outcomes included incidence of receiving at least 30 ml/kg at 3 hours, duration of vasopressors, ICU mortality, and development of fluid overload. Discrete and continuous data were analyzed using Î§[2]and Mann Whitney U tests, respectively.

Results: Sixty patients were included with 46 (77%) in P-LVEF and 14 (23%) in R-LVEF. Patients were similar at baseline and median LVEF was 60% in P-LVEF and 30% in R-LVEF. Both groups received similar volume of crystalloid at hour 3, 14.7 vs 13.6 mL/kg ($P = 0.541$). Less patients in the R-LVEF group received at least 30 mL/kg at 3 hours (7.1% vs. 15.2%) but this was not statistically significant ($P = 0.667$). No differences were seen between groups in duration of vasopressors

(P = 0.628) or development of fluid overload (P = 1.0). ICU death was 33% in the P-LVEF group compared to 14% in R-LVEF, but after adjusting for severity of illness this was not statistically significant.

Conclusion: Patients with R-LVEF receive similar volume of crystalloid for early resuscitation in sepsis and shock. Aggressive resuscitation was uncommon in both groups, so the safety of this practice remains unclear.

75 | Hidden fluids in plain sight: Identifying intravenous medication classes contributing to intensive care unit fluid status

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Introduction: Hidden fluids including intravenous (IV) medications, flushes, and blood products contribute to fluid intake in the intensive care unit (ICU). The specific IV medications contributing to fluid intake are unknown.

Research Question or Hypothesis: Which IV medication classes contribute the most to total fluid intake?

Study Design: Multicenter, retrospective cohort study.

Methods: Patients admitted to an ICU between January 2017 and December 2018 were included. Total fluid and specific IV medication administration data were collected over the first 3 ICU days. The primary outcome was to identify the medications contributing the greatest total volume. The secondary outcomes were to characterize the frequency of IV medication use and to determine total fluid intake. Descriptive statistics were calculated for all variables.

Results: Two-hundred ten patients were included. The cohort had a mean age of 62 years and was 54% male. The IV medication classes that contributed the largest volume were sodium bicarbonate (537 ± 462 mL/day), antibiotics (377 ± 269 mL/day), vitamins minerals and electrolytes (VME) (237 ± 378 mL/day), antiarrhythmics (218 ± 116 mL/day), and anticoagulants (211 ± 253 mL/day). The medication classes that patients received the most frequently were antibiotics (n = 158, 75% per day), medications for pain, agitation, and delirium (PAD) (n = 118, 56% per day), VME (n = 74, 35% per day) and vasoactive agents (n = 70, 33% per day). Daily cumulative intake up to day 3 was 2378 ± 2060 mL, 2468 ± 1769 mL, and 2191 ± 1598 mL, respectively, with hidden fluids comprising 51%, 60%, and 68% of total intake on each day.

Conclusion: Sodium bicarbonate, antibiotics, and VME contributed the largest volumes of total intake in the first 3 ICU days, while antibiotics, PAD, vasoactive medications, and VME were the most frequently administered. Future research should examine strategies to decrease hidden fluid intake, such as antimicrobial stewardship and conversion to enteral administration.

76 | Impact of sugammadex on extubation in adult cardiac surgery patients

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Introduction: The Society of Thoracic Surgeons (STS) database includes postoperative prolonged intubation as a quality metric for adult cardiac surgery patients. Sugammadex results in rapid reversal of neuromuscular blockade due to rocuronium, a paralytic commonly used during cardiac surgery. While sugammadex has demonstrated decreased time to reversal of neuromuscular blockade and reduced postoperative respiratory adverse effects, question remains whether sugammadex will reduce ventilation time in cardiac surgery patients.

Research Question or Hypothesis: Sugammadex reduces time to extubation in post-cardiac surgery patients.

Study Design: Retrospective, observational cohort study

Methods: This 19-month retrospective observational study was conducted at a non-profit community hospital and included 116 adult patients who underwent coronary artery bypass grafting (CABG), valve replacement surgery, or combined CABG plus valve surgery, who received either sugammadex or standard neuromuscular blocker reversal agents such as neostigmine. Primary outcome was time to extubation. Secondary outcomes included time to first continuous positive airway pressure (CPAP) trial and ICU and hospital length of stay. Descriptive statistical analysis was performed and Mann Whitney test was utilized to analyze categorical data.

Results: Use of sugammadex (n = 26) as a rapid neuromuscular blocker reversal agent compared to standard reversal agents (n = 90) did not reduce median time to extubation (240 minutes vs 260 minutes; P = 0.37). There was no significant difference in time to first CPAP trial (P = 0.47), ICU discharge (P = 0.81), or hospital discharge (P = 0.56).

Conclusion: In this small, retrospective analysis, sugammadex did not decrease time to extubation in cardiac surgery patients.

77 | Hyperglycemia risk evaluation of hydrocortisone intermittent boluses versus continuous infusion in septic shock patients

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Introduction: Hydrocortisone showed to be effective in reducing the time till reversal of shock when added to standard therapy in managing of septic shock. Hyperglycemia is a common adverse effects associated with corticosteroids which may be associated with increase mortality in critically ill patients. However, the difference in hyperglycemia risk with different methods of hydrocortisone administration is not clear.

Research Question or Hypothesis: To evaluate whether hydrocortisone given as intermittent boluses increase the risk of hyperglycemia when compared to continuous infusion in septic shock.

Study Design: Retrospective observational study.

Methods: We included all patients admitted to the medical or surgical intensive care units with septic shock received noradrenaline and hydrocortisone. Patients exceeded 200 mg/day of hydrocortisone were excluded. The primary outcome was the mean blood glucose. Linear mixed regression model was used to calculate the mean difference of blood glucose readings between the two groups. The analysis for the primary outcome was adjusted for history of diabetes, median baseline glucose level, and chronic steroid use. All statistical analyses were performed using IBM SPSS, version 22.

Results: A total of 108 patients (with 3021 blood glucose readings) were included in the final analysis. 76 patients received hydrocortisone as intermittent boluses (70.3%) and 32 patient (29.7%) received continuous infusion. For the primary outcome; no difference was found in blood glucose estimated marginal mean, 8.58 mmol/l [95% confidence interval (CI);8.01 to 9.16] in the bolus group and 8.9 mmol/l [95% CI;7.99 to 9.82] in the infusion group with mean difference of 0.32 mmol/l [95% CI;-0.77 to 1.41]. For secondary outcomes; no difference was found between the two groups in mortality, length of stay, reversal of shock or hypoglycemic events.

Conclusion: Administration of hydrocortisone by intermittent boluses was not associated with a higher risk of hyperglycemia when compared to continuous infusion in septic shock patients.

78 | Evaluation of acute kidney injury risk with piperacillin/tazobactam in critically ill patients

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Introduction: Acute kidney injury (AKI) is associated with an increased mortality among critically ill patients. Piperacillin-tazobactam, when combined with vancomycin, is associated with higher risk of AKI compared to other beta-lactams.

Research Question or Hypothesis: To evaluate whether piperacillin-tazobactam, without vancomycin, is associated with higher incidence of AKI compared to other beta-lactams (cefepime or meropenem) among critically ill patients

Study Design: Retrospective observational study

Methods: We included adult patients admitted to medical or surgical intensive care units who received at least one dose of the study drugs. Patients were excluded if they had baseline creatinine clearance (CrCl) below 30 mL/min, were on dialysis, received vancomycin or were shifted from one study drug to another. The primary outcome was composite renal safety outcome (at least 50% increase in serum creatinine or need for renal replacement therapy). Multiple logistic regression with adjustment for pre-specified potential confounders (age, CrCl, hypertension, diabetes, heart failure, liver cirrhosis, vasopressor therapy, duration of therapy and nephrotoxic medications) and baseline imbalances ($P < 0.1$) was used for the outcome analysis. Statistical analyses were conducted using IBM SPSS version 22. Two-sided P-value <0.05 was considered significant for the primary analysis.

Results: Total of 669 patients were included in the analysis; 507 patients in piperacillin-tazobactam group and 162 patients in the control group. Average age was 51.7 years and median Acute Physiology and Chronic Health Evaluation (APACHE-II) score was 10. The composite renal safety endpoint occurred in 85/507(16.8%) of piperacillin-tazobactam group vs. 25/162(15.4%) of the control group (odds ratio [OR], 1.1; 95% confidence interval [CI], 0.68-1.79). The result was not significant after adjustment for potential confounders and baseline imbalances (adjusted OR, 1.46; 95%CI, 0.82-2.61). Mortality was not different between the two groups (OR, 1.03; 95%CI, 0.60-1.78).

Conclusion: Piperacillin-tazobactam was not associated with a higher risk of AKI compared to cefepime or meropenem. Larger studies are required to confirm these findings.

79 | Incidence and predictors of hypokalemia in critically ill patients receiving intravenous insulin infusion

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Introduction: Hypokalemia is a potential complication of intravenous (IV) insulin therapy. Current guidelines suggest insulin therapy be delayed when serum potassium (K) concentrations are <3.3 milliequivalents per liter (mEq/L) although occurrence and outcomes in critically ill populations remain unclear.

Research Question or Hypothesis: To determine the incidence and predictors of hypokalemia in critically ill patients receiving intravenous insulin infusion.

Study Design: This was a single-center retrospective observational study of hospitalized patients who received continuous intravenous insulin for hyperglycemia in the setting of critical illness or diabetic ketoacidosis (DKA) from April 1, 2018 to April 1, 2019.

Methods: Patients were evaluated for the presence of hypokalemia defined as any serum K < 3.3 mEq/L during insulin infusion. The primary outcome of this study was the incidence of hypokalemia during insulin infusion. Secondary outcomes include all-cause in-hospital mortality, intensive care unit (ICU) length of stay, and hospital length of stay comparisons for hypokalemic versus non-hypokalemic patients.

Results: Of the 166 patients included in this study, hypokalemia was identified in 28.9% of patients (48/166). Among hypokalemic patients, 47.9% received no potassium repletion prior to discovery of serum K < 3.3 mEq/L. In comparison, patients who received hospital repletion recommendations per protocol were less likely to become hypokalemic (60.4% protocol adherence in hypokalemic patients [29/48] versus 80.5% protocol adherence in non-hypokalemic patients [95/118]; $P = 0.007$). No statistically significant differences were found between hypokalemic and non-hypokalemic cohorts for all-cause in-hospital mortality (8.3% versus 16.9%; $P = 0.152$). Statistically significant differences were observed in median ICU length of stay (2.5 days versus 2 days; $P = 0.001$) and median hospital length of stay (8.2 days versus 4.8 days; $P = 0.036$).

Conclusion: Hypokalemia is common during intravenous insulin infusion and is associated with longer ICU and hospital lengths of stay. Our results suggest hypokalemia may be prevented with the use of standardized potassium repletion protocols prior to insulin initiation.

80 | Pharmacogenomics (PGx) pilot study of sedation and analgesia in the ICU

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Introduction: PGx may be important in the ICU since many medications used for analgesia/sedation are metabolized by CYP enzymes and/or have target receptors which carry genetic variants.

Research Question or Hypothesis: We hypothesize that genetic variants are common in ICU patients and they receive medications which are impacted by variants that may adversely impact outcomes.

Study Design: This is a prospective, observational, IRB approved pilot study of adult critically ill participant's receiving mechanical ventilation (MV) with a Richmond Agitation Sedation Score (RASS) target between -2 and 0 and expected ICU stay of ≥48 hours.

Methods: DNA was genotyped using a comprehensive PGx panel. The endpoint was the number of altered PGx phenotypes in CYP2B6, CYP3A4 & 5, and OPRM1 genes in patients with RASS at target in <50% of measurements (RASS<50%). Descriptive statistics are presented.

Results: Forty-three participants were enrolled, mean age of 61 +/-12 years and 88.4% Caucasian. Forty-one received propofol, a CYP2B6 substrate; 38 fentanyl, a CYP3A4 substrate and a target of OPRM1; 14 midazolam, a CYP3A4 & 5 substrate; and 1 ketamine a CYP2B6 substrate. In all patients the median time at RASS target was 26.7%. Median time on MV was 47 hours. Zero, 1, 2 and 3 altered phenotypes were present in 23, 14, 5 and 1 individuals, respectively. Individuals with 0 altered phenotypes had a median (IQR)% RASS time in target of 23.5% (28.9), 1 altered phenotype 41.5% (32.9), 2 altered phenotypes 16.7%(55.3) and 3 altered phenotypes had 0% time in target. Median length of stay in ICU (LOS_{ICU}) was 4.4 days and 21% died.

Conclusion: The frequency of altered phenotypes was high and time at RASS target low. Individuals with 2 or 3 altered phenotypes had lower time at RASS target. We will enroll additional patients, genotype for CYP2A6 for dexmedetomidine, and assess the genetic association with time on MV, LOS_{ICU}, ADRs and death.

81 | Efficacy and safety of continuous intravenous lidocaine as adjunctive analgesia in thermal injury patients

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Introduction: Pain experienced by burn victims leads to negative outcomes including depression, poor wound recovery, and chronic pain. Lidocaine offers a non-opiate option as part of a multi-modal approach to pain management. The effectiveness and safety of lidocaine infusion for pain in the burn population remains unknown.

Research Question or Hypothesis: Lidocaine decreases relative opioid requirements in burn patients with limited adverse effects.

Study Design: Retrospective, single center cohort

Methods: Patients admitted to the burn intensive care unit between January and November 2018 who received a lidocaine infusion for at least 12 hours were included. The primary effectiveness outcome was the difference in median morphine milligram equivalents (MME) divided in 24-hour increments before, during, and after the lidocaine infusion. We evaluated pain scores, lidocaine concentrations, and documented adverse drug events (ADE).

Results: A total of 27 patients, 56% male, median age 35, TBSA burn 8%, and pain score of 6/10 were included. The median lidocaine duration was 4 days (IQR:2-5) with an average dose of 0.76 ± 0.3 mg/kg/hr. The MME 24-hours before and during the first 24-hours of lidocaine infusion was similar (108.1 vs 105 mg/day; P = 0.8). Additionally, there was no difference in MME during the last 24-hours of lidocaine infusion compared to the 24-hours after lidocaine was discontinued (107.5 vs 98.1 mg/day; P = 0.09). Pain scores were reduced to 5/10 during lidocaine infusion (P = 0.06). ADEs occurred in 52% (n = 14) with 30% requiring adjustment to lidocaine dose. The average serum level was 3.43 ± 1.37 mcg/mL. Median serum levels in patients who experienced an ADE was not different from those without an ADE [3.44 (IQR:2.53-4.21) vs 3.38 (IQR:1.94-4.01), respectively P = 0.39].

Conclusion: In burn patients with uncontrolled pain, lidocaine infusions reduced pain scores without need for escalating opiate dosages. Overall, lidocaine's impact on pain was modest and did not significantly reduce baseline opiate consumption. ADEs associated with lidocaine infusion were frequent and not correlated with lidocaine concentrations.

82 | Measurement of MMP3 activity in liquid biopsies as a diagnostic marker for Acute Lung Injury in mechanically ventilated patients

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Introduction: Acute respiratory distress syndrome (ARDS) is a fatal lung disease associated with a high mortality rate, in part secondary to delayed diagnosis. A reliable biomarker for the early detection of ARDS may reduce patient mortality. Stromelysin-1 (MMP3) is a matrix metalloproteinase capable of degrading the extracellular matrix components thus contributing to lung edema and has been shown to be elevated in the bronchial alveolar lavage fluid (BALF) samples from mice with acute lung injury (ALI). ALI is often viewed as the first indicator for developing ARDS and thus its identification may help mitigate and identify early ARDS development.

Research Question or Hypothesis: Can elevated MMP3 activity within BALF act as a diagnostic marker for ALI in mechanically ventilated patients?

Study Design: Single Center, Retrospective Cohort Study.

Methods: In this retrospective study, MMP3 activity was measured using a fluorescent resonance energy transfer (FRET) assay. De-identified BALF samples were collected and stored at -80C. Demographic characteristics and patient outcomes were collected retrospectively from the electronic medical record. The results were analyzed using GraphPad Prism 2.0 software.

Results: A total 13 patients were included (7 patients with ALI and 6 patients without ALI). Patients with ALI were slightly younger (57 ± 13 years vs 66 ± 9 years). All patients were mechanically ventilated >24 hours. MMP3 expression was upregulated in BALF samples among patients with ALI (2583 ± 1256) vs. no ALI (131 ± 138) (P < 0.0001).

Conclusion: MMP3 activity measured from BALF may serve as an early screening biomarker for ALI, and future prospective studies are warranted.

83 | Impact of anti-impulse therapy on malperfusion events in the treatment of type B aortic dissection

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Introduction: Current guidelines for the management of acute aortic dissection (AAD) target heart rate (HR) <60 beats per minute (bpm) and systolic blood pressure (SBP) between 100-120 mmHg. Malperfusion related events have been identified in patients treated with anti-impulse therapy (AIT), possibly due to these aggressive therapeutic goals.

Research Question or Hypothesis: Is achieving recommended HR control with AIT associated with malperfusion events?

Study Design: Single-center, retrospective, cohort study

Methods: Patients ≥18 years old admitted for AAD between 01/01/2013 and 06/30/2018 were included. Baseline demographics, history of aortic repair, use of chronic anti-hypertensive medications, and admission HR and SBP were collected. Patients were assigned "achieved" goal HR if the average HR over the first three days of admission was <66 bpm. Primary efficacy outcome was need for emergent repair and safety outcomes included severe hypotension (MAP <60 mmHg) or clinical malperfusion including stroke, myocardial infarction, limb ischemia or end-organ dysfunction. Secondary outcomes included intensive care unit (ICU) and hospital length of stay (LOS), and time to achieve goal HR.

Results: Eleven of 43 patients achieved goal HR and groups were similar at baseline. For "achieved" patients, it took <24 hours from admission to meet goal HR, but no differences were seen with regard to emergent repair, hypotension, or malperfusion. A trend toward increased incidence of AKI was seen in the more aggressive treatment

group (72.7% vs 40.6%; P = 0.088). One patient who did not achieve goal HR exhibited limb ischemia. Patients who required emergent repair were more likely to have hepatic dysfunction (36.4% vs 9.4%; P = 0.058) and had a longer hospital LOS (14 [14-22] vs 7 [7-13]; P = 0.004).

Conclusion: Aggressively lowering HR to <66 bpm may be associated with an increased risk for AKI in patients with AAD without decreasing the need for emergent repair compared to a less aggressive achievement. This study also underscores the importance of frequent end-organ function monitoring in this patient population.

84 | Evaluation of intrathecal nicardipine in aneurysmal subarachnoid hemorrhage

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Introduction: Neurological impairment is common in survivors of aneurysmal subarachnoid hemorrhage (aSAH). Large cerebral artery vasospasm may contribute to the development of delayed cerebral ischemia (DCI) and neurological deficits. Patients at high-risk for or those with refractory vasospasm may receive intrathecal (IT) nicardipine despite limited data demonstrating a clear benefit.

Research Question or Hypothesis: Among patients with aSAH, is IT nicardipine associated with a reduction in vasospasm compared with usual care?

Study Design: This was a retrospective, cohort study conducted at a large academic medical and comprehensive stroke center.

Methods: Adults with modified Fisher grade (mFG) II-IV aSAH requiring an extra ventricular drain were included. Two analyses were performed based on indication of IT nicardipine (prophylaxis versus treatment of DCI) each with their own cohort of controls. Primary endpoints were differences in mean middle cerebral artery (MCA) transcranial doppler (TCD) velocities over the first ten measurements post-aSAH (prophylaxis arm) and percent change in mean MCA TCD velocities three days before and after treatment of DCI (treatment arm). Statistical analyses included repeated-measures ANOVA and Wilcoxon rank sum, respectively. Secondary endpoints were incidence of DCI, discharge modified Rankin score, discharge disposition, hospital length of stay, and mortality.

Results: Baseline characteristics (age, mFG, Hunt Hess Scale) were similar in both arms except the treatment arm control cohort had an increased mFG (3 vs. 4, P = 0.046). In the prophylaxis arm, (nicardipine n = 14, control n = 69) nicardipine exhibited a significant main effect on right TCD velocities with increased velocities during most time points (P = 0.007) and no main effect on left TCD velocities. The treatment arm (nicardipine n = 14, control n = 15) demonstrated no difference in percent change in either left or right TCD velocities. Secondary outcomes were similar in both arms.

Conclusion: Intrathecal nicardipine was not associated with a reduction in mean MCA TCD velocities. Further studies are warranted to determine the role of IT nicardipine in aSAH.

Drug Information

85 | Characterization of cannabis-related consultations in an academic drug information service

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Introduction: As the availability of medicinal and recreational cannabis and cannabis-related products increases, pharmacists are likely to face more questions about these agents and should be prepared with the knowledge and resources necessary to address these requests.

Research Question or Hypothesis: Are questions about the use of cannabis-related products increasing in frequency and which resources are most commonly used to address these questions?

Study Design: Retrospective review and descriptive analysis

Methods: Drug information requests submitted by healthcare providers to an academic drug information center from June 2009 through May 2019 were searched for the following terms: cannabidiol, cannabis, CBD, Epidiolex, hemp, K2, marijuana, pot, spice, THC, and weed. Requests addressing the use of cannabis-related products were characterized with respect to the product used, profession of requestor, type of question asked, and resources required to address each question.

Results: Of 6830 requests received over the ten-year period, 45 (0.66%) concerned cannabis-related products. Of these, questions about cannabis/marijuana were most common (46.7%), followed by cannabidiol (33.3%), hemp oil (11.1%), and K2/spice (8.9%). The number of requests concerning cannabis-related products increased nearly 3-fold over the last five years (n = 33) compared to the first five years (n = 12). One-third of requests related to drug-interactions. Other common requests concerned therapeutic uses, drug screening, safety, and legal issues. Primary literature and/or review articles were needed to address 65% of these requests. Other resources used for >10% of these questions included Natural Medicines, Lexicomp, Clinical Pharmacology, the DEA website, and manufacturer websites.

Conclusion: Questions about cannabis-related products submitted to an academic drug information service increased substantially in recent years, suggesting that practicing pharmacists are also facing more of these questions. Pharmacists should be familiar with the potential safety issues and therapeutic effects of these products and have access to appropriate resources to address these questions.

Education/Training

86 | Perceptions of clinical pharmacist reliance by attending and resident physicians at an academic medical center

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Introduction: Some concern exists at our institution that medical residents may be too reliant on clinical pharmacist expertise, which may impact their understanding of pharmacotherapy management. Currently, no known evaluations of these perceptions exist.

Research Question or Hypothesis: To what extent are clinical pharmacists relied upon in a rounding environment and is this reliance leading to impaired medical resident learning?

Study Design: This was a survey-based evaluation of attending physicians' perceptions of reliance on clinical pharmacists and the impact on medical resident learning at an academic tertiary medical center.

Methods: A 10-item, 5-point Likert-scale survey was delivered to evaluate physicians' perceptions of reliance on clinical pharmacists. The primary objective was to compare attending physicians' personal reliance to their perceptions of medical residents' reliance on clinical pharmacists and its overall impact on resident learning. Secondary objectives included evaluating the impact of gender, years of practice, or medical specialty on these perceptions. Mann-Whitney, Kruskal-Wallis, and Wilcoxon matched-pairs signed-ranks tests were utilized for nominal data, ordinal data, and matched responses, respectively. Statistical significance was set at a *P*-value of <0.05.

Results: Seventy-three attending physicians completed the survey. Respondents perceived that medical residents are significantly more likely to rely on clinical pharmacists for medication selection, drug dosing, information on adverse effects, and medication related literature updates (each $P < 0.0001$) compared to attending physicians' personal reliance. Years of practice or medical specialty did not impact perceptions. Female physicians relied on pharmacists for drug dosing recommendations (3.4 vs. 3.0, $P = 0.019$) and medication related literature updates (3.5 vs. 3.0, $P = 0.043$) significantly more than their male counterparts. Lastly, respondents believed that clinical pharmacists positively impact medical residents' learning experiences (mean = 4.22).

Conclusion: Respondents believed medical residents heavily rely on clinical pharmacist expertise and pharmacist involvement is ultimately benefiting medical residents. Further evaluations at other academic medical centers are necessary.

87 | Advanced HIV elective improves students' perceptions of abilities, confidence, and attitudes toward caring for people living with HIV (PLWH)

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Introduction: Human Immunodeficiency Virus (HIV) is a progressively dynamic field. Prior studies show that pharmacists are not confident in their knowledge of HIV and are uncomfortable with counseling PLWH on antiretrovirals. Additional education in HIV is necessary to assist pharmacy students in providing meaningful and comprehensive care to PLWH.

Research Question or Hypothesis: How will an advanced HIV elective improve students' perceptions of abilities, confidence, and attitudes toward caring for PLWH?

Study Design: Paired pre- and post- intervention survey study.

Methods: An advanced HIV elective course available to second and third year doctorate of pharmacy students was created. Course materials were delivered using a hybrid approach comprising of both in-class and online sessions. Content encompassed a variety of topics ranging from screening and treatment of PLWH to management of common comorbidities, special populations (pediatrics), pre-exposure prophylaxis (PrEP), and future directions in treatment. Additional content relating to pharmacogenetic applications and drug-drug interactions with antiretrovirals were emphasized. The same online survey was administered at the beginning and end of the elective course. Students were asked about their abilities, confidence, and attitudes to care for PLWH. The Wilcoxon signed-rank test was used to calculate statistical significance of changes in survey responses. Assessment performance data was analyzed using descriptive statistics.

Results: Student perceptions of abilities and confidence in caring for PLWH increased significantly over the course (median levels improved from 1 to 4 on all categories using Likert scale of 1-5, $P < 0.001$). These data were supported by student performance on assessments (mean scores greater than 90% on all three exams). Furthermore, students felt significantly less apprehensive about working with PLWH ($P = 0.04$) and there seemed to be an increased interest among students working with PLWH as potential future career ($P = 0.06$).

Conclusion: The advanced HIV elective significantly improved students' perceptions of abilities and confidence in caring for PLWH. Notably, beliefs toward management of PLWH changed positively.

88 | Student efficiency and progression providing telehealth medication therapy management services

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Introduction: Medication therapy management (MTM) is a patient-centered process designed to identify and resolve medication-related problems, reduce the risk of medication-related adverse events, and optimize patient outcomes. Student efficiency and progression providing telehealth MTM services is not well-documented.

Research Question or Hypothesis: Fourth-year pharmacy student efficiency providing telehealth MTM services improves over time during an MTM advanced pharmacy practice experience (APPE).

Study Design: Retrospective

Methods: Fourth-year pharmacy students in a five-week MTM APPE were provided with structured MTM training and then conducted telehealth-based comprehensive medication reviews (CMRs) with patients using the AdhereHealth™ MTM vendor platforms. Student efficiency data included number of calls per hour (CPH), CMRs completed per hour (CMR-H), and average talk time per CMR (T-CMR). Data was analyzed using ANOVA with post-hoc Tukey tests and a significance level of $P \leq .05$ to compare both within-APPE and cross-APPE student performance from January 2018 to April 2019.

Results: Forty-four students called 16,348 patients and completed 4,365 CMRs.

Week	CPH	CMR-H	T-CMR (minutes)
1	2.10 ± 0.83	0.49 ± 0.16	35.44 ± 8.60
2	3.59 ± 0.77	0.96 ± 0.21	33.63 ± 8.34
3	3.86 ± 0.79	1.05 ± 0.24	31.55 ± 7.19
4	4.43 ± 0.85	1.20 ± 0.23	29.40 ± 6.61
5	4.21 ± 1.04	1.09 ± 0.25	29.38 ± 7.46

The average CPH was significantly higher in weeks two through five compared to week one ($P \leq .001$ for all comparisons), in week four vs. two ($P \leq .001$), four vs. three ($P = .026$), and five vs. two ($P = .009$). The average CMR-H was significantly higher in weeks two through five compared to week one ($P \leq .001$ for all comparisons), in week four vs. two ($P \leq .001$) and four vs. three ($P = .019$). The average T-CMR was significantly lower in week four ($P = .005$) and five ($P = .004$) compared to week one. Analysis of cross-APPE student efficiency revealed no consistent pattern of improvement.

Conclusion: Within-APPE student efficiencies improved over time, demonstrating effective training strategies that can be used by other programs utilizing students to complete MTM services. Further study is needed to determine how to optimize longitudinal cross-APPE student learning.

89 | Novel multi-campus model for a critical care research elective

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Introduction: Research electives are commonly offered in the Doctor of Pharmacy program but are typically limited to one faculty member mentoring individual students at a single site for a semester-long self-study experience.

Research Question or Hypothesis: Describe pharmacy student experiences and perceptions of the research process after completing a multi-campus, multi-investigator critical care research elective.

Study Design: Retrospective review of student experiences in the Research in Critical Care Pharmacotherapy elective, which was launched in Spring 2019 and implemented a novel approach to the pharmacy research elective that promotes collaborative research across four campuses and is continued for up to four semesters.

Methods: Course coordinators on each campus reported student research activities. Students completed pre- and post-course surveys that used the Dreyfus model to assess confidence in research activities. Descriptive statistics were performed. The cumulative number of responses in each category were calculated per student and the related-samples Wilcoxon signed-rank test was used to compare pre- and post-course survey responses.

Results: Six second and third year students enrolled in the course and were distributed across all campuses. Students completed a median of 5 unique research activities with at least one student participating in 15 of the 19 activities evaluated. These activities resulted in three poster presentations during the semester (including one best student poster award), four additional abstract submissions, and two manuscripts in progress. The number of novice responses decreased from 10 to 2 ($P = 0.043$), advanced beginner decreased from 6 to 5 ($P = 0.593$), competent increased from 3 to 6 ($P = 0.068$), proficient increased from 1 to 3 ($P = 0.059$), and expert was unchanged (0 to 0, $P = 0.317$).

Conclusion: A novel, multi-campus critical care research elective provided broad research experiences and increased student confidence

related to numerous research skills. The analysis was limited by the single semester and small class size. Future investigations will apply layered learning to research.

90 | Impact of PhORCAS references on overall application score for postgraduate year one (PGY1) pharmacy residency candidates

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Introduction: The disparity between the number of applicants and PGY1 residency positions increases the need to optimize how applicants are evaluated. While scoring procedures vary between programs, references are often and integral piece of the application in the Pharmacy Online Residency Centralized Application System (PhORCAS).The purpose of this study was to evaluate the correlation between PhORCAS reference ratings and overall application score, applicant ranking, and invitation to interview based on program assessment of pharmacy residency candidates.

Research Question or Hypothesis: Ratings from recommendations in PhORCAS do not correlate with program-determined outcomes.

Study Design: This is a multi-center, retrospective study evaluating references in PhORCAS for PGY1 candidates.

Methods: This study evaluated the correlation between PhORCAS application recommendation ratings (eg, the 13 characteristic ratings and overall applicant rating) and program-determined outcomes (eg, application score, applicant ranking, and invitation to interview) for PGY1 applications submitted between 2015 and 2018. Key words and themes within the open-ended comments section of reference letters were also correlated with overall application score.

Results: A total of 5923 PhORCAS references from 1867 PGY1 applications across four pharmacy residency programs were included. The majority (74%) of all characteristics evaluated by reference writers were selected as exceeds, and 91% of all references "highly recommended" the applicant. Average reference characteristic ratings and overall ratings were poorly correlated with application score (R^2 = 0.12, P < 0.0001 and R^2 = 0.08, P < 0.0001 respectively), final ranking (R^2 = 0.02, P < 0.0001 and R^2 = 0.03, P < 0.0001 respectively), and invitation to interview (R^2 = 0.07, P < 0.0001 and R^2 = 0.04, P < 0.0001 respectively). Of the themes evaluated, teaching references showed the greatest correlation with normalized application score although still a poor correlation (R^2 = 0.007, P = 0.0001).

Conclusion: Reference ratings in PhORCAS are poorly correlated with application score, applicant ranking, and invitation to interview. The results of this study suggest that the PhORCAS reference form is of limited utility in its current state.

91 | Letters of reference for residency candidates: An ACCP education and training PRN survey of PGY1 residency program directors

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Introduction: Although letters of reference (LORs) are required for postgraduate year 1(PGY1) residency applications and are used to help distinguish between candidates, residency program director (RPD) perceptions and evaluation of LORs have not been described.

Research Question or Hypothesis: What are PGY1 RPDs' processes, values, and perceptions surrounding LORs?

Study Design: Cross-sectional descriptive survey

Methods: After content validity was assessed, the Education and Training PRN taskforce sent a 25-item electronic survey to 1,266 PGY1 RPDs for completion in October, 2018. Survey questions captured program demographics, LOR requirements and process for review, and perceptions about the value of the LOR and its components. Two open-ended questions solicited suggestions to improve the value of LORs and the existing standardized form.

Results: A total of 278 (22%) accredited programs completed the survey. LORs were rated as extremely or quite valuable by 82% of respondents, moderately valuable by 16%, and slightly valuable by less than 3%. Scoring rubrics for LOR evaluation were used by 79% of programs. Accuracy, detailed comments, and inclusion of specific candidate strengths and areas for improvement were rated as extremely or quite important characteristics by 98%, 90%, 95%, and 96% of respondents, respectively. Specific strengths were reported to be present in LORs more than half of the time by 81% of programs; however, accuracy, detailed comments, and inclusion of specific areas for improvement were only reported to be present about half the time or less by 41%, 63%, and 63% of respondents. Among 207 suggestions

submitted to improve LOR utility, common themes included a desire for specific comments and examples, honesty, avoiding over-inflation, and providing a performance comparison to peers.

Conclusion: LORs are a highly valued component of a PGY1 residency application. While candidate strengths are frequently included, some LOR elements perceived as very important by RPDs are commonly missing.

92 | Relationship between undergraduate involvement in pharmacy organizations and pharmacy school admittance

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Introduction: Studies have analyzed characteristics of students admitted into colleges of pharmacy (COP); however, sparse information on professional organization involvement and how this affects COP admissions exists. This study begins the analysis needed to understand the impact of pharmacy organization involvement in undergraduate years.

Research Question or Hypothesis: Does involvement in pharmacy organizations and fraternities during pre-pharmacy education impact grade point average (GPA) and acceptance into COPs on the first attempt?

Study Design: A retrospective, cross-sectional, multicenter, national survey.

Methods: An electronic survey was sent to first year pharmacy students enrolled in seven U.S. COPs. Students enrolled in 0-6 format programs and those completing a gap year were excluded. The survey contained 16 items and collected information on current COP enrollment, undergraduate education, pharmacy organization and fraternity involvement, number of attempts for COP admission, and GPA upon admission. Other information included leadership positions and opinion of impact of organizational involvement on professional development. SPSS v25 was used for statistical analysis. Fisher's exact, chi-square, and t-tests were used where appropriate.

Results: Of the 93 eligible responses 6.5% were accepted on their second attempt, 40.1% completed a degree preceding pharmacy school acceptance, 61.3% weren't involved in pharmacy organizations, and 21.5% held leadership positions as an undergraduate. There was no significant difference in students accepted on their first or second attempt based on professional organization involvement (P = 1.00) or in mean GPA in those involved in a professional organization (3.61 vs 3.59, P = 0.728). There was no difference in acceptance to a COP (P = 0.618) or GPA (P = 0.578) based on leadership positions during undergraduate education.

Conclusion: The results of this study suggest no difference between acceptance to COPs on first attempt or GPA among those involved in a pharmacy organization as an undergraduate.

93 | Examining the current landscape of residency application deadlines and its impact on protected time and burnout

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Introduction: Utilizing 2019 American Society of Health System Pharmacy (ASHP) Match data, nearly 25,000 recommendations were potentially written for the 8,364 residency applicants. Recommendations written over the holidays interferes with protected time from work, increasing the risk of job-related strain and burnout.

Research Question or Hypothesis: The purpose of this study is to examine current residency application deadlines and the implications of proposed timeline changes.

Study Design: Retrospective, observational review.

Methods: Data were collected on residency type, location, number of positions, and application deadline from the ASHP residency directory as of December 2018. Programs with unlisted deadlines or those March 1st or later were excluded. Cohorts were established to review programs with deadlines prior to January 1st, January 1st-4th, January 5th-7th and post-January 7th. Number of residency positions and programs were categorized by deadline and grouped as PGY1 or PGY2. Data were collated and means (+SD) and medians (IQR) were calculated. Potential impact of proposed timeline changes by cohort were examined.

Results: A total of 2,449 programs (4,927 positions) were identified. Following exclusion of 362 programs with deadlines unlisted or after March 1st, 1,165 PGY1 programs (3,299 positions) and 922 PGY2 programs (1,182 positions) were analyzed. The mean deadline was January 5th (median January 4, IQR January 2nd to January 8th) with 11% of programs (238; 574 positions) having deadlines prior to January 1st. The mean and median deadline was January 2nd for the 42% of programs with deadlines between January 1st and 4th. Proposing January 5th or 7th as the earliest universal deadline would impact 54% of programs (57% positions) and 72% of programs (75% positions), respectively.

Conclusion: As most deadlines fall prior to January 5th, 54% of programs and 57% of positions would be affected by setting a universal deadline of January 5th. Future directions include identifying timing of recommendations and application submission considering deadlines.

94 | Impact of supplementary material on student perception of knowledge

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Introduction: In education, calibration is the degree of fit between student judgement of performance and actual performance. An improved sense of performance likely increases achievement in pharmacy school and clinical practice. The purpose of this study is to determine if students who self-report use of supplemental study materials are better able to predict performance on an in-class assessment.
Research Question or Hypothesis: Students who use optional supplementary materials will have better calibration.
Study Design: Prospective, cohort study conducted at one college of pharmacy in 2018 and 2019.
Methods: Third year pharmacy students were given 36 supplemental questions via Quizlet to prepare for an in-class readiness assessment test (IRAT). Before the IRAT, students were asked if they used the Quizlet and to predict how many points they would score. After the IRAT, they were asked to postdict how many points they earned. The prediction and postdiction results were then compared to actual IRAT scores based on self-reported use of the Quizlet. An equal variance, two-sample t-test was used to determine differences in relative accuracy between groups (JMP Pro v14.1.0, SAS Institute, Inc., Cary, NC).
Results: Use of the optional Quizlet was reported by 273 (60%) students and was associated with significantly higher IRAT scores (7.7 vs. 7.2 out of 10; $P = 0.004$). All students underpredicted their IRAT scores, regardless of Quizlet use, with a mean relative accuracy of -1.2 in the Quizlet group vs. -1.0 in those who did not use Quizlet ($P = 0.47$). Similarly, all students under-postdicted their IRAT scores with a mean relative accuracy of -1.3 in the Quizlet group vs. -1.0 in those who did not use Quizlet ($P = 0.13$).
Conclusion: Use of a supplemental Quizlet was significantly associated with improved IRAT performance. All students were underconfident before and after the IRAT, but use of supplementary material was not associated with better calibration.

95 | Evaluating a multimodal/hybrid design on pharmacy student retention in diabetes pharmacotherapy

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Introduction: Over the last several years, pharmacy education has been moving towards a blended/hybrid model of learning. The purpose of this study was to evaluate the impact of a hybrid, multi-modal design in a pharmacotherapy diabetes sequence on retention and acquisition of knowledge, as well as which pedagogical methods produce better outcomes.
Research Question or Hypothesis: Does a hybrid/multimodal pedagogical design improve knowledge retention in a diabetes sequence?
Study Design: Retrospective cohort study
Methods: The lecture-based diabetes pharmacotherapy series in 2015 was converted to a hybrid/multimodal model (the Model). Activities included: insulin worksheet, progressive treatment cases, and Jeopardy!™ with Standards of Care categories. The primary outcome measure was student retention from matched questions on exam 1 to the final exam. Secondary measures were knowledge acquisition and activity effectiveness. The 2015 cohort served as a control. To measure student retention student scores were analyzed in quartiles for the final exam and exam 1 to assess acquisition. Activity effectiveness was assessed by comparing exam 1 and final exam scores by activity and objective. T-test and Chi-squared were used for data analysis.
Results: All final exam scores, regardless of quartile, showed improvement in the Model group indicating improved overall retention ($P < 0.05$). Exam 1 quartiles indicate the Model may benefit students scoring lower on the exam in acquisition ($P = 0.0002$ and 0.07 for 3rd quartile and 4th quartile, respectively). Top scoring students in the control cohort scored higher than those in the Model ($P < 0.05$). Progressive cases showed statistically significant ($P < 0.001$) improvement for acquisition for the initiation of type 2 diabetes treatment. The insulin worksheet, Jeopardy, and progressive cases all showed statistically significant ($P < 0.001$) improvement for retention versus lecture.
Conclusion: Complex learning activities in a hybrid/multimodal model are associated with improved retention compared to a traditional lecture format.

96 | Perceptions of PGY1 residency interviewees on a group case activity to evaluate clinical skills and the big five personality domains

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Introduction: As residency training becomes more desirable and the number of applicants increases, programs must employ objective ways

to differentiate applicants based on not only clinical skills, but also soft-skills. Assessment of the Big Five personality domains may aid in this. We implemented a group-case activity to assess clinical skills and Big Five personality domains, and determined perceptions on effectiveness of this activity in allowing demonstration of these domains.

Research Question or Hypothesis: A group case-activity incorporated into the onsite PGY1 interview allowed applicants to demonstrate clinical skills and Big Five personality domains

Study Design: A survey was conducted of all applicants to the PGY1 positions at our institution who completed an onsite interview.

Methods: An online survey was delivered in mid-March 2018 and 2019 following the rank submission deadline to all candidates who interviewed onsite. The group case-activity required applicants to participate in a 15-minute group case activity, which required working with other applicants to develop a patient case and three multiple-choice questions. Group members presented the case to a panel of interviewers and answered questions during the following 15-minutes.

Results: Overall response rate was 79% (n = 91). Ninety-one percent (n = 83) agreed/strongly agreed the case activity allowed demonstration of clinical skills. Respondents ranked conscientiousness (68%), clinical skills (48%), and extraversion (48%) as the top three domains demonstrated with the case. Ranked in the bottom three were openness to new experience (62%), emotional stability (62%), and agreeableness (59%). For future interviews, 96% agree/strongly agree the case should be included.

Conclusion: The group case-activity allowed respondents to demonstrate not only clinical skills, but also domains included in the Big Five personality domains. The case best allowed demonstration of conscientiousness, an attribute associated with success in healthcare. Incorporation of activities like this one will allow determination of clinical skills in addition to other important soft-skills.

97 | Health literacy in college students

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Introduction: Health literacy is the ability to obtain, communicate, process, and understand basic health information and services necessary to make appropriate medical decisions, which may impact health outcomes.

Research Question or Hypothesis: While college students are considered to have above average education, it is unclear what their health literacy levels are, and if there are any variations based on different factors, including area of study.

Study Design: A prospective web-based survey, utilizing the validated health literacy tool, Medical Term Recognition Test (METER), administered to university students.

Methods: METER contains a mix of 70 real and fake medical words and requires participants to identify the true medical terms. Participant demographics, areas of study, history of health-related coursework, health literacy attitudes and frequency of healthcare access were also collected.

Results: Respondents completed 553 surveys (female = 80%), of which 518 were utilized in data analysis. Representation from each college (76 majors) and all years of study were obtained. Most respondents (54.3%) had not completed a health-related course (range:0-7+), stated confidence in understanding health-related information (82.4%) and considered health literacy important (92%). Two validated scoring methods were utilized; #1 calculated correct choices from 40 actual health words (mean:37.05 ± 3.14), #2 subtracted for incorrectly selected words (mean:35.4 ± 3.84). Most participants demonstrated functional health literacy, defined as a score of 35+ (69.9%), followed by marginal (score: 21-34; 29.2%) and low health literacy (score: 0-20; 1.0%). Significant differences between mean scores were not found to exist between different colleges and demographics.

Conclusion: While the majority of participants exhibited functional health literacy, there exists a population of students who may struggle in their understanding of medically related terms and issues. Systematic education related to overall health may increase the health literacy of all matriculated students, which may in turn lead to more informed health choices.

98 | Long-term impact of a clinical pharmacy career event on students' career and educational decisions

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Introduction: The public, including students, is relatively unaware of the role that clinical pharmacists play in health care and may be reluctant or hesitant to pursue a career in clinical pharmacy. Increasing students' knowledge of clinical pharmacy may increase interest in pursuing a career in clinical pharmacy.

Research Question or Hypothesis: A local ACCP chapter's event promoting clinical pharmacy careers to students will positively influence students' career or educational decisions.

Study Design: All students who attended the clinical pharmacy event and provided an e-mail address were sent a link to a voluntary, anonymous Qualtrics survey at pre-determined time points post-event. Students were stratified into high school, pre-pharmacy, or current pharmacy student categories.

Methods: Local high school, college pre-pharmacy, and current pharmacy students were invited to a clinical pharmacy career exploration event held three consecutive years. Students were surveyed 3, 6, 12, and 24 months post-event. Students' perceptions of the event's value in promoting clinical pharmacy were assessed. Students

described actions taken to pursue a career in pharmacy as a result of event attendance and how the event impacted them. Quantitative results were analyzed using descriptive statistics.

Results: 34 (61%), 22 (39%), 14 (25%), and 5 (9%) students (response rate) completed the survey at 3, 6, 12, and 24 months, respectively. A majority of students reported the event was valuable (agreed or strongly agreed). Students took a variety of actions (changed APPE preferences, researched different pharmacy careers, etc.) after the event. At 3 months, six pre-pharmacy students (30%) applied to pharmacy school. At 12 and 24 months, a majority of students expressed a sustained interest in a clinical pharmacy career (agreed or strongly agreed).

Conclusion: A clinical pharmacy event for students positively influenced their career and educational decisions. This event may be replicated by other organizations or schools of pharmacy seeking to increase prospective student interest and enrollment.

99 | Predictors of student failure on advanced pharmacy practice experiences

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Introduction: The Accreditation Council for Pharmacy Education provides curricular standards to support success on Advanced Pharmacy Practice Experiences (APPE). Predictive factors for poor student performance have not been consistently identified, therefore identifying at-risk students remains difficult.

Research Question or Hypothesis: What factors are predictive of student failure on APPEs?

Study Design: Retrospective cohort

Methods: All students entering the Pharm.D. program from 2012-2014 at St. Louis College of Pharmacy were evaluated. Students with an F on ≥1 APPE (failure group) were compared to all other students (non-failures). A secondary evaluation compared students with a C or F on ≥1 APPE (poor performers) to all other students (non-poor performers). Data was collected on didactic and experiential performance, identifiable professionalism issues from Introductory Pharmacy Practice Experiences (IPPE), and Academic Honor Code violations. Univariable and multivariable logistic regressions were performed to determine factors associated with APPE failure and poor performance.

Results: A total of 669 students were analyzed. Twenty-eight (4.2%) students failed ≥1 APPE and eighty-one students (17.3%) were identified as poor performers. For the primary outcome, professional GPA < 2.7, practicum failure, IPPE professionalism issue(s), and pharmacotherapy course failure were identified for inclusion in multivariable analysis. IPPE professionalism issue(s) (HR: 4.8 [95% CI 1.9-12.4]) and pharmacotherapy course failure (HR: 4.2 [95% CI 1.6-11.1]) were associated with APPE failure on multivariable regression. On our secondary analysis, the same variables were identified for multivariable regression, with professional GPA < 2.7 (HR: 2.7 [95% CI 1.5-5]), IPPE professionalism issue(s) (HR: 3.9 [95% CI 2.2-6.9]), and pharmacotherapy course failure (HR: 2.0 [95% CI 1.1-3.7]) associated with poor performance.

Conclusion: Poor academic performance and identified unprofessional behavior on IPPEs are associated with APPE failure and APPE poor performance. Interventions should be aimed at identifying at-risk students and addressing their risk factors prior to APPEs.

100 | Combating implicit bias in the healthcare team: A pharmacist's role

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Introduction: Implicit Attitudes (IA) are attitudes or stereotypes that affect understanding, actions, and decisions in an unconscious manner that negatively impact and break down relationships. Implicit Attitudes Tests (IAT) are a computerized test measuring IA through unconscious associations between concepts and evaluations. The current landscape of IA and effects on the healthcare team is unknown.

Research Question or Hypothesis: We hypothesize pharmacists have implicit attitudes towards different health professions that may impact their work.

Study Design: Prospective, mixed-methods study

Methods: Pharmacists were recruited from the ACCP Adult Medicine PRN Listserv to take an IAT of doctors, nurses, and other pharmacists as well as measure explicit attitudes (EA) towards those professionals by rating each professions' professionalism and efficacy on a 7-item Likert scale. The primary outcome was the level of pharmacist IA towards doctors, nurses and other pharmacists, as measured by Greenwald et al. (2003)'s D-score. The secondary outcomes are the pharmacist demographics contributing to IA and the correlation between EA and IA.

Results: Mean D-scores of 67 participants differed by target profession (0.09 ± 0.36 towards other pharmacists, 0.2 ± 0.34 towards nurses, 0.26 ± 0.41 towards doctors), indicating pharmacists have the significantly lower positive feelings and more IA towards other pharmacists than either nurses (P = 0.03) or doctors (P = 0.002). Having a doctorate of pharmacy was associated with having less positive IAs towards other pharmacists (P = 0.023). Pharmacists reported higher negative EA towards nurses (P = 0.049) and higher positive EA towards other pharmacists than the IAT results indicated (P > 0.001).

Conclusion: Pharmacists have higher negative IA towards other pharmacists than nurses and doctors. Having a Doctor of Pharmacy was

associated with higher negative IA towards other pharmacists. There is discordance with the IA and EA of pharmacists and how they view nurses and pharmacists. Interventions may reduce IA to improve the dynamics of the healthcare team.

101 | Effect of a transition of care simulation on student empathy: A pilot study

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Introduction: Empathy among healthcare providers is associated with improved patient outcomes. Simulation exercises are effective tools to augment empathy. Transitions of care (TOC) is the movement of patients between healthcare locations or levels of care. Non-medical issues, such as communication and transportation, may present significant challenges to patients. Few studies have measured student pharmacists' empathy toward patients undergoing TOC hardships in a simulation environment.

Research Question or Hypothesis: Will this simulation increase student pharmacists' empathy toward patients undergoing TOC?

Study Design: Single-center simulation with baseline and post-intervention survey

Methods: Student pharmacists voluntarily participated in a simulation where they assumed the role of patient who had suffered a myocardial infarction. Students were "discharged" from a simulation hospital by trained actors posing as healthcare providers. Students were provided a discharge packet, prescriptions, bus route and bus pass. Students navigated public transportation to obtain discharge medications at a community pharmacy and return "home" to debrief with study investigators. Demographics were analyzed using descriptive statistics. The Kiersma-Chen Empathy Scale (KCES), a validated, 15-item survey based on a 7-point Likert-scale, was administered pre- and post-simulation to assess empathy. Changes in individual items were analyzed via Wilcoxon signed-rank test, while overall scores for the KCES were analyzed via t-test for comparison of means.

Results: Thirteen students (100%) completed baseline and post-simulation surveys. Of these students, 69.2% were first year students, 23.1% were second year students, and 7.7% were fourth year students. Mean (+/- standard deviation) of students' overall empathy scores increased from 85.6 (±12.2) to 94.2 (±9.57) ($P = 0.057$) following completion of the simulation. Of the 15 items on the KCES, statistically significant increases ($P < 0.05$) were seen in two affective domain items.

Conclusion: Results of this pilot demonstrated no significant increase in overall empathy among student pharmacists. Implementation on a large-scale may yield different results.

102 | Impact of an online residency mentoring program on fourth-professional year pharmacy student success in obtaining post-graduate residencies

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Introduction: Schools and colleges of pharmacy routinely strive to help students secure post-graduate residencies. Online mentoring focused on residencies may assist students in their application, interviewing and eventual matching into PGY-1 programs.

Research Question or Hypothesis: To ascertain if successful match into PGY-1 pharmacy residency programs by fourth-professional year pharmacy students is associated with participation in an online residency mentoring program.

Study Design: Retrospective case control study.

Methods: Students at a single, private school of pharmacy who registered for the ASHP Residency Match between the years 2010 and 2019 were included. The outcome of interest was successful match and the exposure of interest was participation in the school's online residency mentoring program; the primary outcome was the odds ratio associated with this relationship. The online program was implemented for the class of 2015 and components included detailed emails from faculty on a wide range of topics, question and answer forums conducted via email, panel discussions from preceptors and current residents, and a comprehensive mock interview simulation. Secondary outcomes included the change in average match rate pre- and post- implementation of the program.

Results: The study examined a total of 380 students who participated in the ASHP Residency Match, 196 (51.6%) having participated in the online residency mentoring program and 184 (48.4%) having not participated. Students who participated in the program were more likely to be successful in the Match (OR = 2.23; 95% confidence interval (CI):1.45-3.42). Average student match rates of students in their graduating year for the five years prior to implementation of the program to the five years after implementation significantly increased from 56.6% to 70.3% ($P = 0.0084$).

Conclusion: Implementation of an online residency mentoring program is correlated with successful PGY-1 residency matching.

103 | The impact of a cultural competency course on the pharmacy student's cultural awareness

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Introduction: Patient care is largely affected by providers' knowledge in cultural differences and there is a need for programs to improve cultural competency and cultural awareness in healthcare. Unfortunately, limited information exists regarding the integration of cultural awareness within pharmacy school curricula or the impact of cultural competency coursework on student cultural awareness.

Research Question or Hypothesis: A designated course within the pharmacy school curriculum will enhance student cultural awareness.

Study Design: Retrospective, cohort study using online pre- and post-survey

Methods: Third year pharmacy students enrolled in the elective 6-week cultural competency course at Texas Tech University HSC School of Pharmacy. The course incorporated various teaching methodologies including lectures, cultural encounter exercises, a cultural video project, and presentations. Prior to beginning the course, students assessed individual cultural awareness via 20 self-assessment questions which was then repeated at the conclusion of the course. Descriptive statistics and Wilcoxon Signed-Rank Test were used to evaluate the data.

Results: Ninety-seven students completed both pre- and post-cultural awareness assessments between 2015-2018. Student surveys showed significant improvement in 17 out of 20 questions between pre- and post-survey responses. Specific areas of improvement included understanding of cultural competence as an ongoing process, awareness of institutional barriers that prevent cultural/ethnic groups from seeking healthcare services, and awareness of stereotyping attitudes, preconceived notions and feelings that they have toward members of other cultural/ethnic groups.

Conclusion: A cultural competency course can improve student confidence in certain areas of their own cultural awareness as well as their ability to apply essential skills regarding cultural competency in their future endeavors. Implementation of a similar course or experiences should be considered to be a required part of the pharmacy curriculum.

104 | Initiating precepting development in P4 students' final course to measure their confidence and knowledge as it evolves with teaching interventions

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Introduction: This project evaluates the change in perception of confidence in pharmacy students at precepting learners with unprofessional behavior pre and post didactic and simulated training sessions.

Research Question or Hypothesis: Does student perception of their confidence in precepting unprofessional learners change with a didactic learning session and corresponding simulation activity? Does student knowledge of providing feedback when precepting change based on the interventions?

Study Design: This is a quality improvement study utilizing quantitative research methods in a correlational design. A newly developed assessment tool was administered in a pretest / posttest fashion around both didactic teaching and simulation interventions.

Methods: An assessment tool was built to examine the student perception of their confidence and their knowledge of precepting learners. The tool consisted of two parts: (1) a 7-item survey measuring student confidence on a 4-point scale and (2) a 7-item test measuring student knowledge of precepting. The assessment tool was administered to 66 P4 students in the fourth-year capstone course before and after didactic and simulated training sessions. “Confidence” and “knowledge” scores were calculated based on the responses to the survey and test items. A *dependent t-test* was conducted to analyze the difference between pre- and post-intervention “confidence” and “knowledge” scores. Cronbach's alpha coefficient was used to examine the reliability of the two separate parts of the assessment tool.

Results: The pre- and post- data analysis revealed a statistically significant increase in student confidence after the intervention ($t = 7.8$; $P = .000$). The difference in “knowledge” scores was not statistically significant ($t = 1.67$; $P > .05$). The reliability analysis resulted in Cronbach's alpha of .84 indicating high internal consistency reliability of the “confidence” scale.

Conclusion: The didactic instruction and the simulation activity introduced to P4 students contributed significantly to their “confidence” in precepting learners.

105 | Degree of agreement of areas for improvement and strengths reported by candidates and recommenders: A qualitative analysis of data from PGY1 pharmacy residency applications

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Introduction: Learners can gain understanding of their areas for improvement and strengths through feedback from mentors. Despite widespread knowledge of the importance of feedback, evidence suggests it is lacking in pharmacy education. Letters of intent (LOI) and

letters of recommendation (LOR) in pharmacy residency applications provide vital information about candidates. Assessment of agreement between candidates and recommenders' areas for improvement and strengths in applications could provide insight to the level of feedback provided to learners.

Research Question or Hypothesis: Do areas for improvement and strengths reported by postgraduate year 1 (PGY1) pharmacy residency candidates and recommenders agree?

Study Design: This was a retrospective qualitative study.

Methods: Applications to a PGY1 pharmacy residency program at a community teaching hospital from 2015 and 2018 were collected. LOI, LOR, and site-specific candidate self-assessments were blinded and analyzed to identify areas for improvement and strengths. A codebook was developed from approximately 20% of the materials which was used for coding areas for improvement and strengths. Two investigators coded separate equivalent sections of the materials. Bivariate analyses (phi coefficient, Ï†) were conducted to assess the agreement between candidates and recommenders' reported areas for improvement and strengths.

Results: A total of 108 LOR were collected from 34 applications. Phi coefficients for areas for improvement were Ï† = 0.3689 (knowledge base), Ï† = 0.3158 (delegating tasks), Ï† = 0.2787 (public speaking skills), Ï† = 0.0429 (confidence), and Ï† = 0.0185 (critical thinking skills). Phi coefficients for strengths were Ï† = 0.3354 (personality), Ï† = 0.2357 (time management skills), Ï† = 0.1179 (work ethic), and Ï† = 0.0667 (independence).

Conclusion: Areas for improvement and strengths reported in pharmacy residency applications demonstrated slight to fair agreement between candidates and recommenders. Providing personalized, detailed, and constructive feedback in a collaborative manner could allow learners to better understand their areas for improvement and strengths.

106 | Comfort quotient: Assessing student pharmacists' level of comfort with public speaking

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Introduction: Accreditation Council for Pharmacy Education Standards 2016 state that effective interpersonal communication is required to be introduced, reinforced, and practiced in a Doctor of Pharmacy (Pharm.D.) curriculum. Previous studies describe the success of an evidence-based oral presentation skills series and an elective pharmacy course assessing the efficacy of creative-thinking exercises in developing and presenting original ideas in a TED Talk format. At one school of pharmacy, PHPR 6610: Seminar I (the course) is a required one credit hour course for third-year PharmD candidates.

Research Question or Hypothesis: How do student pharmacists' perceived comfort levels with public speaking change after completion of a didactic public speaking course?

Study Design: Retrospective cohort

Methods: Third-year PharmD candidates enrolled in the course during 2014, 2015, 2016, 2017, and 2018 fall semesters, who completed the Comfort Quotient Survey (CQS) before the start and at the end of the course, were included. CQS includes 10 questions, with responses of 1 = Always, 2 = Frequently, 3 = Sometimes, 4 = Seldom, and 5 = Never. The sum of the responses provides a total score. During the course, PharmD candidates received instruction on written and oral communication strategies for successful presentation delivery and delivered two 5-minute presentations, one geared toward health care professionals and one for the lay public. Presentations were evaluated by one of six faculty members. CQS total scores were analyzed for changes before and after the course using paired student's t-test. Wilcoxon signed-rank and Kruskal-Wallis were used for secondary analyses. Criteria for significance was $\alpha = 0.05$.

Results: Data for 356 PharmD candidates were included. The average CQS score changed from 30 (average assurance and skills) to 35 (above average assurance and skills); overall change was 5 ($P < 0.001$). Semester of enrollment, need to repeat a presentation, and assigned presentation evaluator did not impact change in CQS score.

Conclusion: Perceived comfort levels improved after PharmD candidates received instruction on and gained experience with public speaking.

107 | Emotional intelligence of pharmacists in the United States and in Japan

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Introduction: Current literature on Emotional Intelligence (EI) of pharmacists is limited. This study compares EI scores between practicing pharmacists in the United States and in Japan.

Research Question or Hypothesis: Pharmacists practicing in U.S. pharmacists have higher EI scores than pharmacists in Japan.

Study Design: Cross-sectional study utilizing an online survey

Methods: An online survey (using the TEI-que Short Form) of pharmacists in the practice settings of community, hospital, university, and pharmaceutical industry, either working in the U.S. or Japan, was conducted. The primary outcome was the comparison of pharmacists' EI scores between those practicing in the U.S. and Japan. Each question was categorized into one of the four competencies of EI: self-awareness, self-management, social awareness, and relationship management. Descriptive statistics and an unpaired t-test was used to compare the EI scores.

Results: We received responses from 172 pharmacists. The overall mean EI scores were 163 and 140 (difference 22.16; $P < 0.0001$) for pharmacists in the U.S. and Japan, respectively. Self-awareness, social awareness, relationship management, and self-management scores between U.S. and Japan were 5.4 vs 4.8 ($P < 0.0001$), 5.8 vs 5.1 ($P < 0.0001$), 5.2 vs 4.3 ($P < 0.0001$), and 5.1 vs 4.6 ($P < 0.0001$), respectively. When comparing EI scores across pharmacy practice settings in the U.S. or Japan, there were no statistically significant differences.

Conclusion: This study shows pharmacists in the U.S. have statistically significant higher EI scores in all four domains than those of pharmacists practicing in Japan. Future studies may focus on measures of patient satisfaction and pharmacist job satisfaction in correlation to EI scores of pharmacists, which may be beneficial to both pharmacists and patients.

108 | Implementation and initial evaluation of an innovative approach to research and scholarship training in pharmacy education

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Introduction: National and international pharmacy organizations have long emphasized the need for pharmacists to develop skills in research and scholarship. However, competing priorities in Pharm.D. curricula and lack of coordinated research opportunities often create barriers to achieve this goal. In 2015, our School implemented the Research and Scholarship in Pharmacy (RASP) pathway, built around a longitudinal, faculty-mentored scholarly project, which promotes research and scholarship training via a 3-course elective series and scholarship deliverables. The purpose of this study was to evaluate the impact and perceived value of RASP following completion of the first student cohort.

Research Question or Hypothesis: RASP provides a feasible and effective approach to research and scholarship training within pharmacy education.

Study Design: Observational mixed-methods

Methods: This retrospective analysis included 25 students who completed RASP in 2019. To assess the impact and perceived value, quantitative (number of students and faculty mentors, abstracts accepted to national meetings, manuscripts submitted/accepted) and qualitative (program exit survey responses) data were collected. Data were analyzed using descriptive statistics.

Results: Twenty-five students (19% of the class) completed RASP within research teams led by 19 distinct faculty mentors representing all 5 academic divisions within the School. At the time of graduation, 17 (68%) students had already presented an abstract at a national meeting. Ten (40%) submitted a manuscript to a peer-reviewed journal with 5 (20%) already accepted for publication. Of the 24 students who completed the exit survey, 23 (96%) were satisfied with their experience, 24 (100%) agreed this experience helped them gain a deeper understanding of how to conduct research and scholarship, 20 (83%) believed their experience helped differentiate them during post-graduation interviews, and 18 (75%) would recommend RASP to future students.

Conclusion: RASP provides an innovative approach to feasibly and effectively integrate research and scholarship training within Pharm. D. curricula. The potential to replicate this program at peer institutions remains to be determined.

109 | Effect of burnout on postgraduate year-one pharmacy residents' pursuit of additional training

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Introduction: The decision for PGY1 pharmacy residents to pursue additional post-graduate training (PGT) is impacted by a variety of internal and external factors.

Research Question or Hypothesis: Burnout in PGY1 residents impacts the decision to pursue additional PGT, most commonly PGY2 training.

Study Design: This was a national, cross-sectional survey of PGY1 pharmacy residents completing their training during 2017-18.

Methods: A 40-item survey instrument was developed and distributed over four weeks in February-March 2018 after submission of rank lists but prior to Match results using an online survey software/insight platform (Qualtrics, Provo, UT). Pharmacy residents were surveyed regarding burnout, demographics, and intention to pursue additional PGT. Two respondent groups were developed: Additional PGT and No Additional PGT. Burnout domains (emotional fatigue, depersonalization, and personal fulfillment) and profiles (engaged, ineffective, overextended, disengaged, and burnout) were compared between groups. A multivariable logistic regression was conducted to determine variables associated with additional PGT pursuit.

Results: Of 570 PGY1 residents who participated, 344 (60.4%) were in the Additional PGT group. Those in the No Additional PGT group

scored higher in emotional fatigue (median 24, interquartile range (IQR) 19-29 vs. median 22, IQR 17.5-26) and depersonalization (median 11, IQR 9-13 vs. median 11, IQR 9-13) and lower in personal fulfillment (median 14, IQR 12-17 vs. median 16, IQR 12-19). Following multivariable logistic regression analysis, burnout profile (odds ratio (OR) 0.53, 95% confidence interval (CI) 0.31-0.91) and opportunity to complete PGY2 training at the PGY1 institution (OR 0.31, 95% CI 0.23-0.40) were associated with additional PGT pursuit. PGY1 residents in the No Additional PGT group were categorized as having the burnout profile more frequently (36.3% vs. 23.6%).

Conclusion: PGY1 residents pursuing/planning to pursue additional PGT felt less burned out than those not pursuing additional PGT. Opportunity to complete PGY2 training at the resident's PGY1 institution and burnout profile were associated with pursuit of additional PGT.

110 | What's in a capstone? A review of capstones in pharmacy education

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Introduction: Capstones are experiences during which students integrate and apply knowledge acquired from a curriculum. The objective of this study was to better understand the design, purpose, and results of capstones in Doctor of Pharmacy (Pharm.D.) degree programs.

Research Question or Hypothesis: What is the current status and utility of pharmacy education capstones?

Study Design: Qualitative methods: literature review, with follow up interviews

Methods: A literature review was conducted, and 14 papers were found describing the design and evaluation of a capstone. Corresponding authors were invited to discuss their capstones. Eleven authors agreed to be interviewed. Data from interviews were coded to four domains by two researchers: viability, feasibility, desirability, and challenges. Coded segments were summarized and synthesized via pattern coding to reveal themes within each domain.

Results: Of the 11 capstones discussed with the corresponding author, six (55%) schools integrated the capstone into a pharmacotherapy course, with a focus on APPE readiness, four (36%) used capstones to provide research experiences or develop critical thinking, and one (9%) involved students attending an immersive camp. Most capstones appeared viable, with only two (18%) of the research capstones discontinued while the others (82%) were still ongoing. Ten (91%) schools mentioned the time intensive burden on faculty, which may influence the feasibility and desirability of implementing and sustaining capstones. Challenges included student motivation and engagement as well as grading inconsistencies and maintaining faculty commitment. Despite these challenges, all participants recognized capstone experiences as necessary to prepare students for either APPE rotations or research opportunities.

Conclusion: Capstones are primarily utilized to assess APPE readiness and provide research experience. Currently there are no guidelines for capstones within pharmacy education, thus leading to variability in design and purpose, along with several challenges influencing the viability, feasibility, and desirability of implementing and sustaining capstones.

111 | We are studying this topic to express our sincere interest in the lack of original letters of intent

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Introduction: Plagiarism occurs in personal statements submitted for medical residency applications. It is unknown if plagiarism occurs in Letters of Intent (LOI) submitted for PGY-1 pharmacy residencies and if so, how plagiarism affects interview invitations and/or rank list placement.

Research Question or Hypothesis: The percentage of plagiarized LOI are similar for applicants invited to interview vs. not invited and applicants ranked vs. not ranked.

Study Design: This is a retrospective, observational study of all LOI submitted in 2015, 2016, and 2017 to the University of Illinois at Chicago's PGY-1 program.

Methods: A list of 569 LOI submitted from 2015-2017 was generated from the Pharmacy Online Residency Centralized Application Service (PhORCAS). The primary outcome was to compare the similarity index between applicants invited to interview vs. not invited and ranked vs. not ranked. Similarity index was calculated by iThenticate© plagiarism detection software using a ≥ 10% match-threshold. To identify plagiarism occurrence within individual pharmacy schools, an intra-school analysis was performed utilizing T-Lab© software's inter-document similarity function.

Results: There were 555 LOI included in the analysis. Distribution of LOI were as follows: 183 invited, 372 not invited, 141 ranked, and 42 not ranked. There was no statistical difference in the percentage of plagiarized LOI in the invited vs. not invited groups and ranked vs. not ranked groups [4.37% vs. 4.03% ($\hat{e}^{2}$ 0.036; P = 0.850) and 4.26% vs. 4.76%, ($\hat{e}^{2}$ 0.020; P = 1.000)]. Mean and median similarity scores were similar amongst groups (P = > 0.05). Three almost-identical LOI were identified in the secondary analysis corresponding to applicants applying from one individual pharmacy school over a three-year period. All three of these applicants were invited to interview and ranked.

Conclusion: Letter of Intent plagiarism, although occurring, does not decrease the likelihood of interview invitations or rank list placement.

112 | Evaluation of journal club versus clinical debate activities within pharmacy experiential education

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Introduction: Within pharmacy experiential education, discussion and evaluation of literature usually occurs via journal clubs (JC), which are often required in advanced pharmacy practice experiences (APPE). Although JC are frequently used, clinical debates (CD) have recently gained traction as a more engaging alternative. The purpose of this study was to compare JC versus CD during APPE rotations at four institutions in regards to clinical knowledge application and literature evaluation abilities.

Research Question or Hypothesis: What is the impact of a JC versus CD on clinical knowledge and literature evaluation?

Study Design: Prospective study of fourth year professional pharmacy students on an inpatient medicine APPE with one of the study investigators.

Methods: Fourth year professional pharmacy students on an inpatient medicine APPE with one of the study investigators participated in both a JC and CD during their rotation on one of four topics. Topics were randomly assigned to students and were completed as either a JC or CD. All topics had corresponding articles that were predetermined by the investigators. After each experience, students completed an investigator-created, 10-item knowledge assessment comprising of six items related to clinical knowledge of the topic and four questions related to literature evaluation, scored on a 10-point scale. Combined and individual topic assessment scores were compared between JC assessments and CD assessments using a *student's t-test*. A *P*-value of <0.05 was considered statistically significant.

Results: 32 students participated in these activities. The average total score was 5.6 ± 1.9 for JC assessments and 5.8 ± 2.3 points for CD assessments with no statistically significant difference between activities ($P = 0.38$). Additionally, there was no difference between JC and CD assessment scores for each of the individual topics ($P > 0.05$ for all interactions).

Conclusion: There was no difference in knowledge assessments of JC versus CD activities. Clinical debates are a reasonable alternative to traditional journal clubs regarding knowledge and literature evaluation skills.

113 | The impact of test session assignment on student performance on objective structured clinical exams (OSCEs)

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Introduction: Deploying OSCE cases across multiple time-frames is common practice. Older literature suggests there is no difference in student performances across time-frames. Given that technology today makes communication to large groups quick and discreet, the issue should be revisited.

Research Question or Hypothesis: Does student performance on OSCE stations improve from AM to PM administration?

Study Design: Retrospective cohort analysis

Methods: WesternU College of Pharmacy administers three OSCEs across the P2 and P3 years. Sharing information regarding OSCE stations is a violation of the school's honor code. Mean OSCE station scores for the past five years were analyzed using a Student's t-test to determine if differences in performance exist when comparing AM and PM test takers. Linear mixed effects models were used to evaluate the difference in clinical and communications performance across the AM and PM groups, clustered on faculty and station levels allowing for random intercepts and slopes and controlling for age, gender, and cohort year.

Results: Data from 36 stations over five years were analyzed, including 671 unique student subjects. Mean OSCE station scores were two points higher in PM testers (81.5 +/- 11.4% vs. 79.4 +/- 12.0%; $P = 0.001$) compared to AM testers. PM testers scored significantly higher ($P < 0.05$) in 7 stations and no station exhibited a significantly higher mean score for AM testers. Similar findings were reported with the linear mixed effects models for communications and analytical checklists, but not for SOAP notes.

Conclusion: The results of this retrospective analysis support the hypothesis that afternoon test-takers score significantly higher on OSCE assessments than those testing in the morning, although it is not clear if SOAP notes are impacted in this way. There are several possible explanations for this difference, including information sharing between morning and afternoon testers. Further investigation is warranted to discern possible causes for this pattern and to ensure the integrity of the assessment process.

114 | Affective domain predictors of successful matching for post-graduate pharmacy residency training

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Introduction: The Birkman Method® is a validated, comprehensive self-assessment that provides end users with a detailed explanation of affective domain (AD) data to help determine personality components. Certain AD-related factors may be associated with successful matching for post-graduate residency training (PGRT).

Research Question or Hypothesis: Are there significant associations between Birkman Method® AD-related personality components and students' successful matching for PGRT?

Study Design: Data were collected retrospectively and analyzed using logistic regression models to determine which AD components are significantly associated with successful residency match.

Methods: This retrospective study was conducted in two Colleges of Pharmacy (COP) in the Southeast United States. Graduating students from the classes of 2017 through 2019 completed the Birkman Method assessment as first professional year students and were included in the study. The study also included student data (age, hometown, location and distance of PGY-1 from hometown, etc.) that were analyzed with AD-related data using Statistical Analysis Software (SAS) and Microsoft Excel.

Results: The study included 424 students with 34.7% successfully obtaining PGRT. There was a statistically significant positive association between Emotional Energy Needs/Stress (P = 0.0150), Usual Thought (P = 0.0021), and Usual Assertiveness (P = 0.0295) scores with PGY-1 Match. In addition, blue organizational focus (innovative) (P = 0.0413) and having the red (energetic, likes practical) Birkman usual color (P = 0.0486) were associated with successful PGY-1 match. There was a statistically significant negative association between Usual Self Consciousness scores and PGY-1 match (P = 0.0064).

Conclusion: A variety of significant positive and negative associations between AD factors and PGRT match exist. Early identification of students' personality components may optimize career path planning and PGRT match success.

115 | Students' perspective on the use of Desire2Learn and ExamSoft platforms for examination administration: 2018 update

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Introduction: Desire2Learn is a software utilized to evaluate our P2 students' knowledge of pharmacokinetics. The platform is used to administer in-class tests consisting of multi-choice questions as a component of Pharmacokinetics, a four credit hour course. In our college, we also utilize an alternate platform (ExamSoft).

Research Question or Hypothesis: The goal of this project was to understand whether students had a preference concerning examination platform. Although a similar anonymous survey was conducted in 2017, a low response rate limited data usage; therefore, another survey was conducted in 2018.The latest data as well as pooled 2017 and 2018 data are reported here.

Study Design: An exploratory web-based survey.

Methods: Students' preference on the use of the two platforms, Desire2Learn and ExamSoft, was evaluated with three questions using a 5-point Likert scale (1-Strongly Disagree to 5-Strongly Agree), as a part of an anonymous summative survey conducted by the Academic Affairs office.

Results: The response rate was higher (75%) in 2018 compared to the 2017 survey (27-28%). Fifty-two percent of the students agreed or strongly agreed that it was a good idea to administer the pharmacokinetics exams through Desire2Learn (Question 1). Forty-eight percent of the respondents indicated that they would recommend Desire2Learn usage for future pharmacokinetics exams (Question 2). While 40% agreed or strongly agreed that they prefer using Desire2Learn over ExamSoft for other examinations (Question 3), the rate of disagreement or strong disagreement was 41%. The pooled data indicated agreement or strong agreement responses to the three questions as 63, 60, and 49%, respectively.

Conclusion: The 2018 data indicated that while our P2 students were in favor of utilizing Desire2Learn for pharmacokinetics exams, they did not have a platform preference for other exams. Based on pooled data; however, more respondents preferred Desire2Learn over ExamSoft usage in general.

116 | Using an escape room to teach evidence based medicine

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Introduction: Bringing literature to life in the classroom is challenging and while active learning engages students, participation in escape room activities may further enhance student engagement and enjoyment.

Research Question or Hypothesis: Do students' perceptions of participating in an escape room activity differ from those of participation in usual Team Based Learning (TBL) application exercises?

Study Design: Cross-sectional

Methods: An escape room activity was developed for the final day of class in the Evidence Based Medicine unit, offered at the end of second year. Students were given a recent meta-analysis published in JAMA to read before class. Escape room activities involved 5 consecutive puzzles: solving a word scramble to unlock the patient's medical records, calculating an ASCVD risk score, completing a quiz to evaluate the article, identifying recent guidelines, and counseling the patient with a medical recommendation. Divided into teams of 5-6, students began by reviewing a patient case as a community pharmacist and were handed an article by the patient (an engineer) about aspirin prophylaxis. After completion of the escape room, faculty led a carefully constructed debriefing session to review concepts. Students

completed an anonymous survey to provide feedback at the end of class.

Results: Forty-six students completed the survey. The majority felt more engaged (82.6%) and found the class more enjoyable (84.4%), compared to a traditional TBL experience. About half of the class felt that their team discussed possible answers (52%) and worked collaboratively (59%) more than with traditional TBL. The majority of the class (78.3%) felt that the debrief solidified understanding of literature evaluation for the treatment of an individual patient. Over 90% of the class said that they would participate in a similar escape room activity.

Conclusion: Escape room activities increase student engagement and enjoyment in the classroom and provide students an alternative to traditional TBL activities.

117 | The impact of pharmacy student-led opioid overdose prevention and response education

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Introduction: The opioid overdose epidemic has contributed to an increasing number of opioid-related deaths. Education on recognizing and responding to an opioid overdose is an essential life-saving prevention tool that clinical pharmacists and the general public can utilize. To date, no studies have reported the effect of opioid overdose education to staff at rehabilitation centers and across all high school grade levels.

Research Question or Hypothesis: What is the impact of pharmacy student-led opioid overdose prevention and naloxone education on perceptions about naloxone and the ability to recognize and respond to an opioid overdose?

Study Design: This descriptive, retrospective cohort study utilized trend surveys for data collection. Subjects included students from high schools, universities, and staff from rehabilitation facilities throughout Houston, Texas. Baseline demographics and knowledge assessments on opioid overdose prevention and naloxone education were obtained using pre- and post-surveys.

Methods: University of Houston College of Pharmacy students provided opioid overdose prevention and response education presentations. The primary endpoint was an increased ability to recognize and respond to an opioid overdose, and improved perceptions about naloxone. A Likert scale was used to create pre- and post-surveys. A paired t-test, Chi-squared, and Fisher's exact test, with a significance level of 0.05, were used for data analysis.

Results: The ability to identify an overdose, indicated by the mean score of the pre- and post-survey responses (N = 400), increased following educational intervention (2.2 v 4.1; $P < 0.0001$). Increased mean scores regarding perception about naloxone access (2.9 v 4.2; $P < 0.0001$), naloxone availability in the community (3.0 v 4.4; $P < 0.0001$), and the ability to respond to an overdose were observed (1.9 v 4.1; $P < 0.0001$).

Conclusion: Pharmacy student-led opioid overdose prevention and response education improved perceptions about naloxone as well as the ability to recognize and respond to an opioid overdose. Increasing community education of the opioid overdose epidemic may be beneficial in targeting and reversing the crisis.

Emergency Medicine

118 | Prevalence, predictors, and trends of opioid prescribing for lower back pain in emergency departments: A national cross-sectional study

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Introduction: Current evidence-based guidelines for the treatment of acute low back pain (ALBP) recommend the use of opioid medications only after failure of nonpharmacological therapy, non-steroidal antiinflammatory drugs, and skeletal muscle relaxants and after thorough evaluation of risks and benefits. Despite this recommendation and the state of the opioid epidemic in the United States (US), opioids remain a common choice for ALBP in the emergency department (ED).

Research Question or Hypothesis: How often are opioids prescribed and what are the predictors for receiving opioids for ALBP in the ED?

Study Design: National cross-sectional study of the National Hospital Ambulatory Medical Care Survey from 2013-2016.

Methods: ED visits for patients ≥18 years of age treated for ALBP were included in this IRB-exempt analysis. Visits involving fractures or patients with cancer were excluded. The primary endpoint was frequency of opioids prescribed during the study period. Patient- and provider-level predictors of opioid use in patients diagnosed with ALBP were assessed using a multivariate logistic regression model.

Results: This analysis included 2,754 visits for ALBP. Opioid medications were prescribed in 32.2% of visits. The positive predictors of opioid prescribing were pain scale score of 7-10 compared to 0-3 (OR 1.85; 95% CI 1.26-2.70), and patients seen in the Southern (OR 2.53; 95% CI 1.47-4.36) or Western US (OR 2.10; 95% CI 1.19-3.70) compared to patients seen in the Northeast. Opioids were

less likely to be prescribed to patients aged 18-30 years compared to 31-49 years (OR 0.69; 95% CI 0.48-0.98), non-hispanic blacks compared to non-hispanic whites (OR 0.76; 95% CI 0.58-0.99), and by medical resident providers compared to attending physicians (OR 0.34; 95% CI 0.15-0.75).

Conclusion: Opioid prescribing rates for ALBP remain high despite guideline recommendations and associated risks. The predictors identified in this analysis demonstrate that this prescribing pattern is not uniformly distributed across the patient and provider characteristics studied.

119 | Impact of a pharmacist-led collaborative drug therapy management program for culture follow-up in an emergency department

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Introduction: There are minimal studies assessing the impact of emergency medicine pharmacists (EMPs) on culture follow-up through a collaborative drug therapy management (CDTM) program that allows independent prescribing without consultation with a provider. This expanded role for EMPs may optimize outpatient antimicrobial stewardship in the emergency department (ED).

Research Question or Hypothesis: The purpose of this study was to assess the impact of a pharmacist-led CDTM program for culture follow-up on 28-day ED revisit rate.

Study Design: This was an institutional review board-approved retrospective cohort study over a one-year study period comparing six months before and after implementation of the program.

Methods: The primary outcome was 28-day ED revisit rate for the same complaint. Patients included were at least 18 years of age, had a positive microbiology culture obtained during an ED visit, and discharged from the ED. Secondary outcomes were the number and type of interventions made by EMPs, turnaround time from positive culture to EMP review, and microbiology culture and susceptibility data. Statistical analysis included a *P*-value of <0.05 using Fisher's chi-square test and a calculated sample size of 120 patients to meet 80% power for the primary outcome. Descriptive statistics were used for all other outcomes.

Results: A total of 719 patients were included with 287 patients in the pre-implementation group and 432 patients in the post-implementation group. There were 29 (10.1%) ED revisits within 28 days in the pre-implementation group compared to 26 (6.0%) in the post-implementation group. There was a 4.1% decrease in ED revisit rate when EMPs conducted culture follow-up compared to ED providers (P = 0.044). A total of 432 interventions were made by EMPs with 37 (8.6%) requiring an alternative antibiotic prescription sent by EMPs.

Conclusion: The impact of implementing a pharmacist-led CDTM program for culture follow-up was a reduction in 28-day ED revisit rate.

120 | Frequency of blood glucose monitoring following insulin for hyperkalemia

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Introduction: Dextrose is concomitantly administered with insulin when managing patients with hyperkalemia to avoid hypoglycemia. The incidence of hypoglycemia in the first six hours following this regimen remains relatively high and frequent blood glucose monitoring is required to prevent patient harm.

Research Question or Hypothesis: The aim of this study was to evaluate the frequency of blood glucose monitoring following intravenous (IV) insulin plus dextrose for the treatment of hyperkalemia.

Study Design: Single-center retrospective chart review study.

Methods: Following ethical approval, data were obtained by chart review for patients admitted between January-2018 and May-2019. This study included adult patients (≥18 year) with hyperkalemia (K > 5 mEq/mL) who received IV insulin plus dextrose. Patients who did not receive dextrose within 60 minutes of administering insulin were excluded. The primary outcome was the frequency of monitoring the blood glucose level within 6 hours of administering insulin.

Results: A total of 321 episodes of hyperkalemia were available for the analysis. The number of episodes with only one follow-up blood glucose measurement was 102 (31.9%). Moreover, 17 episodes (5.6%) had two follow-up blood glucose measurements and two episodes had three follow-up blood glucose measurements. The remaining 200 episodes had no blood glucose measurement up to six-hour following the regimen (62.3%). The median time of obtaining the first, the second, and the third blood glucose measurements were 3.2 hour (IQR 1.6-4.4 hour), 5.1 hour (IQR 3.3-5.7 hour), and 5 hour respectively. The majority of the follow-up blood glucose measurements were obtained via finger stick (98.7%).

Conclusion: The frequency of monitoring blood glucose level following insulin therapy was low which may indicate a potential lack of awareness about the incidence of hypoglycemia. The results highlighted an urgent need to adopt protocols incorporating frequent monitoring of blood glucose level at regular intervals.

121 | Evaluating the impact and compliance of a hospital driven code sepsis protocol on patient outcomes

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Introduction: Literature has emphasized the importance of early intervention in the treatment of patients with sepsis, and encourages institutions to implement "Sepsis Bundles". It is important for hospitals to assess their own protocols to evaluate their outcomes.

Research Question or Hypothesis: Does the implementation of a Code Sepsis protocol improve compliance to Surviving Sepsis Campaign bundles and improve patient outcomes?

Study Design: Single center, observational retrospective chart review

Methods: This is a retrospective study using data from 324 electronic medical records at an academic community medical center. Patients were divided into two cohorts: pre- and post- Code Sepsis. The primary endpoint to determine if the Code Sepsis protocol impacted patient outcomes was in-hospital mortality. Secondary outcomes included median length of stay and admissions to the intensive care unit. Finally, an analysis was conducted to determine compliance to the protocol, as individual components and as a composite percentage score.

Results: Of the 324 patients examined in this retrospective chart review, mortality during hospital length of stay was 19.5% in the pre-Code Sepsis group and 16.6% in the post-Code Sepsis group ($P = 0.496$). Median length of stay did not differ significantly between pre-Code Sepsis and post-Code Sepsis patients (9.4 days vs. 7 days, $P = 0.190$), nor did rate of ICU admissions (36.6% vs. 30.8%, $P = 0.268$). The composite endpoint of percentage of patients with complete compliance to all components of the sepsis bundle increased significantly in the post-Code Sepsis group (21.1% vs. 47%, $P < 0.05$).

Conclusion: Despite significantly increased compliance to sepsis bundles via the implementation of a Code Sepsis tool at our hospital, there was no difference in patient mortality or hospital length of stay. Further studies at our institution could examine if a more stringent Code Sepsis protocol would have a greater impact on bundle compliance and patient outcomes.

122 | Asthma relapse visits associated with use of dexamethasone vs. prednisone/prednisolone at a pediatric emergency department

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Introduction: Systemic corticosteroids during acute asthma exacerbations reduce emergency department (ED) relapses. Studies have shown that dexamethasone may be as effective as prednisolone/prednisone/methylprednisolone (hereby referred to as prednisolone) in reducing ED relapses. We changed our clinical practice guideline (CPG) in April 2018 to recommend dexamethasone instead of prednisolone for acute asthma exacerbations.

Research Question or Hypothesis: Are ED asthma relapse rates similar at our institution after the CPG change in steroid recommendation?

Study Design: Retrospective chart review

Methods: We examined ED visits from 1/1/17 through 5/15/19, involving patients' ≤21 years old with a discharge diagnosis of asthma, ≥1 dose of albuterol and a systemic steroid. We excluded patients that received both prednisolone and dexamethasone from analysis. Primary outcome measure was relapse visits to our institution within 7 days after discharge. Secondary outcomes included number of prescriptions for second dose of dexamethasone and associated relapse visits. Relapses were compared using interrupted time series (ITS) and regression analysis.

Results: Our study sample included 2225 visits, of which 41 received both dexamethasone and prednisolone; leaving 2184 visits for analysis; with 1133 (51.9%) visits before and 1051 (48.1%) visits after the CPG change. Before the CPG change, 84.3% patients received prednisolone; whereas 85.5% patients received dexamethasone after the CPG change. Relapse rates before and after the change were similar within 3 days (2.8% v 3.4%, $P = 0.42$) and within 7 days (3.8% v 4.4%, $P = 0.49$) after discharge respectively. ITS analysis showed no difference in relapse rates before and after the CPG change. Of the 899 visits with dexamethasone, 215 (24%) involved a prescription for a second dose of dexamethasone. For visits with a prescription for second dose of dexamethasone, the relapse rates within 3 days and within 7 days after discharge were similar to visits without the prescription.

Conclusion: In our study, ED asthma relapse rates are similar after the CPG change in steroid recommendation.

123 | Pharmacologic treatment of renal colic in the emergency department: A multi-center cohort analysis

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Introduction: Renal colic is a common pain condition seen in the emergency department (ED). Nonsteroidal anti-inflammatory drugs (NSAIDs) are superior to opioids in reduction of renal colic pain, while also potentially reducing exposure to opioids, both in the ED and after discharge.

Research Question or Hypothesis: To determine if patients who receive NSAIDs as first therapy in the ED for renal colic have reduced opioid use upon discharge.

Study Design: Multi-center retrospective cohort analysis.

Methods: Adult patients were included if they (1) had an ICD-10 diagnosis code for renal colic, (2) visited one of 15 EDs in Western Pennsylvania between 2016-2018, and (3) received analgesics in the ED. Data extracted included demographic, medication(s) administration records, visual analog pain scores, and adverse effects. Patients were stratified into three separate groups, based on whether they received NSAIDs first, opioids first, or a combination of NSAID and opioid for initial treatment. The primary outcome was the proportion of patients discharged from the ED on an opioid. Chi-square and analysis of variance (ANOVA) tests were utilized for categorical and continuous variable comparisons, respectively.

Results: A total of 807 patients were reviewed and 368 patients were included. A total of 152 (41.3%) received an opioid first, 128 (32.8%) received an NSAID first and 88 (23.9%) received an opioid/NSAID together. On average, patients were approximately 45 years old, and presented with an initial pain score of eight. A total of 123 (80.9%), 81 (63.3%), and 73 (83.0%) patients were discharged with an opioid across three groups, respectively (P = 0.00048). The average change in pain score after the first treatment was larger for patients receiving combination therapy over opioids or NSAIDs alone (P = 0.0002).

Conclusion: Patients who received an opioid as part of their primary therapy for renal colic were more likely to receive an opioid prescription when discharged home.

124 | Potentially inappropriate medication use in older adults at a tertiary academic medical center emergency department

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Introduction: Older adults are at risk for adverse drug events and poor health outcomes due to multiple comorbidities and medications, altered pharmacokinetics, and changes in physiological responses. The American Geriatrics Society publishes a list of potentially inappropriate medications (PIMs) for older adults: the Beers Criteria. The use of PIMs in older adults is associated with poorer outcomes and increased healthcare costs and resource utilization. We sought to further investigate PIM use and prescribing in older adults presenting to the emergency department (ED) at our institution.

Research Question or Hypothesis: To evaluate the use of PIMs in older adults who present to the ED.

Study Design: Single-center, retrospective observational study

Methods: A random sample of patient electronic medical records from March 2017 to August 2017 were reviewed. Patients 65-89 years old who presented to a tertiary academic medical center ED and discharged to home or an outpatient facility were included. The primary outcome was the number of PIMs administered in the ED. Secondary outcomes included PIMs prescribed at ED discharge, ED length of stay (LOS), ED readmission rates, and hospital admission rates. Descriptive statistics were used.

Results: 202 ED visits were included in the final analysis. The median age was 72 years (range: 65-88 years). 67 Beers list medications were administered in the ED and 14 prescriptions for Beers list medications were written for at ED discharge. The median ED LOS was 215 minutes (range 23 -1,843 minutes). 55 patients (27%) were readmitted to the ED within 30 days of the evaluated visit and 19 patients (9%) were admitted to the hospital.

Conclusion: The results of this study imply improvement is needed with PIM prescribing in the ED at our institution. Further analysis of the association between medications and repeat ED visits/admissions is needed.

125 | Anticoagulation in atrial fibrillation at emergency department discharge

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Introduction: Atrial fibrillation (AF) affects approximately 2.7 to 6.1 million people in the United States and increases a person's lifetime stroke risk by four to five times. The AHA/ACC/HRS guidelines for Antithrombotic Therapy for AF recommends oral anticoagulation therapy to be considered for patients with a $CHADS_2$ or CHA_2DS_2-VASc score ≥ 1. However, a majority of patients discharged from the Emergency Department (ED) are not regularly discharged on proper anticoagulation.

Research Question or Hypothesis: To evaluate the impact of receipt of a prescription for oral anticoagulants at ED discharge in patients with new onset AF.

Study Design: A retrospective cohort study in a single community hospital.

Methods: We included patients who presented to the ED October 1, 2015-June 30, 2016 and received a diagnosis of new onset AF. The primary outcome of this study was to determine the incidence of oral anticoagulation in patients discharged from the ED at 3, 6, and 12 months' post-discharge.

Results: A total of 25 patients were included in the study. Baseline characteristics included a mean age of 72.5 years, 64% were female. For the primary outcome, 12% of patients were given a prescription for oral anticoagulation at discharge while 88% were not. At 3 months, of those who did receive a prescription at discharge, 33% picked up their oral anticoagulation versus 9% of those who did not receive a prescription (95% CI -0.304-0.789; P = 0.33). At 6 months, 67% picked up their oral anticoagulation versus 14% (95% CI -0.022-1; P = 0.091), and at 12 months, 100% had picked up their oral anticoagulation versus 22% (95% CI 0.598-0.948; P = 0.024) respectively.

Conclusion: Our study shows that patients diagnosed with new onset AF who receive an anticoagulation prescription from the ED may have an increased propensity to fill it in the following year.

126 | Evaluation of burnout syndrome among emergency medicine pharmacists

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Introduction: Burnout syndrome (BOS) is a prolonged response to chronic emotional and interpersonal stressors and becoming an increasing concern in the medical community. BOS in emergency medicine pharmacists (EMPs) has not been previously assessed.

Research Question or Hypothesis: What is the prevalence of BOS in EMPs and, if present, what demographic, professional, seasonal, and job-related correlations exist?

Study Design: Cross-sectional descriptive survey study.

Methods: Pharmacists practicing ≥50% of their time in the EM setting were invited through the ACCP EMED PRN listserv to complete an electronic REDCap survey at three different, four-week, time periods (July 2018, October 2018, April 2019). The survey contained the Maslach Burnout Inventory™ for Medical Personnel to detect burnout, in addition to questions targeting demographic, professional & personal characteristics. July 2018 results were presented at the 2019 ACCP Virtual Poster Session. Descriptive statistics were used to describe each population and Chi-square analysis and Spearman's Rank Order correlation were employed to identify correlations.

Results: A total of 534 surveys were completed across all periods (116 [July], 207 [October], 161 [April]) and response rates were 18.4%, 31.6%, 22.7%, respectively. BOS was identified in 69.8%, 57%, and 61.5% of respondents with no difference between periods. Preliminary analysis shows no association with BOS in demographics such as age, marital status, and career length with the exception of a positive correlation with board certification and post-graduate residency training (April). Prospective order verification (October) and difficult pharmacist colleagues (October, April) correlated positively with burnout. A positive correlation with alcohol use was noted (October, April).

Conclusion: Burnout is prevalent in a majority of EMPs throughout the year. Several statistically significant positive correlations with BOS were identified and require further investigation to identify effective strategies to address BOS.

127 | Evaluation of the blood pressure effect of diltiazem versus metoprolol in the acute treatment of atrial fibrillation with rapid ventricular rate

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Introduction: Atrial fibrillation with rapid ventricular rate (AF with RVR) is frequently treated in the emergency department (ED) with rate controlling medications that may additionally affect patients' hemodynamics.

Research Question or Hypothesis: There is no difference in blood pressure effect of diltiazem intravenous push (IVP) and metoprolol IVP in the acute management of AF with RVR.

Study Design: Retrospective cohort study.

Methods: Adults who presented to the ED between January 2012 and September 2018 in AF with RVR and received either diltiazem IVP or metoprolol IVP for rate control. Primary outcome was change in systolic blood pressure (SBP) within one hour of medication administration. Secondary outcomes included number of repeat doses within one hour, rate control to less than 110 beats per minute, and SBP less than 90 mmHg or decrease by at least 40% within three hours. Subgroup analysis of patients with a baseline SBP less than 110 mmHg was conducted. Continuous variables were reported as medians with interquartile ranges and compared with the Mann-Whitney U test. An a priori P-value <0.05 was selected as the threshold for statistical significance.

Results: Of the 160 patients included, 80 received diltiazem and 80 metoprolol. The primary outcome of median change in SBP at one hour showed a reduction of 9 [-21 to 6] mmHg in the diltiazem group versus a reduction of 4 [-18 to 9] mmHg in the metoprolol group (P = 0.102). There were no differences in the secondary outcomes between groups. Subgroup analysis (n = 28) of patients with a baseline SBP less than 110 mmHg demonstrated an increase of 7 [-0.25 to 19] mmHg in the diltiazem group versus increase of 7 [0 to 13] in the metoprolol group (P = 0.910).

Conclusion: There was no difference observed in the blood pressure effect of diltiazem versus metoprolol in the acute management of AF with RVR.

128 | Evaluation of sepsis 1-hour bundle in the emergency department

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Introduction: Surviving Sepsis Campaign released a 1-hour sepsis treatment bundle because rapid administration of antimicrobial

therapy was associated with reduced mortality. This recommendation has received criticism because of lack of supporting evidence and potential harm. There is a paucity of literature evaluating the implementation of the 1-hour bundle and its impact.

Research Question or Hypothesis: Implementation of the sepsis 1-hour bundle in the emergency department improves patient outcomes.

Study Design: This is a retrospective, single-center, observational cohort study.

Methods: Patients were identified via a random selection of patients with severe sepsis or septic shock ICD-10 codes using a reporting system. Patients included were over 18 years of age with appropriate ICD-10 codes between October 1, 2018 and December 31, 2018. Patients excluded were those transferred in or out of our facility or met defined sepsis criteria outside the emergency department. The primary endpoint was a composite of in-hospital mortality, vasopressor requirements, and suboptimal lactate clearance. Secondary endpoints include each primary endpoint component, ICU and hospital lengths of stay, ventilator requirement, and 30-day readmissions.

Results: The study included 42 patients in the passed and 82 in the failed SEP-1 groups. Patients in the failed group were younger (70.2 vs. 63.9 years, $P = 0.033$) with worse initial renal function (SCr 1.5 vs. 2.7 mg/dL, $P = 0.021$). Although not statistically different, the failed group presented as an overall sicker group with higher lactate (3.2 vs. 3.6), lower mean arterial pressure (84 vs. 81.3 mmHg), and higher SOFA score (3.5 vs. 4.6). The primary composite outcome was not significant occurring in 54.8% of the passed SEP-1 group and 53.7% of the failed SEP-1 group. Secondary outcomes were worse in the failed group but showed no statistical differences.

Conclusion: This study showed that implementation of the 1-hour bundle in the emergency department does not statistically improve patient outcomes.

129 | Time to active Gram-negative antibiotic coverage for severe sepsis and septic shock in patients with and without a reported penicillin allergy: A retrospective cohort study

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Introduction: Early empiric antibiotic therapy is crucial in critically ill patients including those with severe sepsis and septic shock, as delays greater than one hour have been shown to increase mortality. Few studies have assessed the impact of penicillin allergies on time to administration of appropriate empiric antibiotic therapy in patients with severe sepsis and septic shock.

Research Question or Hypothesis: Does a penicillin allergy label impact the time to active antibiotic administration amongst patients in the emergency department (ED) or intensive care unit (ICU) diagnosed with severe sepsis or septic shock with documented Gram-negative bacteremia?

Study Design: Single-center retrospective cohort study of ED and ICU patients

Methods: Consecutive ED and ICU patients with severe sepsis or septic shock and Gram-negative bacteremia from 2015 to 2018 were assessed for inclusion in the study. The primary endpoint was the proportion of patients who received an antibiotic with active Gram-negative coverage within 60 minutes of their first positive blood culture draw. Secondary outcomes included time to administration of any and active Gram-negative coverage from first positive blood culture draw, 30-day in hospital mortality, hospital and ICU length of stay, and total duration of antibiotics.

Results: A total of 115 patients (penicillin allergy = 22, non-penicillin allergy = 93) were included in the study. No differences in baseline characteristics between the two groups were observed. Time to active Gram-negative coverage within 60 minutes occurred 50% and 48.4% ($P = 1$) and the median time to active Gram-negative coverage was 70.5 minutes vs 55 minutes ($P = 0.21$) in the penicillin allergy and non-penicillin allergy groups, respectively. The most common organism for bacteremia was *Escherichia coli*.

Conclusion: In patients with and without a penicillin allergy, no statistically significant difference was identified in the proportion of patients who received active Gram-negative coverage within 60 minutes.

130 | Predictors for extended spectrum beta-lactamase producing organisms in urine cultures of emergency department patients: An exploratory analysis

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Introduction: Recent increasing prevalence of extended spectrum beta-lactamase producing Enterobacteriaceae (ESBLE) in urinary tract infections (UTI) places patients at risk for inadequate empiric therapy. In a recent emergency department (ED) study, over 5% of UTIs were secondary to ESBLE, with nearly half of patients having no identifiable risk factor and 80% receiving discordant empiric antimicrobial therapy. More reliable identification of risk factors for ESBLE UTI in the ED is needed to better direct empiric pharmacotherapy.
Research Question or Hypothesis: What are potential unidentified risk factors for ESBLE in urinary cultures drawn in the ED?
Study Design: Single-center retrospective cohort study
Methods: Medical records of patients in whom a urine culture was collected during an ED visit from 2015-2018 were reviewed. Adult patients with Enterobacteriaceae UTI were included. Data collected included: culture and susceptibility data, patient demographics, past medical and surgical history, recent or current immunotherapy, recent infectious and antimicrobial therapy history, and antimicrobial agent prescribed for acute UTI treatment. The primary endpoint was the identification of characteristics associated with ESBLE urine cultures.
Results: Of 466 patients included, 76 were ESBLE positive and 390 were ESBLE negative. Statistically significant differences in characteristics were chronic kidney disease, cardiovascular disease, kidney transplant, history of ESBLE infection, any surgery within 90 days, genitourinary surgery within 30 days, presence of nephrostomy tubes, hospital admission within one year, oral antibiotic use within one year, intravenous antibiotic use within 30 days, failure of initial antibiotic therapy, and immunosuppressant use within 30 days. Forty percent of patients with ESBLE UTI required antimicrobial therapy modification, compared to 6% in non-ESBLE patients.
Conclusion: Several statistically significant differences and higher rates of discordant empiric antimicrobial therapy were identified in the ESBL positive vs ESBL negative group

131 | Evaluation of cefazolin with gentamicin compared to extended-spectrum beta-lactam therapy for grade III open fracture prophylaxis

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Introduction: Open fractures are a major source of morbidity after trauma, often leading to infection, chronic osteomyelitis, and amputation. The Eastern Association for the Surgery of Trauma guidelines recommend initiating systemic antibiotic therapy with targeted Gram-positive and Gram-negative coverage as soon as possible in grade III open fractures.
Research Question or Hypothesis: Is there a difference in efficacy and safety between cefazolin with gentamicin and an extended-spectrum β-lactam for antibiotic prophylaxis in grade III open fractures?
Study Design: Retrospective cohort analysis
Methods: Patients ≥18 years who received cefazolin with gentamicin or an extended-spectrum β-lactam for grade III open fracture prophylaxis between June 2015 and February 2019 were screened for inclusion. Patients with chronic kidney disease, an active infection upon admission, and/or who were immunocompromised were excluded. The major endpoint was the incidence of surgical site infection (SSI) at 30 days. Minor endpoints included the incidence of SSI at 1 year, duration of antibiotic therapy and mortality. Safety endpoints were the incidence of acute kidney injury (AKI) and time to the administration. Fisher's exact test was used for categorical data and Mann-Whitney U test for continuous data.
Results: Forty-one patients were included in the analysis; 22 received cefazolin with gentamicin and 19 received an extended-spectrum β-lactam. There was no significant difference in the incidence of SSI at 30 days (15.7% with cefazolin and gentamicin vs 18.7% with an extended-spectrum β-lactam, $P = 1$), AKI or any of the minor outcomes. The median time from presentation to the administration was 218 minutes for cefazolin with gentamicin and 126.5 minutes for an extended-spectrum β-lactam ($P = 0.52$).
Conclusion: The use of cefazolin with gentamicin compared to an extended-spectrum β-lactam resulted in similar rates of SSI with no difference in the incidence of AKI. Further studies are needed to determine the best prophylaxis regimen in this patient population.

Endocrinology

132 | Predicting insulin dosing patterns after bariatric surgery

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Introduction: The American Diabetes Association estimates that 1.5 million Americans are newly diagnosed with diabetes every year. While the pathophysiology of type 2 diabetes mellitus (T2DM) is complex, the leading causes are increasing weight and obesity. Bariatric surgery is a successful treatment option endorsed by several guidelines because the procedure results in decreases in weight and A1c. There is limited data available on how bariatric surgery affects insulin dosing.
Research Question or Hypothesis: Is there a predictable pattern of insulin dosing post-bariatric surgery?
Study Design: Retrospective cohort

Methods: Individuals, age 18-89 years, with type 1 or 2 diabetes who underwent Roux-en-Y Gastric Bypass or laparoscopic sleeve gastrectomy (LVSG) at MercyOne West Des Moines and followed up at MercyOne Des Moines Endocrinology Care between March 1, 2012-September 30, 2018, were included. The primary outcome was the difference between the total daily units of insulin from the pre-operative period to 12 months post-surgery. Data post-op and at 3 and 6 months, as well as weight and A1c values were also collected. Paired t-tests were used to analyze the primary and secondary outcomes.

Results: Subjects (n = 39) were an average of 53 +/- 9.9 years of age with 92% having T2DM and 90% undergoing LVSG. The average insulin daily dose pre-operatively was 124.6 +/- 67.7 units. There was a decrease in insulin dosing from the preoperative period of 62% (mean 47.9 +/- 61.9 units), 68% (mean 40.1 + 59.9 units), and 74% (mean 32.7 +/- 51.2 units) at months 3, 6, and 12, respectively ($P < 0.001$ for all comparisons). The average weight decreased from baseline by 13%, 18%, and 19% at months 3, 6, and 12, respectively ($P < 0.001$ for all comparisons).

Conclusion: There were consistent and statistically significant decreases in insulin requirements and weight over a 12-month period following bariatric surgery in obese individuals with diabetes.

133 | Evaluation of dosing in patients undergoing conversion from insulin glargine (Lantus) to insulin glargine (Basaglar)

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Introduction: Basaglar, an insulin glargine follow-on biologic, was developed after the patent for Lantus expired in 2015. Several trials have shown similar efficacy and safety between each agent, but there are limited comparisons in real-world settings.

Research Question or Hypothesis: Are Basaglar and Lantus comparable in a real-world setting?

Study Design: multicenter, retrospective cohort study

Methods: Adult patients with type 1 or type 2 diabetes mellitus (T2DM) who were converted from Lantus to Basaglar were included. The primary outcome compared mean basal insulin dose (units/day) from the date of conversion to 6 months. Basal insulin and total daily insulin doses were also compared from baseline to 3- and 12-months post-conversion, as well as change in A1c, body weight, and estimated monthly acquisition costs of basal insulin. Paired t-tests were used to analyze the primary and secondary outcomes.

Results: Of the 225 patients included, 56% were male, 81% had T2DM, and 70% had diabetes for 10 years or more. The mean conversion dose (units/day) of Lantus was 46.3 + 32.7. There was no significant difference in the mean Basaglar dose (units/day) at 6 months (45.9 + 33.5; $P = 0.52$), nor was there a statistical difference at 3- or 12-months. There were no significant differences in change in A1c at 3, 6, and 12 months. There was a small decrease in weight of 0.6 kg from conversion to 6 months ($P = 0.01$), though this difference was not significant at 3- and 12-months. The estimated monthly acquisition cost of Basaglar was significantly less expensive than Lantus at conversion and 6 months ($286/$290 vs. $341/$351, $P < 0.001$ for all comparisons).

Conclusion: The results of this retrospective, cohort study suggest that Basaglar compares favorably to Lantus with regards to clinical outcomes in a real-world setting, and may be a preferable option in a value-based healthcare environment.

134 | Impact of pharmacist-driven professional continuous glucose Monitoring in adults with uncontrolled diabetes: A retrospective cohort study

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Introduction: Continuous glucose monitoring (CGM) is one approach to measuring glycemia, but the ideal method of implementation is unknown. The expansion of clinical pharmacy allows pharmacists to be at the forefront of implementing this technology, but literature on the impact of pharmacist-driven professional CGM (prof-CGM) is lacking.

Research Question or Hypothesis: Implementation of prof-CGM by a clinical pharmacist will lead to improved hemoglobin A1c (HbA1C) within a six-month follow-up period compared to physician-driven implementation.

Study Design: Retrospective single-center cohort study

Methods: Adults identified via CPT code 95250 or 95251 undergoing prof-CGM with CGM data available for interpretation were included. Patients with additional CGM use within the six-month follow-up period were excluded. Data collection included baseline HbA1c, CGM-associated interventions, and HbA1c during the six-month follow-up period. Patients were categorized as pharmacist-driven (RPh) or physician-driven (MD). RPh patients were further classified as having one (RPh1) or two (RPh2) encounters for CGM data analysis. The primary outcome was change in HbA1c from baseline to six months. Data was analyzed via pairwise independent sample t-tests using R statistical software.

Results: Of 378 patient charts reviewed, 315 met inclusion criteria: 58 RPh1, 35 RPh2, and 222 MD. For patients with follow-up HbA1c data (52 RPh1, 30 RPh2, and 171 MD), mean reduction from baseline to 6 months was 0.97%, 1.31%, and 0.56%, respectively (baseline

HbA1c 8.38%, 8.84%, and 9.11%, respectively). RPh patients experienced greater mean reduction in HbA1c compared to MD (P = 0.002). RPh2 patients had statistically significantly greater reductions compared to MD (P = 0.005) but not compared to RPh1 (P = 0.054). Number of CGM-associated pharmacotherapeutic interventions was 1.33 for RPh1 patients, 1.63 for RPh2 patients at the first encounter and 1.34 at the second, and 1.17 for MD patients.

Conclusion: Pharmacist-driven implementation of prof-CGM yielded greater reductions in HbA1c and more pharmacotherapeutic interventions compared to physician-driven implementation.

135 | Vitamin D testing and replacement patterns among adults in a large medical center

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Introduction: Hype in 25-hydroxyvitamin D (25OHD) testing, driven by studies linking vitamin D (VD) deficiency with many diseases has been challenged due to cost and uncertain health benefits. Knowledge of current practices in VD testing and replacement patterns can inform development of strategies to ensure judicious testing.

Research Question or Hypothesis: To assess trends in 25OHD testing and appropriateness, VD status change, VD regimens prescribed, and factors associated with reaching sufficient levels at retest.

Study Design: Single center retrospective large data analysis study in Singapore General Hospital.

Methods: Data (25OHD tests, patient demographics, co-morbidities and medications) were electronically extracted from 2011 to 2016. Risk conditions for 25OHD testing according to American Endocrine Society were identified. Linear regression and chi-square test were used to compare annual change for continuous and categorical variables respectively. McNemar test was used to compare VD status change at retest between adults with low (25OHD <30 ng/mL) and sufficient (25OHD ≥30 ng/mL) baseline levels. Multivariate logistic regression was used to identify factors associated with achieving sufficient levels.

Results: Total of 25,502 25OHD tests were performed in 15,605 adults. Annual tests increased 3.4 fold from 2,125 to 7,236 tests in 2012 and 2016 (P < 0.05). Almost 81% of adults had risk conditions, which included chronic kidney disease (57.6%) and fractures (29.6%). Among 4,120 adults with repeated tests, VD status didn't change significantly between adults with baseline low and sufficient levels (P = 0.26). Prescribed VD regimens included VD products at doses <800 units/day (42.1%) and cholecalciferol 1,000 units/day (32.1%). Factors with higher odds in achieving retest sufficient levels were adults with no risk conditions (OR 1.29, CI 1.03-1.62, P = 0.03) and high VD doses (>1,000 units/day) (OR 1.23, CI 1.003-1.51, P = 0.05).

Conclusion: There was an uptrend in 25OHD tests over time. While adults were aptly tested, VD status didn't improve with repeated testing. High VD doses and no risk conditions were associated with achieving sufficient levels.

Gastroenterology

136 | Real world impact of acid suppressive therapy on hepatitis C treatment with ledipasvir/sofosbuvir

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Introduction: Prescribing information for hepatitis C virus (HCV) treatment, ledipasvir/sofosbuvir, provides specific dosing and administration recommendations for concomitant acid suppressive agents. These recommendations are based on pharmacokinetic studies in healthy volunteers in which solubility of ledipasvir decreased with increasing gastric pH resulting in decreased serum levels of ledipasvir. There is limited data on the impact of acid suppressive therapy taken with ledipasvir/sofosbuvir on HCV treatment cure rates, defined as sustained virological response (HCV RNA below the lower limit of quantification) 12 weeks post-treatment (SVR12).

Research Question or Hypothesis: The purpose of this study is to compare SVR12 rates in patients treated for HCV infection with ledipasvir/sofosbuvir with concomitant acid suppressive therapy versus those not taking concomitant acid suppressive therapy.

Study Design: This was a retrospective chart review of patients who completed ledipasvir/sofosbuvir with or without ribavirin for treatment of HCV. All patients received face to face education and monitoring before and during HCV treatment by a clinical pharmacist that specifically addressed dose and administration timing of ledipasvir/sofosbuvir with acid suppressive therapy.

Methods: Computerized patient records were reviewed to determine HCV treatment and duration, concomitant acid suppressive medication and dose, and SVR12 rates. Chi square was used to compare rates of SVR12 in patients taking concomitant acid suppressive therapy with patients not taking concomitant acid suppressive therapy.

Results: There were 364 patients with HCV viral load results at least 12 weeks after treatment with ledipasvir/sofosbuvir with or without ribavirin. A total of 141 patients were receiving acid suppressive therapy. The SVR12 rate among patients receiving acid suppressive therapy was 92.2% (130/141) compared to an SVR12 rate of 97.3% (217/223) among patients not receiving any acid suppressive therapy (P = 0.026).

Conclusion: Acid suppressive therapy taken with ledipasvir/sofosbuvir negatively impacts HCV cure rates, even when dosing and administration times are confirmed through face to face education.

137 | Duration of Proton Pump Inhibitors PPIs for the treatment of Helicobacter Pylori induced peptic ulcer: A review of local practice

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Introduction: *Helicobacter pylori* (*H. pylori*) infection is associated with risk of peptic ulcer, gastric cancer, and gastric mucosa-associated lymphoid tissue lymphoma; thus eradication regimens remain a great concern globally. Treating H. pylori infection with a combination of antibiotics and Proton Pump Inhibitors (PPIs) can effectively heal peptic ulcer disease and prevent recurrence. Several international organizations consistently recommend 14 days treatment duration for healing of H.pylori induced uncomplicated duodenal ulcer or gastric ulcers <1 cm in diameter. Variations in management often accounts for extended PPI duration and thus potentially higher costs and long-term complications.

Research Question or Hypothesis: The aim of this review was to evaluate the appropriateness of PPI treatment duration as part of *H. pylori* eradication regimens, in accordance with local and international clinical guidelines

Study Design: Retrospective chart-review in a single-center secondary hospital

Methods: A list of Patients who received PPIs as part of *H. pylori* eradication therapy from Sep, 2018 to Dec, 2018 was generated using endoscopy unit patients registry. Patients' electronic health records were reviewed retrospectively. The review focused on the following domains: existence of bleeding, gastric obstruction, duration of therapy and concomitant use of medications associated with risk of gastrointestinal bleeding. IBM SPSS, Version 22 was used for statistical analyses

Conclusion: These results reflect a need for increasing compliance to local and international clinical guidelines. Further education will be reinforced by sharing an evidence-based statement with concerned prescribes grand-rounds on targeted topics and educational handouts.

138 | Evaluating a pharmacist-driven protocol for the treatment of opioid-induced constipation

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Introduction: Opioid-induced constipation (OIC) treatment guidelines recommend over-the-counter laxatives as first-line therapy, followed by treatment with a peripherally-acting mu-opioid receptor antagonist (PAMORA) in refractory patients. To promote guideline-based practice, a pharmacist-driven protocol was implemented at a large community teaching hospital. This novel study evaluated the ability of the protocol to promote increased scheduled laxative use prior to escalation to PAMORA therapy in patients with OIC.

Research Question or Hypothesis: Does a pharmacist-driven OIC protocol promote appropriate scheduled laxative use?

Study Design: Retrospective, single-center cohort

Methods: Patients ≥18 years of age who had taken opioids within 48-hours of laxative/PAMORA administration and received ≥ one inpatient dose of naloxegol or methylnaltrexone were included. Two years pre- and post-protocol implementation were evaluated. The primary outcome was the difference in the percentage of patients receiving two scheduled laxatives prior to PAMORA therapy pre- and post-protocol. Secondary outcomes included time to first bowel movement after PAMORA initiation and difference in total number of laxative/PAMORA doses administered. Data was analyzed using chi-squared tests and Student's t-tests.

Results: Three-hundred patients were included (150 patients in the pre- and post-protocol groups each). The majority of patients received morphine, oxycodone, and fentanyl during admission with no difference in mean oral morphine equivalents (177.1 mg vs 190 mg, $P = 0.829$). In the pre-protocol group, 53 patients (35%) received two scheduled laxatives for two days prior to naloxegol/methylnaltrexone compared to 96 patients (64%) in the post-protocol group ($P < 0.0001$). One-thousand twenty-one scheduled laxative doses were given pre-protocol versus 1625 doses post-protocol ($P = 0.001$). Average time to first bowel movement was similar between groups (17.7 hours vs 16.0 hours, $P = 0.441$).

Conclusion: A pharmacist-driven OIC protocol is associated with an increase in use of scheduled laxatives prior to PAMORA administration. This is consistent with promotion of guideline-based practice, though a larger, prospective study is necessary to assess if this leads to faster/more effective OIC resolution.

Geriatrics

139 | Pharmacist-led pilot targeting high-risk older adults after emergency department discharge in an academic medical center

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Introduction: After an emergency department (ED) visit, older adults are at elevated risk for repeat ED visits/hospitalizations. Scripted, nursing-led transition of care interventions have been ineffective at reducing negative outcomes after ED discharge, perhaps because they have not targeted the highest-risk patients or involved substantial clinical assessments.

Research Question or Hypothesis: Does implementation of a clinical pharmacist-led phone intervention reduce the 30-day incidence of repeat ED visits, hospitalizations, or death among a cohort of "high-risk" older adults compared to a historical control cohort with similar high-risk characteristics?

Study Design: Retrospective, cohort study of patients with ED visits prior to and during a pharmacist-led transition of care intervention

Methods: This intervention was implemented for University of Colorado Health older adults with an ED visit between 8/18/18-2/19/19. Outcomes for these patients were compared to a pre-intervention group with ED visits between 8/18/17-2/19/18. Included patients were at high risk for readmission, defined as presence of chronic obstructive pulmonary disease, heart failure or at least one additional ED visit in the previous 6 months. The composite primary outcome was the proportion of patients with at least 1 repeat ED visit/hospitalization/death within 30 days of discharge. The unadjusted primary outcome was evaluated using chi-square (SAS version 9.4).

Results: 134 high-risk patients were identified during the 6-month intervention period compared with 162 patients in the historical group. The primary outcome occurred in 25% of intervention patients compared to 24% of historical control patients (P = 0.82). A return ED visit within 30 days occurred in 19% of intervention patients versus 15% in the control group (P = 0.46); 9% of patients were hospitalized within 30 days in each group (P = 0.93); and death at 30 days was rare and did not differ between groups.

Conclusion: After 6 months of the pilot intervention, no difference was found in the 30-day primary outcome rate for high-risk older adults discharged from the ED.

140 | Anticholinergic burden and increased risks of cognitive impairment in older adults

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Introduction: Studies reveal that ~10-27% of older adults chronically use anticholinergic medications. Increased cumulative burden anticholinergic burden scores are associated with increased risks of dementia. The mechanisms by which anticholinergic drugs negatively impact cognition remain elusive. However, researchers speculate that the drug's impairment in cholinergic neuron promotes neuroinflammation.

Research Question or Hypothesis: We hypothesize that drugs with anticholinergic properties will induce inflammation in the brain. MCP1 and IL-6 are chemokines that contribute to neuroinflammation. We investigated the influence of the anticholinergic drug diphenhydramine on the production of MCP1 and IL-6 in normal human astrocytes.

Study Design: Cell culture.

Methods: Normal Human Astrocytes were cultured (seeded at 5,000 cells/cm2) and treated with a clinically relevant concentration of diphenhydramine (66 ng/mL). MCP1 and IL-6 protein production were measured from cell culture supernates by ELISA. Statistical analyses were performed via T-test.

Results: We observed a 10% non-statistically significant decrease in MCP 1 protein production. (mean ± SEM: 3866 ± 49.73 pg/mg vs 3200 ± 327.1 pg/mg, P=NS). However, we observed a statistically significant 20% decrease in IL 6 protein (mean ± SEM: 85.45 ± 3.78 pg/mg vs 68.65 ± 1.94 pg/mg, P = 0.029). Our results suggest that diphenhydramine may have some anti-inflammatory properties within this subset of cells from the human brain.

Conclusion: Drugs with anticholinergic properties are generally considered to be pro-inflammatory. However, our data suggest that diphenhydramine possesses anti-inflammatory properties. Therefore, this preliminary data suggests the possibility of pathological mechanisms of anticholinergic medications with dementia that may not be associated with inflammation. Further evaluation of the effects of anticholinergic drugs in the human brain is warranted.

141 | SAFE—home opioid management education in older adults: Naloxone awareness program

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Introduction: Older adults are among those at the highest risk the opioid epidemic with 9-fold prescription increases between 1995-2010. Naloxone is effective at reducing mortality due to opioid overdose. In Illinois, opioid overdose commonly occurs in rural areas where there is a lack of naloxone access from low numbers of distribution centers and low physician coprescribing. The SAFE-HOME Naloxone Awareness Initiative utilizes home health care coordinators to educate older adults prescribed opioids on safe access to and use of naloxone.

Research Question or Hypothesis: We hypothesize by utilizing care coordinators as physician extenders to educate older adults in their

homes about opioids and naloxone, it will increase older adult knowledge of opioid risks and effective use of naloxone.

Study Design: Prospective, interventional design

Methods: Education tools for opioid risks in older adults and naloxone use were developed and vetted for low literacy levels with corresponding pre-and post-education questionnaires. Home health care coordinators administered the education and questionnaires to patients 65 years and older who were prescribed opioids. Outcomes included baseline knowledge level, change in knowledge level after education and care coordinator assessment of patient knowledge.

Results: The average patient pre-education questionnaire score was 37.3% (n = 45). The average post-education questionnaire score was 90.8% (n = 39). Of the thirty-five older adult participants who completed the full study, the average change in score was +51.1% ($P < 0.00001$). Prior to patient education, care coordinators believed that their patients did not know what naloxone is or how to get naloxone (72.7% and 81.8%, respectively).

Conclusion: Using well-trained care coordinators as physician extenders to directly educate older adults on the facts of opioids and naloxone significantly increases knowledge of older adults prescribed chronic opioids.

142 | Prediction of annual alveolar bone loss in older adults taking oral bisphosphonate: A case control study

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Introduction: Periodontitis is highly prevalent in older adult, it can result in the destruction of alveolar bone and ultimately tooth loss. Oral bisphosphonates (OBIS) are commonly prescribed for osteoporosis in older adults they hinder calcification and suppress bone resorption. It was considered that OBIS intake may prevent even alveolar bone loss, stimulate new bone formation and reduce tooth loss. Data regarding the clinical implications of this relationship is limited.

Research Question or Hypothesis: Older adults taking BIS have less alveolar bone loss compared to those who do not take OBIS

Study Design: single center, retrospective, case control study

Methods: Using institution's electronic medical records, adults ³ 65 years old, taking BIS, and have ³ 2 dental radiographs over 2 years were included. Twenty-six patients were identified and matched with 26 patients who are not taking OBIS. The primary outcome is the difference in alveolar bone level in mL at follow up visits compared to baseline. Periodontitis was classified according to the American Academy of Periodontology case definition. Linear mixed-effects model was conducted to adjust for confounding variables. Results: Fifty-two subjects were included. Mean age was 71 (SD = 0.2) years, 92% females and 54% were of white descent. Most patients had mild periodontitis (94.2%) followed by moderate (50%). Mild periodontitis was higher in OBIS group, while moderate periodontitis was higher in the no OBIS group; (96% vs. 92%) and (61.5% vs. 38.4%), respectively. Upon adjusting for systemic diseases and risk factors, the BIS group experienced more bone loss compared to the no OBIS group (95% CI: 0.001, 0.176. P-value = 0.048).

Conclusion: OBIS intake did not preserve alveolar bone level in older adults. Larger clinical studies that explore alternative administration routes, and account for various periodontal procedures are warranted to confirm these findings.

143 | The prevalence of potentially prescribing omission of antiplatelet and statin in geriatrics: A single center cohort study

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Introduction: The Screening Tool to Alert doctors to Right Treatment (START) criteria for geriatric has been developed to recognize potentially prescribing omission (PPO) of clinically indicated medications. According to these criteria, Statin and Antiplatelets should be prescribed for geriatric patient with documented history of coronary, cerebral or peripheral vascular disease and diabetes mellitus (DM) with cardiovascular (CV) risk unless it's contraindicated.

Research Question or Hypothesis: The aim of this study is to investigate the adherence of physicians to START criteria and identify the PPO considering the prescription of Statin and Antiplatelets in two conditions; documented history of coronary, cerebral or peripheral vascular disease, and diabetes mellitus with cardiovascular risk.

Study Design: Single center cohort retrospective study

Methods: Patients aged >65 years, have a history of coronary, peripheral, cerebrovascular disease were included. The prevalence of adherence to statin and aspirin or clopidogrel therapy were measured. Patients with contraindications to statin or antiplatelets were excluded. This study was guided by STOPP/START criteria published in 2016.

Results: A total of 351 patients were included in this study. Among 183 patients with CVD, 92(50.2%) and 142 (77.6%) were on statin and antiplatelet respectively. Regarding 168 patients with diabetes and cardiovascular risk factors,76(45.2%) and 126(75%) of these patients were using statin and antiplatelet respectively.

Conclusion: The prevalence of potential prescribing omission (PPO) for statin was high in patients with CVD disease or diabetes with cardiovascular risk. More efforts should be done to evaluate the risk benefit of statin use in geriatrics.

144 | **Effectiveness of a primary care-based outreach program for the assessment of fall risk in a geriatric indigent population**

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Introduction: Fall prevention interventions reduce morbidity and mortality in older adults, but there is a lack of cohesive implementation, particularly in indigent populations. A multi-disciplinary team that serves an indigent population developed a pilot fall risk prevention program based on the Center for Disease Control's Stopping Elderly Accidents Deaths and Injuries tools.

Research Question or Hypothesis: In a predominantly indigent population was primary care-based outreach effective in identifying fall risk? Was the team successful in connecting patients to services?

Study Design: Retrospective

Methods: All patients over 65 from March 2016 through June 2018 were included. The numbers of patients screened and their fall risk were identified. Documentation included the percentage of patients who were evaluated by a fall risk program nurse or physician, were referred to a fitness program, received a home assessment, were referred for an eye exam, and received a medication review by a pharmacist. Recommendations regarding medications were tallied. Fisher exact tests were used to assess whether patient characteristics were associated with a higher likelihood of receiving screening or increased fall risk.

Results: Of the 350 geriatric patients, 59% were female and 60% were ages 65 to 70. The majority were Latino, and patients' primary languages included Portuguese (43%), Spanish (23%), and English (21%). The team screened 81% of eligible patients and of those, 27% and 21% were at high and moderate fall risk respectively. Over 30% of patients reported a fall in the previous year. Nearly 60% of patients screened were connected to fitness programs and 45% of high risk patients received a home assessment. Of the patients at moderate to high fall risk, 74% saw a program provider. Of the high risk patients, 31% received a medication review, and 60% needing an eye exam were made an appointment.

Conclusion: The intervention was successful in identifying fall risk, but connecting patients to services was challenging.

Health Services Research

145 | **Severe distress & denial among Asian patients with type 2 diabetes in the primary care: A prospective, cross-sectional, multicentre study**

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Introduction: Asians make up majority of people globally living with diabetes. The demands of diabetes management contribute toward emotional burdens, formally termed *diabetes distress*. Coupled with high cardiovascular (CV) risk, diabetes distress leads to poor outcomes. Currently, little is known about the prevalence and relationship between CV risk and diabetes distress among Asian primary care patients with Type 2 Diabetes Mellitus (T2DM).

Research Question or Hypothesis: In the Asian primary care population - How prevalent is diabetes distress? Is there an association between CV risk and diabetes distress?

Study Design: Prospective, cross-sectional, multicentre study.

Methods: Adults with T2DM (HbA1c > 7.0%) and polypharmacy were included, while those with Type 1 Diabetes or unable to communicate independently in English, Mandarin or Malay were excluded. Participants were stratified into two groups based on their Framingham Risk Score (FRS - high defined as ≥10%, low <10%) and matched in accordance to their baseline HbA1c. CV risk was estimated using the FRS while diabetes distress was measured using the Problem Areas in Diabetes (PAID) scale (denial defined as 0-10, severe distress ≥40). McNemar tests were used to assess differences in PAID scores between the groups.

Results: A total of 1940 patients were approached, of which 210 were eligible and agreed to participate. Following exclusion of missing data and matching, 132 (62.9%) participants were analyzed. Median PAID score was 17.5 (IQR 6.25-41.56), with an even distribution in each distress category (P = 0.477). High prevalence of severe distress (31.4%) and denial (33.8%) were detected. There was no significant difference in PAID scores between the high and low FRS groups (20.00 vs 13.75, P = 0.446).

Conclusion: A high prevalence of severe diabetes distress and denial was detected in our sample of Asian primary care patients with T2DM. No clear association was found between CV risk and diabetes distress.

146 | **Acceptance and attitudes of healthcare staff towards the clinical pharmacy services in Egyptian hospitals: A descriptive cross-sectional study**

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Introduction: Clinical pharmacists provide medication therapy evaluations and recommendations to patients and healthcare professionals that contribute eventually to improved health and quality of life. Most western countries identified the positive impact of clinical pharmacy services in improving the overall patient care. In Egypt, clinical pharmacy is considered new and is still in its initial phase and not very common as in developed countries; Yet, published data about the challenges and opportunities of clinical pharmacy services is very limited.

Research Question or Hypothesis: Assess the level of acceptance and attitudes of physicians and nurses towards the introduction of a ward-based clinical pharmacy services in Egypt.

Study Design: A descriptive cross sectional study among some Egyptian Hospitals.

Methods: The perception of medical staff was assessed through pretested self-administered questionnaires before and after introducing clinical pharmacy services in form of lectures and seminars. The study was conducted on a total number of 156 physicians and 33 Nurses across 6 hospitals in four different Egyptian governorates.

Results: The majority of both medical staff stated that they would accept clinical pharmacists' recommendation regarding medications (91 % (142/156) for physicians and 97% (32/33) for nurses. The rate of implementation of pharmacist's recommendations by physicians was 71.15% (111/156) (95% CI 68 - 79%; P < 0.001). In the post-intervention survey the majority of physicians 91.8% were convinced to work with competent clinical pharmacists and accepted the necessity of this service to improve standards of care, about 83% of nurses agreed to participate in the first questionnaire. Nurses considered that clinical pharmacy services are unnecessary through the perceptions of the participating nurses negative at baseline survey.

Conclusion: There is a promising attitude towards implementing clinical pharmacy in Egyptian hospitals, yet there is an urge to improve harmony between clinical pharmacists and nursing staff.

147 | Memes for health: Curating illustrated health messaging using the CDC clear communication index

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Introduction: Health educational materials are mostly composed of large chunks of text. As a result, patients with below basic literacy skills often receive inadequate care guidance, resulting in lower health literacy and poor clinical outcomes. Research has been done to prove that visuals can provide higher understanding, but the images and messages being conveyed are simplistic. Health care imagery can communicate complicated messaging evocatively and consistently.

Research Question or Hypothesis: The Centers for Disease Control (CDC) Clear Communication Index can be used to identify health illustrations that prompt minimal heterogeneity among the responses of people who encounter the illustrations, in correspondence with the illustrators' intended messaging.

Study Design: Cohort responses to illustrated health imagery were compared using an anonymous survey based on the CDC Clear Communication Index.

Methods: Study illustrations were created by attendees of the Pharmacy Presentation at the Trio Women in STEM Conference on May 18, 2019 using CDC guidance. Survey responses were collected from two cohorts—attendees of the Pharmacy Presentation and members of the Memes for Health Review Board who did not attend the presentation. Responses were collected through an anonymous online survey, which respondents accessed by QR code on their personal electronic devices. The primary endpoint was low heterogeneity when comparing responses between cohorts; the secondary endpoint was low heterogeneity when comparing cohort responses to the illustrators' stated messaging.

Results: Out of nine illustrations considered, four demonstrated a visible lack of heterogeneity among all respondents; three were consistent with the illustrator's stated messaging.

Conclusion: A modified CDC Clear Communication Index can be utilized to recognize health imagery that communicates focused messaging to a variety of respondents. Repeated studies, utilizing more sophisticated messaging, are needed to test the integrity of this model.

148 | Improving transitions from hospital to home through expanded discharge communication

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Introduction: Reducing avoidable hospital readmissions is a key component of healthcare quality improvement. Direct communication of changes to the medication regimens of discharging patients from The University of Iowa Hospitals and Clinics (UIHC) to a preferred community pharmacy provider is not currently part of the standard discharge process.

Research Question or Hypothesis: Will providing a preferred outside pharmacy provider with an updated medication list upon discharge significantly decrease all-cause 30-day hospital readmissions?

Study Design: Single-center, retrospective chart review following an intervention previously completed by the research team.

Methods: An updated discharge medication list for a randomized subset of UIHC patients discharged from 1/1/2018 - 4/1/2018 was faxed to an outside pharmacy provider. No intervention was performed in the control group which included a similarly sized, randomized, subset of UIHC patients discharged during the same time frame. Inclusion: ≥ 18 years old; discharged to home with self-care. Primary

objective: determine if an association exists between the intervention and 30-day hospital readmission rates. Secondary objective: determine if/how defined covariates affect 30-day hospital readmission. Covariates included in the model: age, biological sex, LACE score, number of high-alert medications, prescription insurance, weekend hospital discharge, length of stay (LOS), high-risk principal diagnosis, and number of services consulted. A binary, multiple logistic regression analysis was performed using IBM SPSS® (n = 274). A significance level of 0.05 was utilized.

Results: After controlling for all covariates, the risk of being readmitted within 30 days of hospital discharge was significantly decreased in the study group (HR = 0.495, 95% CI [0.249 - 0.982], *P* = 0.044). The relative risk of 30-day readmission was decreased by 50.5%.

Conclusion: A slight alteration in the information dissemination component of the discharge process at UIHC may improve the quality of hospital-to-home transitions of care by preventing avoidable hospital readmissions.

149 | Perceptions and barriers to the implementation of antimicrobial stewardship services in community pharmacy settings

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Introduction: Antimicrobial stewardship programs are designed to optimize treatment and prevent adverse events associated with antimicrobial therapy. These programs are common in the inpatient setting, but are rarely found in community pharmacy settings.

Research Question or Hypothesis: We hypothesize that community pharmacists are willing to participate in AMS, but there are no sufficient guidelines for them to follow.

Study Design: This was a cross-sectional electronic survey designed to evaluate community pharmacists' perceptions and barriers regarding AMS.

Methods: Survey invitations were sent via the Pharmacists Society of the State of New York (PSSNY) list-serv and responses were collected over 6 weeks from May 2019 through June 2019. The 43 item survey instrument was developed at the University at Buffalo based on a review of the published literature. We ensured all questions and answer choices were pertinent to community pharmacy respondents. The questionnaire was pilot tested for readability, length and relevance of specific items. Surveys were completed via the secure online application, Research Electronic Data Capture (REDCap) software and the data were analyzed descriptively using Microsoft Excel.

Results: A total of 74 completed surveys were included in the analysis. The majority of pharmacists agreed that outpatient AMS will improve patient care (91%), reduce antimicrobial resistance (88%), lead to cost savings (77%) and could reasonably be implemented in the community (83%). A majority of pharmacists (73%) indicated they were not currently involved in AMS efforts and have not previously collaborated with other healthcare professionals on AMS projects (70%). Most pharmacists surveyed believe barriers include financial compensation (79%), additional medical liability (54%) and overcoming patient expectations (84%). All facilitators questioned in the survey were perceived by the majority (>74%) to be beneficial to outpatient AMS efforts.

Conclusion: Our results suggest that pharmacists believe outpatient AMS will be beneficial and feasible to implement, as long as certain barriers are addressed and facilitators are included.

150 | Reducing 30-day readmissions and emergency department encounters while stratifying high risk patients in a care transitions program

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Introduction: Readmissions, Emergency Department (ED) encounters, and primary medication non-adherence contribute to significant healthcare spending. Grant-funded pharmacists implemented programs for hospitalized patients to transition them through the healthcare continuum to reduce medication errors, improve medication access, education, and adherence, with the ultimate goal of reducing 30-day hospital readmissions or ED encounters. An acuity score that incorporated medication-related risk factors associated with increased readmission risk was developed to stratify high risk patients.

Research Question or Hypothesis: Can 30-day hospital readmissions or ED encounters be decreased by a pharmacist-run program using an acuity scoring system?

Study Design: Retrospective cohort study comparing patients with pharmacist intervention vs different standards of care.

Methods: Patients 18 years and older discharged between 1/1/18 and 3/31/19 were included. Patients with the pharmacist intervention were compared to different service models. Thirty-day readmission and ED encounter rates were compared using chi-squared statistic with Bonferroni correction where appropriate. Multiple logistic regression evaluated independent predictors of healthcare utilization. Rates of new/changed medications-in-hand within 48 hours of discharge were reported for the intervention group.

Results: A total of 17,856 encounters met entry criteria, 13,104 had acuity score at discharge, and of those, 1,349 received pharmacist intervention. Pharmacist intervention decreased the risk of hospital readmission by 40% (OR = 0.599, 95% CI 0.476-0.752) and ED encounters by 45% (OR = 0.55, 95% CI 0.478-0.632), when adjusted for length of stay and acuity score at discharge. Pharmacists cared for a higher proportion of high acuity patients ($P < 0.001$) and 97% of those that received pharmacy services had all new/changed medications in hand within 48 hours of discharge.

Conclusion: Pharmacists significantly decreased the likelihood of 30-day hospital readmission and ED utilization adjusting for the higher risk of a hospital encounter after discharge. The program demonstrated high medication possession rates.

151 | Analysis of an interprofessional hotspotting pilot program for super-utilizers

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Introduction: Super-utilizers are patients that overuse emergency care, accounting for significant preventable healthcare costs. A University at Buffalo (UB) Interprofessional Faculty and Student Hotspotting team program aims to identify and address patient-specific social determinants of health (SDOH) to develop a plan to prevent readmissions.

Research Question or Hypothesis: To characterize the quantity and type of interventions made by the UB Hotspotting Program.

Study Design: Our pilot program enrolled 16 super-utilizer patients from 2018-2019. This is a retrospective review of the Situation, Background, Assessment, Recommendation (SBAR) notes completed by students after a patient consultation. Students in the program were trained, have texting access to faculty, and meet monthly. SBAR notes are reviewed by faculty (n = 4) and clinic staff (n = 2) for accuracy and implementation.

Methods: Descriptive statistics were used to analyze and categorize de-identified data. Student notes were reviewed by faculty to quanitify the following: type and number of interventions made, appropriateness of the intervention, SDOH classification, and patient outcome.

Results: Thirty-six patient consultations were conducted at a hospital admission (n = 16), patient home (n = 12), or other location in the community (n = 8). For SDOHs, students' identified Health and Health Care Issues, Economic Stability, and Social Community Context issues most frequently at 55%, 28%, and 8%, respectively. A total of 73 recommendations were documented; 52% regarding access to care (improving medications access/compliance, recommending/scheduling consultation services, providing transportation or phone services), 30% regarding employment, housing or food assistance, and 18% on health literacy. Most student recommendations were accepted by the faculty. Only 36% of the patients had a follow up visit, which may be improved by aligning this with other scheduled clinic visits.

Conclusion: Students were able to recommend interventions based on SDOH among super-uilizers. The most common interventions were those consistent with accessing the healthcare system. Further training is needed to improve patient follow up visit.

152 | The LABEL study: Health literacy assessment based on evaluation of food labels

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Introduction: In 2016, the FDA revised Nutrition Facts Label(NFL) to improve consumer comprehension, also reflecting a patient's health literacy. The Newest Vital Sign (NVS) is used clinically to screen health literacy with questions based on an ice cream label.

Research Question or Hypothesis: What effect does the revised NFL have on consumers' ability to interpret and apply nutritional information and any relationship to health literacy.

Study Design: Prospective web-based survey distributed between September 2018-January 2019 to US adults.

Methods: Participants answered demographic questions, and dietary habits and food product selection habits when shopping. They were presented with 2 different labels both for a similar ice cream product and answered 5 similar questions (taken from the NVS) on each that assessed their ability to interpret the label while providing a health literacy evaluation.

Results: 2191/2474 (88.6%) respondents consented to complete the survey. Demographics: Age 18-75 years, 55% female, 34% white with a wide range of education levels. Two versions of the NVS were utilized, and using the revised label, participants performed significantly better on Q1, 90 ± 1.7% vs 97 ± 0.9% ($P < 0.0001$), significantly worse on Q2, 81 ± 2.1% vs 75 ± 2.4% ($P = 0.009$), significantly better on Q3, 85 ± 2% vs 89 ± 1.7% ($P = 0.028$), and significantly worse on Q4, 90 ± 1.7% vs 82 ± 2.3% ($P = 0.0038$). Participants who met USDA recommended intake of vegetables or fruits performed better on the NVS ($P = 0.001$, 0.003, respectively).

Conclusion: Although some measures were significantly improved by revised NFL, it still challenged our participants, particularly with numeracy (questions 2&4), highlighting issues with fractions/percentages for patients. The validity of the revised label should be further investigated for its ability to accurately assess health literacy. However, in its current form, it provides a realistic picture of a label a

consumer may encounter with the new revisions, as well as updated serving sizes.

153 | Relationship between patient characteristics and administrative burden to complete a telephonic comprehensive medication review

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Introduction: Medicare plan providers are incentivized to maximize the reach of their Medication Therapy Management programs. However, it is unknown how unique patient characteristics may influence administrative burden.
Research Question or Hypothesis: What is the relationship between patient characteristics and administrative burden in completing telephonic comprehensive medication reviews (CMRs).
Study Design: Retrospective cross-sectional analysis of patients having completed a CMR in 2017.
Methods: Patients were excluded if: under 65 years; had incomplete data; participated in an employer-sponsored plan; or completed a CMR with their provider. A negative binomial regression assessed effects of age, gender, number of chronic medications, poverty level, Limited English Proficiency (LEP), number of years qualified to receive a CMR, if needed a caregiver to complete a CMR, and geographic region.
Results: The analysis included 222,163 patients. Females needed 1.09 Incident rate ratio (IRR) (95%CI 1.08-1.11) times more calls to complete a CMR than males. For every additional year of enrollment in the program, patients required 0.91IRR (95%CI 0.908-0.92) times fewer calls to complete the CMR. Older adults over 75 years of age in comparison to those between 65-74 years of age needed 0.93IRR (95%CI 0.92-0.94) times less calls to complete a CMR. Patients needing a caregiver to complete the CMR, required 1.34IRR (95%CI 1.32-1.37) times more calls than patients who did not. A statistically significant interaction was detected between LEP and poverty quintile regarding the burden to complete a CMR.
Conclusion: This study found increasing poverty level to inversely affect administrative burden between those considered LEP and English language speakers. Female gender and caregiver presence during a CMR were associated with increased administrative burden. Older age and previous MTM program participation were associated with reduced administrative burden. Future research is warranted to assess whether MTM programs should implement targeted approaches to meet the unique needs of these populations.

Hematology/Anticoagulation

154 | Real-world observation of DOAC treatment failures in extreme obesity

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Introduction: Given limited clinical data and PK/PD data suggesting decreased exposure, direct oral anticoagulants (DOACs) are not recommended for use in patients with body mass indexes (BMI) above 40 kg/m^2. However, the prevalence of patients in the United States with BMIs above 40 kg/m^2 as of 2010 is 6.6%, and obesity increases the risk of developing disease states requiring anticoagulation. Therefore, there is clinical relevance in examining the relationship between DOAC use and outcomes in patients with a BMI above 40 kg/m^2.
Research Question or Hypothesis: What is the rate of readmission related to bleed or thrombosis in patients on DOACs with a BMI above 40 kg/m^2?
Study Design: Single center retrospective cohort
Methods: All adult patients on a DOAC during hospitalization from January 1 to June 30, 2017 were evaluated. Charts were reviewed for all patients with a BMI above 40 kg/m^2. Specific DOAC, indication, readmissions within one year, and reasons for readmission including bleed or thrombosis were recorded.
Results: 63 of the 422 patients receiving a DOAC had a BMI above 40 kg/m^2. Of these, 12 (19%) were prescribed apixaban, five (8%) dabigatran, and forty-six (73%) rivaroxaban. Indications included atrial fibrillation or flutter (44%), treatment or history of venous thromboembolism (43%), and venous thromboembolism prophylaxis (13%). Twenty (32%) patients with a BMI above 40 kg/m^2 were readmitted within one year, however none (0%) of the readmissions were related to bleed or thrombosis.
Conclusion: The 0% readmission rate related to bleed or thrombosis in patients with a BMI above 40 kg/m^2 is lower than anticipated when compared to DOAC treatment failure rates published in the literature. However, the population studied was small and treatment failure can occur outside hospital admission. Though these findings cannot be extrapolated to predict long-term outcomes in extremely obese patients treated with DOACs, they do highlight the need for additional research in this patient population.

155 | Evaluation of the validity of SAMe-TT2R2 score in a cohort of venous thromboembolism patients treated with warfarin in Qatar

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Introduction: Available evidence indicates that SAMe-TT_2R_2 score (sex female, age < 60 years, medical history [more than two comorbidities], treatment [interacting drugs, eg, amiodarone for rhythm control], tobacco use [doubled], race [doubled]) score) may predict optimum anticoagulation control among atrial fibrillation patients (reflected by time in therapeutic range (TTR) above 65-70% with SAMe-TT_2R_2 score of 0-1). However, association between the score and anticoagulation control in Venous Thromboembolism (VTE) patients is controversial.

Research Question or Hypothesis: Can SAMe-TT_2R_2 score be used to evaluate quality of anticoagulation control, measured by TTR, in patients treated with warfarin for VTE?

Study Design: A retrospective cohort study

Methods: Adult patients treated with warfarin for VTE for at least 6 months in ambulatory anticoagulation clinics of two hospitals in Qatar were included. Relevant data were collected through electronic chart review over one year. SAMe-TT_2R_2 score was calculated. Categorical variables were compared using Chi-square test while continuous variables compared using T-test using SPSS.

Results: A total of 295 patients were included (55.9% males), with majority being younger than 60 years old (77.3%). The mean TTR was 76.6 ± 18.6%.

Patients with low SAMe-TT_2R_2 score (zero or 1) had statistically significant higher TTR than those with high SAMe-TT_2R_2 score (2 or more) (95 ± 3.2% vs 76 ± 18.6%, $P = 0.022$)

Compared to patients with good INR control (TTR >70%), those with poor control (TTR ≤70%) were more likely to have SAMe-TT_2R_2 score of 2 or more (OR: 1.495, 95%CI:1.38-1.62).

Conclusion: There is a significant association between lower SAMe-TT_2R_2 score and good anticoagulation control in a cohort of VTE patients treated with warfarin in Qatar. Contribution of other clinical factors and whether a different scoring may yield better prediction of anticoagulation control remains to be tested

156 | Safety and efficacy of direct oral anticoagulants in extreme body weights

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Introduction: Current literature on the safety and efficacy of direct oral anticoagulant (DOAC) therapy in patients who are extremely obese or underweight are limited. However, these agents are still being prescribed and often left for physicians to monitor.

Research Question or Hypothesis: In patients prescribed a DOAC after an initial venous thromboembolism (VTE), how do patients of extreme body weights compare to normal weight patients with regards to recurrent VTE and major bleeds?

Study Design: A multi-site, retrospective cohort design at four University of Pittsburgh Medical Center (UPMC) hospitals was performed.

Methods: Between November 2012 and August 2017, patients who were extremely obese (>120 kg or BMI > 40 kg/m^2), underweight (<60 kg or BMI < 18.5 kg/m^2), or normal weight (60-120 kg or BMI 18.5-40 kg/m^2) who experienced an initial VTE and placed on a DOAC were included. The proportion of patients who experienced a recurrent VTE (primary efficacy outcome) and/or major bleed event (secondary safety outcome) within 12 months from the index VTE were compared between body weights. Univariate statistical tests and multivariate logistic regression analyses were performed.

Results: Recurrent VTE occurred in 7.4% (13/175) extremely obese patients, 4.6% (37/801) normal weight patients, and 8.4% (7/83) underweight patients ($P = 0.14$). Major bleeding occurred in 5.7% (10/175) extremely obese patients, 9.6% (77/801) normal weight patients, and 22.9% (19/83) underweight patients ($P < 0.001$). Extremely obese patients had similar proportions of major bleeding compared to normal weight patients [95% CI for difference in proportions; -0.1, 0.02] whereas underweight patients had a greater proportion [95% CI; -0.21, -0.05].

Conclusion: In this study, body weight was not shown to have an association with recurrent VTE events. However, it was statistically related with major bleeding, specifically underweight patients having a higher risk.

157 | Impact of pharmacist-conducted anticoagulation patient education and follow-up phone calls on safety outcomes post-discharge

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Introduction: Patient education on anticoagulant care plans has been associated with improved patient outcomes. Effective education, follow-up care and communication are recommended to reduce the risk of adverse events during care transitions.

Research Question or Hypothesis: This study aims to assess the impact of pharmacist-conducted anticoagulation education and follow-up on bleeding and readmission rates.

Study Design: This was a randomized, non-blinded interventional study conducted at a tertiary care teaching hospital in Beirut, Lebanon. Participants were inpatients ≥18 years, discharged on a therapeutic dose of anticoagulant.

Methods: Patients were randomized by block randomization. The control group received the standard anticoagulant discharge counseling provided by nurses. The intervention group was counseled by a pharmacist in addition to the standard discharge counseling. All patients received 2 phone calls from the study investigators at day 2 or 3 and at day 30 post-discharge. Primary outcome measures included readmission rates within 30 days post-discharge and bleeding events. Secondary outcomes included unplanned patient contact with prescribers post-discharge.

Results: Out of 193 patients, 99 were counseled by pharmacists, and 94 by nurses. The patient population included (56.5%) females with a mean age of 73.8 years. There was no significant difference in the bleeding rates between the groups that occurred within 3 days or at day 30 post-discharge (6.1% vs. 2.1 %, $P = 0.370$ and 8.1% vs. 12.8%, $P = 0.128$ respectively), and in readmission rates (11.1% vs. 10.6%, $P = 0.135$). A significantly higher number of patients in the pharmacist-counseled group contacted their prescribers within 3 days post-discharge (13.1% vs. 3.2%, $P = 0.014$) but there was no difference at 30 days (10.1% vs. 10.6 %, $P = 0.592$).

Conclusion: Although pharmacist-conducted anticoagulation education did not appear to reduce bleeding or readmission rates at 30 days, pharmacist education significantly increased patient communication with their providers in the early days post-discharge.

158 | Effects of prophylactic oseltamivir on warfarin control

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Introduction: Older adults and other high-risk patient populations are recommended to receive prophylaxis against influenza once exposed. Patients with multiple comorbidities also have an increased potential for coadministration of oseltamivir and warfarin. Currently, there is conflicting evidence regarding oseltamivir's potential for a drug-drug interaction with warfarin.

Research Question or Hypothesis: The objective of this study is to evaluate the impact on INR in patients on chronic stable warfarin therapy who were concomitantly prescribed prophylactic oseltamivir treatment.

Study Design: National retrospective cohort study within the Veteran Health Administration.

Methods: Patients receiving chronic stable warfarin therapy who received prophylactic oseltamivir for at least 7 days or longer were evaluated. The primary endpoint was mean change in INR from baseline to day 10 following oseltamivir use. Secondary endpoints included change in INR based on renal function and length of oseltamivir treatment, number of patients with an INR outside of goal range (2-3 ± 0.2), and incidence of thrombosis and bleeding.

Results: A total of 1,041 patients were evaluated (97.6% male, 76% Caucasian, average age 73 years old). Oseltamivir was prescribed for a mean of 13 (±6) days. Concomitant oseltamivir treatment resulted in a significant increase in mean INR from 2.39 to 2.52 ($P < 0.001$). Mean INR was also increased in patients with a creatinine clearance of 31-60 mL/min ($P < 0.01$) and when oseltamivir was used for 7 ($P < 0.001$) and 8-10 days ($P = 0.02$). At day 10, 156 (15.0%) patients recorded an INR below goal and 143 (13.7%) recorded an INR above goal. Thrombosis and bleeding events were recorded in 53 (5.1%) and 18 (1.8%) patients, respectively.

Conclusion: There was a statistically significant increase in INR following prophylactic oseltamivir use in patients taking chronic warfarin, but this change may only be clinically significant in certain patient populations. Oseltamivir impacted INR more in patients with impaired renal function and within 7-10 days of oseltamivir initiation.

159 | Evaluation of a pharmacist-managed inpatient warfarin dosing service at a community hospital

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Introduction: Warfarin dosing poses many challenges due to its narrow therapeutic index and risk for serious adverse effects. In a medium-sized community hospital, the pharmacy department established a pharmacist-managed inpatient warfarin dosing service with the goal of providing safe and effective warfarin dosing.

Research Question or Hypothesis: To evaluate the efficacy and safety of a new pharmacist-managed warfarin dosing service when compared to provider-managed warfarin dosing during the same time period.

Study Design: Retrospective, cohort, single-center, chart review.

Methods: Adult patients who received warfarin between September 2018 and March 2019 were included. Patients were grouped in either the pharmacist-managed group or the provider-managed group based on who managed daily assessment and orders. Efficacy endpoints included time to initial therapeutic INR, average number of days with a sub- or supra-therapeutic INR, and average time in therapeutic range. Safety evaluation of bleeding rates utilized GUSTO criteria.

Results: 170 patients were evaluated, 134 in the pharmacist-managed warfarin group and 36 in the provider-managed warfarin group. Baseline demographics were similar between the two groups, with the pharmacist group having a statistically insignificantly higher percentage of male patients (62% vs 44.4%). Average time to initial therapeutic INR was lower in the pharmacist group compared to the provider

group (3.5 days vs 4.8 days, P = 0.037). The pharmacist group had a lower number of days spent with sub-therapeutic INR when compared to the provider group (2.9 days vs 3.6 days) and time in therapeutic range was similar between the two groups, lower for the pharmacist group (41% vs 42.3%); however, neither of these were statistically significant. Difference in bleeding rate, although not statistically significant, was lower in the pharmacist group of patients compared to those in the provider group (11.9% vs 16.6%).

Conclusion: Pharmacist-managed warfarin dosing appears at least equally safe and effective when compared to provider-managed dosing.

160 | Four-factor prothrombin complex concentrate for reversal of apixaban and rivaroxaban

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Introduction: Prior to the release of coagulation factor Xa (recombinant), inactivated -zhzo (Andexxa), there was no direct antidote for apixaban and rivaroxaban, though prothrombin complex concentrate has been used for the reversal of these agents.

Research Question or Hypothesis: Four-factor prothrombin complex concentrate (4F PCC) demonstrates effectiveness and safety for the reversal of apixaban and rivaroxaban.

Study Design: This was a retrospective, single-center study that included adults admitted between January 2016 and January 2018.

Methods: Patients were included if they received 4F PCC for the reversal of a bleeding event while taking rivaroxaban or apixaban. Patients were excluded if they received any anticoagulation other than apixaban or rivaroxaban before reversal, 4F PCC for scheduled pre-operative reversal of anticoagulation, or received activated 4F PCC.

Results: Thirty-seven patients received 4F PCC for reversal, 18 (49%) with an intracranial hemorrhage (ICH), 9 (24%) with a gastrointestinal bleeding, and the remaining 10 (27%) with other bleeding etiologies. Twenty-six patients (70%) were anticoagulated with rivaroxaban prior to reversal and 11 (30%) with apixaban. The median dose of 4F PCC was 27.2 units/kg adjusted body weight (IQR [23.1-30.7]) with a median time to administration from presentation of 2.1 hours (IQR [1.3-4.1]). In those with an ICH, 9 had an intraparenchymal hemorrhage (IPH) and 8 had a subdural hematoma (SDH). Neither IPH volume (12.1 mL vs 11.6 mL at 7.5 hours) nor maximum SDH width (4.5 mm vs 9 mm at 7 hours) from baseline to repeat imaging met criteria for hematoma expansion. The overall in-hospital mortality rate of the cohort was 19% (n = 7). One patient (3%) experienced a myocardial infarction within 72 hours of 4F PCC administration.

Conclusion: The reversal of apixaban and rivaroxaban with 4F PCC demonstrated acceptable clinical outcomes in his cohort. Our results need to be confirmed in future larger prospective studies.

161 | Venous thromboembolism prophylaxis for non-surgical patients on medical floors: Are we compliant?

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Introduction: Venous thromboembolism (VTE) is a common disease that is 100 times more prevalent in hospitalized patients. Preventive efforts have been successful in well-defined subgroups of hospitalized patients in which VTE prophylaxis reduces morbidity and mortality. These benefits have not been replicated in non-surgical wards patients and there is a paucity of convincing literature to guide VTE prophylaxis in this subgroup. American College of Chest Physicians (ACCP) recommends a risk assessment model(RAM) called the Padua score which uses patient characteristics and risk factors to identify those at highest risk of VTE who would benefit from prophylaxis.

Research Question or Hypothesis: Do clinicians at a community, Level I Trauma, tertiary-care teaching hospital follow the ACCP VTE prophylaxis recommendations of the Padua RAM?

Study Design: Retrospective, observational study. IRB approved.

Methods: Patients admitted to the internal medicine service for >48 hours were included. Patients who underwent general anesthesia, in intensive care unit, or on therapeutic anticoagulation were excluded. Padua score was calculated to determine ideal prophylaxis and compared to actual prophylaxis received using the exact binomial test. Logistic regression modeling determined those patient characteristics and Padua score components which best predicted appropriateness of prophylaxis, and were powered to model 4 independent variables given sample size.

Results: In 100 patients enrolled, overuse of prophylactic anticoagulation was 59% (23% mechanical, 35%chemical; P < 0.036). Best predictors of appropriate VTE prophylaxis were higher Padua score (OR 2.47, 1.72-3.83) and patient activity restriction (OR = 2.29, 1.53-3.82).

Conclusion: VTE prophylaxis is prescribed in excess in non-surgical wards patients and not appropriately withheld in those at lowest risk of VTE by Padua. Overuse of prophylaxis may cause adverse events, including patient discomfort, harm, increased costs and length of stay. Further study to evaluate these outcomes and their clinical significance is warranted. Ongoing clinician education and strategic leverage of electronic health records may have an immediate effect on mitigating VTE prophylaxis overuse in this population.

162 | Evaluation of a direct oral anticoagulation stewardship program: analysis of a drug consult review process

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Introduction: Despite evidence based dosing guidance for direct oral anticoagulants (DOAC), there has been large variation in prescribing practices that may lead to negative outcomes. The purpose of this study is to determine changes in DOAC prescribing practices as it pertains to FDA approved indications and dosing for indication and renal function through a specialized drug consult review process.
Research Question or Hypothesis: How can the utilization of a specialized drug consult review process affect the use of DOAC prescribing practices?
Study Design: Multi-site, single center, retrospective cohort study
Methods: Patients who were prescribed DOAC therapy from January 13, 2018 to July 13, 2018 were identified through data warehouse extraction. A manual chart review was conducted for data points including: anticoagulation indication, DOAC dose at time of consult submission, initial or renewal consult, documented labs, documented weight, consult approval or denial, and rational for approval or denial. Patients were excluded if the duration of DOAC therapy was less than 20 days, if a complete manual chart review was unable to be obtained, or if DOAC therapy was prescribed by an non-VA provider. Consults were then stratified into three categories: appropriate, inappropriate, and clinical grey areas.
Results: A total of 592 consults were included in the final analysis. Of the 233 general consults evaluated, 212 (91.0%) were deemed appropriate, 15 (6.4%) inappropriate, and 6 (2.6%) as clinical grey areas. Of the 233 specialized consults evaluated, 218 (93.6%) were deemed appropriate, 1 (0.4%) inappropriate, and 14 (6.0%) as clinical grey areas. There was a significant difference in consults worked inappropriately ($P = 0.0004$).
Conclusion: Implementation of a DOAC stewardship program in a healthcare system promotes appropriate and optimal use of DOACs. A drug-specific consult review process improves inappropriate approval or denial of DOAC therapy.

HIV/AIDS

163 | Exploring the relationships between HIV diagnoses in urban and rural communities in North Carolina

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Introduction: In 2004 North Carolina put together an analysis of HIV/STD health disparities providing insight into these diseases. Updated data is needed to understand factors in rural NC populations with hopes of slowing HIV transmission through additional supports.
Research Question or Hypothesis: How does IV drug use and social determinants of health differ as predictors for HIV diagnosis in rural/urban NC?
Study Design: Retrospective analysis of publicly available data.
Methods: HIV data was pooled from HIV/STD Surveillance Reports, demographic data by the US Census, health data from County Health Rankings and Roadmaps, and causes of death from NC Center for Health Statistics. The primary outcome assesses drug related deaths in rural versus urban NC with its correlation to HIV diagnoses. The secondary outcome uses social determinants of health as predictors of HIV diagnoses in urban versus rural communities.
Results: Independent sample t-tests and simple/stratified linear regressions were performed. The primary outcome found no difference in drug related deaths between urban and rural NC ($P = 0.335$). Stratified linear regression determined drug related death rates negatively predict HIV diagnoses in urban (-0.088, $P = 0.04$) and rural (-0.041, $P = 0.002$) communities. Secondary outcomes show rural median income as a positive predictor of HIV diagnoses ($P = 0.035$) and primary care provider rates as negative (-0.06, $P = 0.032$). Urban communities have non-English speakers (3.69, $P = 0.009$) and number of PrEP clinics (0.875, $P = 0.02$) as positive predictors.
Conclusion: In urban communities, additional HIV PrEP clinics indicate more individuals are being diagnosed leading to earlier treatments and education on transmission prevention. Increasing numbers of these clinics in rural communities may show benefit - as many are likely living with HIV undiagnosed. Rural counties also have higher uninsured rates. This, compounded with lack of primary care providers, is negatively impacting HIV diagnoses. Data should be used to target unique populations across North Carolina to educate and reduce transmission rates of HIV.

164 | Pharmacist-led patient satisfaction survey for people living with human immunodeficiency virus taking single-tablet bictegravir/emtricitabine/tenofovir alafenamide after being switched from two-tablet dolutegravir plus emtricitabine/tenofovir alafenamide

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Introduction: Bictegravir (BIC)/emtricitabine (FTC)/tenofovir alafenamide (TAF) (single tablet) has been shown to be non-inferior to dolutegravir (DTG) plus FTC/TAF (two tablets) for the treatment of human immunodeficiency virus (HIV)-1. There has been increased focus placed on choosing an antiretroviral (ART) regimen that reduces pill burden while maintaining effectiveness and tolerability.
Research Question or Hypothesis: Will switching from a two-tablet to single-tablet integrase inhibitor-based ART regimen enhance patient satisfaction and minimize adverse effects while retaining effectiveness?
Study Design: Post-implementation prospective survey of adult patients switched from DTG plus FTC/TAF to BIC/FTC/TAF within University of Colorado Infectious Diseases Clinic.
Methods: Patients were screened for enrollment during outpatient clinic visits. The primary objective was to evaluate patient satisfaction at 24 weeks and adverse effects at 12 weeks via administered surveys. Secondary objectives were to evaluate and compare effectiveness and degree of patient adherence via CD4 count and HIV-1 RNA (baseline vs. approximately six-months post-switch). The paired t-test, chi-squared test, and descriptive statistics were utilized for analysis.
Results: 21 patients were consented and enrolled: 86% male, 57% Caucasian, mean age 47 ± 9 years, mean weight 88 ± 17 kg. Overall, 91% of patients were "happy and satisfied" with their ART switch and would "support the recommendation to switch other eligible patients to single-tablet BIC/FTC/TAF." The most common adverse events reported at 12 weeks (although some were reported to be present at baseline) were fatigue (38%), hand and/or foot pain (38%), and slight memory loss (33%). There were no differences observed when comparing baseline and post-switch laboratory parameters: CD4 (mean ± SD): 734 ± 332 cells/mm^3 vs. 729 ± 385 cells/mm^3 (P = 0.97) and HIV RNA < 50 copies/mL: 100% vs. 95% (P= > 0.99) [follow-up data available: CD4 (48%) and HIV-1 RNA (95%)].
Conclusion: Single-tablet BIC/FTC/TAF seemed to enhance patient satisfaction (when compared to two-tablet DTG plus FTC/TAF) while maintaining effectiveness and tolerability.

165 | Awareness, knowledge and comfort of pharmacy students on the use of pre-exposure prophylaxis (PrEP) for HIV prevention

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Introduction: Pre-Exposure Prophylaxis (PrEP) is a daily antiretroviral therapy to prevent acquisition of HIV for individuals at significant risk for infection. Pharmacists are uniquely qualified to promote PrEP; however, data suggest that pharmacists have poor familiarity with PrEP. No such data exist for pharmacy students. The objective of this study was to measure pharmacy students' awareness, knowledge, and comfort regarding PrEP.
Research Question or Hypothesis: Pharmacy students have limited awareness, knowledge, and comfort regarding PrEP.
Study Design: A 24-point questionnaire was designed to assess the following domains regarding PrEP use and promotion among pharmacy students: awareness, knowledge, beliefs, attitudes, self-efficacy, norms, and intent.
Methods: An electronic survey was distributed to Doctor of Pharmacy students at St. John's University College of Pharmacy and Health Sciences via Google Forms.
Results: A total of 88 responses were collected from the survey. Most students were between 18-24 years of age, in year 5 of pharmacy school, female, Asian, and employed by chain community pharmacies. Almost 90 percent of students had heard of PrEP. Most students were able to correctly identify tenofovir/emtricitabine as the FDA-approved regimen for PrEP; however, only 52.3% of students were able to correctly report the recommended duration of treatment. Over 95% of students thought that a pharmacist or intern counseling patients on PrEP was beneficial; however, only 55.8% of students strongly agreed that they intended to counsel patients on PrEP, and only 17.4% of students reported that counseling patients on PrEP would be easy.
Conclusion: Pharmacy students have strong awareness, but limited knowledge and comfort regarding PrEP. Results from the survey will be used to assess learning needs of pharmacy students regarding PrEP and inform future curricular changes.

166 | Awareness, knowledge and comfort of pharmacy students on the use of post-exposure prophylaxis (PEP) for prevention of HIV infection

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Introduction: HIV Post-Exposure Prophylaxis (PEP) is a means of reducing the risk of viral acquisition after HIV exposure. PEP is indicated in emergent situations, making provider comfort with PEP extremely important. Studies have demonstrated a lower than expected understanding of PEP among pharmacists, nurses, and medical students, but have not specifically assessed PEP understanding among pharmacy students living in the United States (U.S). The objective of this study was to assess the understanding of PEP in U.S. pharmacy students in order to identify target areas of concern.
Research Question or Hypothesis: Pharmacy students have limited awareness, knowledge and comfort regarding PEP.
Study Design: A 24-point questionnaire on PEP was designed covering the following domains: Awareness, knowledge, beliefs/attitudes, self-efficacy, norms, and intent.
Methods: An electronic survey was distributed to pharmacy students at St. John's University College of Pharmacy and Health Sciences in their 1-4 professional years via Google Forms. All students in the class were sent an email with an invitation to participate.
Results: Eighty-eight students responded to the survey, majority of which work in a pharmacy and had previously taken a course that

included content on PEP. Almost 90% of students indicated they have heard of PEP. However, only 50% correctly identified an FDA-approved PEP regimen and one third were unable to identify the recommended duration. Ninety-two percent of students reported never counseling a patient on PEP and 51% said they would be uncomfortable doing so. Additionally, 45% reported that counseling on PEP would be difficult or extremely difficult. Nearly 100% of participants felt that counseling on PEP is beneficial for patients.

Conclusion: Pharmacy students have a strong awareness, but limited knowledge and comfort regarding PEP. Results from this survey will be used to identify areas of weakness in student understanding and will help inform future curricular changes.

167 | Which provider type is most PrEPared: A retrospective cohort study analyzing retention in care among pre-exposure prophylaxis (PrEP) patients

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Introduction: Pre-exposure prophylaxis (PrEP) is a novel biomedical prevention tool that decreases the acquisition of HIV. This once-daily pill, consisting of tenofovir (TDF) 300 mg/emtricitabine (FTC) 200 mg, has been shown to decrease the rate of HIV acquisition by 92% in adherent men who have sex with men (MSM). Barriers remain in PrEP implementation, including uncertainty of the most optimal provider for PrEP rollout. It is critical to investigate the impact the provider type has on PrEP dissemination to maximize its uptake and retention of care in high risk patients.

Research Question or Hypothesis: Does the rate of retention in care among PrEP patients change with the type of provider offering PrEP services?

Study Design: This study is a single center, retrospective cohort, chart review that was conducted at CrescentCare in New Orleans, Louisiana and was Institutional Review Board (IRB) approved by Xavier University of Louisiana.

Methods: This study included all individuals initiated on tenofovir disoproxil fumarate/emtricitabine for PrEP therapy between February 2016 to December 2017 at the clinic and had been prescribed PrEP for a minimum of 6 months (but not more than 12 months). Demographic data, adherence rates, number of attended visits, and sexual risk behaviors were collected.

Results: A total of 216 patients were prescribed PrEP from February 2016 to December 2017 and included in the analysis. A multivariable model was performed to identify significant predictors of retention in care. Overall, no factors were associated with increased retention in care. Provider type was not predictive of retention in care and no difference was observed between the two groups (OR = 0.88,95% CI 0.36-2.16).

Conclusion: The finding of this study are consistent with the CDC's recommendations and highlight that PCPs provide similar retention in care outcomes as ID physicians and play a key role in disseminating PrEP to individuals in vulnerable communities.

168 | Identification and characterization of transmitted drug resistance in treatment-naïve adults with human immunodeficiency virus

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Introduction: HIV treatment recommendations have changed dramatically in the last 10 years with a shift from non-nucleoside reverse transcriptase (NNRTI)- and protease inhibitor (PI)-based regimens to integrase strand transfer inhibitor (INSTI)-based regimens. Historically, INSTI transmitted drug resistance (TDR) has been assumed to be low due to rare reporting but may be rising with increased use.

Research Question/Hypothesis: What are the patterns and incidence of TDR and how do they compare with data reported from 2011?

Study Design: retrospective, observational, cohort study

Methods: The study included antiretroviral (ARV)-naive adults with HIV-1 entering care between 2012 and 2018. The primary objective was to identify and characterize TDR in these patients. Secondarily, the results were compared with data from 2011, prior to widespread INSTI use. Genotypic data were collected and interpreted utilizing International AIDS Society-USA guidelines and the Stanford University HIV Drug Resistance Database. Descriptive statistics were used to summarize demographic and clinical characteristics. Results were reported as frequency (percent) and pre/post time frames were compared using Pearson Chi-Square tests (SAS software v9.4 for Windows). An a priori level of significance was set at 0.05.

Results: Of the 684 patients included, 390 had at least 1 drug resistance mutation identified. PI associated mutations were detected in 201 patients. There were 12 nucleoside reverse transcriptase inhibitor mutations reported in 12 individual patients; however no M184 V or K65R mutations were documented. The NNRTI class had 222 mutations recorded among 192 individuals, and notably, there were 28 INSTI mutations reported in 28 patients. Decreased drug susceptibility was predicted in 147 patients (21.5%) compared with 119 out of 429 (27.7%) reported between 2007 and 2011 (P = 0.017), based on interpretation from the Stanford Database.

Conclusions: Overall, TDR affecting clinical susceptibility to ARVs declined from that reported in 2011; however, de novo resistance to INSTIs was identified.

169 | Investigating knowledge and perceptions of HIV pre-exposure prophylaxis (PrEP) among African American women

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Introduction: HIV Pre-Exposure Prophylaxis (PrEP) with Truvada® (tenofovir disoproxil and emtricitabine) is the first medical intervention with proven efficacy to reduce HIV contraction in patients who are not infected with the virus. Though AA women continue to be more affected by HIV than women of any other race/ethnicity, this demographic remains underrepresented in HIV prevention literature and PrEP studies. The objective of this project was to assess the knowledge and perceptions of HIV PrEP therapy among AA women.

Research Question or Hypothesis: If AA women were knowledgeable of HIV PrEP therapy, then would they be willing to take a medication to prevent contracting HIV.

Study Design: Prospective, observational study

Methods: A 17-item multiple-choice survey was created to assess the knowledge of HIV PrEP therapy in AA Women. The data collection instrument was administered to AA women throughout the Metro-Atlanta area from November 2017 to April 2018.

Results: A total of 96 AA women completed the research study. Although all participants reported being knowledgeable about HIV/AIDS and the HIV risk factors associated with the disease, more than half reported not knowing about HIV PrEP therapy. However, over 70% of participants stated that they would be willing to take a daily pill to prevent contracting HIV. A correlation was also found showing that greater knowledge of HIV PrEP therapy is associated with a higher willingness to use the medication.

Conclusion: African American women may be more likely to use HIV PrEP therapy when educated that prevention therapy is available. Pharmacists have a unique opportunity to serve as a useful resource for screening, educating, and monitoring for patients receiving HIV PrEP therapy.

Infectious Diseases

170 | Adherence to the 2017 IDSA/SHEA clinical practice guidelines for *Clostridioides difficile infection*

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Introduction: The IDSA/SHEA released updated clinical practice guidelines for *Clostridioides difficile* infection (CDI) in February 2018. These guidelines changed practice recommendations and metronidazole is no longer recommended as a first-line option for the treatment of non-severe episodes of CDI. Although evidence-based medicine is known to optimize patient outcomes, adherence to new guidelines remains suboptimal.

Research Question or Hypothesis: To evaluate the extent of adherence to guidelines for CDI and to assess the medical residents' knowledge and confidence levels before and after an educational intervention.

Study Design: Retrospective observational study with an educational intervention.

Methods: Data from hospitalized adults with CDI at a 233-bed community teaching hospital were collected using Cerner between February 2018 and February 2019. Each patient was stratified according to disease severity and prior episodes of CDI to assess treatment appropriateness per guidelines. A pharmacy-led educational intervention was then conducted for medical residents who were asked to complete pre- and post-surveys to assess knowledge and confidence levels in treating patients with CDI.

Results: A total of 43 patients were included in the study, 93% of patients (40/43) were diagnosed with an initial episode of CDI and 7% of patients (3/43) had recurrent episodes. Of those patients with initial episodes, 50% (20/40) were non-severe, 22.5% (9/40) were severe, and 27.5% (11/40) were fulminant episodes. Only 23.3% (7/43) of treatment regimens were appropriate per guidelines. Inappropriate antibiotic selection was the most common reason for non-adherence to guidelines occurring in 53.5% of patients (23/43). A total of 14 medical residents completed the surveys. The average score on the assessment significantly increased from 72.3% to 99.1% and the median confidence level significantly improved from 4/5 to 5/5 following the educational intervention.

Conclusion: This study demonstrates a low level of adherence to treatment guidelines for CDI. The educational intervention increased the residents' knowledge and improved their confidence levels in treating patients with CDI.

171 | Evaluation of antimicrobial stewardship programs within governmental hospitals in Qatar: A SWOC analysis

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Introduction: Antimicrobial resistance (AMR) represents a worldwide public health crisis. Antimicrobial stewardship programs (ASPs) have been proposed as a strategy to minimize AMR in healthcare institutions. Although ASPs were implemented in governmental hospitals in Qatar in 2015, a formal evaluation of these programs has not been conducted.

Research Question or Hypothesis: We aimed to assess the current status of ASPs in Qatar in accordance with international standards, and to identify strengths, weaknesses, opportunities and challenges (SWOC) associated with these programs.

Study Design: Cross-sectional study.

Methods: A face-to-face interview was conducted with lead stakeholders of ASPs across Hamad Medical Corporation (HMC) governmental hospitals. A survey adapted from the Centers for Disease Control and Prevention checklist for ASP core elements was also distributed to gather additional information. In addition, a SWOC analysis was conducted to further enhance and standardize these programs across governmental hospitals in Qatar.

Results: All 12 governmental hospitals in Qatar participated in the study. All hospitals had an infectious diseases physician designated as an ASP leader and almost all hospitals (92%) had a pharmacist designated as an ASP leader too (major strength identified). However, almost all hospitals (92%) lack a financial statement and information technology resources that support ASPs (major weaknesses identified). Among hospitals surveyed, 75% had an antibiotic preauthorization policy, 75% had a prospective audit with feedback strategy, 33.3% had an automatic system to switch from intravenous to oral antibiotic, 92% tracked antibiotic use by measuring the defined daily dose, and 33.3% tracked rates of *Clostridioides difficile* infection. Qatar's rich economy allows for the development of ASPs, but challenges would emerge if financial resources were not allocated in a timely manner.

Conclusion: Although ASPs were implemented in all HMC governmental hospitals in Qatar, national efforts and more resources are needed to further develop and improve these programs.

172 | Ten-year experience of outpatient antimicrobial stewardship program in a tertiary hospital in Taiwan

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Introduction: Antimicrobial use is the most important modifiable driver of antimicrobial resistance (AMR), and powerful antimicrobial stewardship programs (ASP) are critical for healthcare organizations to lead the fight against AMR. Despite well recognition, inappropriate antibiotic use in outpatient settings may approach 50% of antimicrobial prescriptions. More and more stewardship interventions are developed accordingly to survey and optimize comprehensive antibiotics use.

Research Question or Hypothesis: Implementation of outpatient ASP could improve antibiotic prescribing patterns and economic outcome.

Study Design: This is a cross-sectional study to measure the antibiotic prescribing rate and economic outcome before and after ASP interventions were implemented.

Methods: Implementation of outpatient stewardship programs consist of four components: (1) restriction policies of antibiotic prescribing; (2) medical chart review, audit and feedback; (3) continuous monitoring and report of antibiotic prescribing rates with feedback mechanism; and (4) didactic educational meetings. In this study we reviewed the data of Healthcare Information System (HIS) based stewardship program to summarize the details of antibiotic prescribing rates and inappropriate antimicrobial prescribing defined by stewardship group. We also analyze the economic impact on healthcare system. The database was of the consecutive 10-years from 2009 to 2018. All statistical analyses were performed using SAS Enterprise Guide version 5.1 (SAS Institute Inc., North Carolina, USA).

Results: After implementing stewardship programs, the proportion of visits that involved antibiotic prescriptions declined from 61.02/1000 clinic visits to 49.10/1000 clinic visits annually ($P < 0.01$). The proportion of antimicrobial expenditure in outpatient healthcare system declined 13% after stewardship interventions (9.3 ‰ vs. 8.1‰, $P < 0.05$). One-third of all antibiotic prescriptions lacked an informative diagnostic code was documented in medical chart review model.

Conclusion: Establishing effective stewardship interventions can improve prescribing and economic outcomes in outpatient setting. Better diagnostic coding of clinical condition would allow identification of further potential for reductions in inappropriate antibiotic prescriptions.

173 | The role of probiotics in Clostridioides difficile disease severity and time to disease resolution

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Introduction: *Clostridioides difficile* infection (CDI) is the leading cause of hospital-related diarrhea. It accounts for 15,000-30,000 deaths per year in the US and costs approximately $5 billion annually. The Infectious Disease Society of America guidelines have no recommendations regarding probiotic therapy. There is conflicting data regarding its efficacy and research on the role of probiotics in disease severity is lacking.

Research Question or Hypothesis: Do probiotics play a role in CDI severity and time to infection resolution?

Study Design: This was an IRB approved, single-centered, retrospective cohort analysis. Electronic medical records identifying patients diagnosed with CDI in NYU-Winthrop Hospital between 8/1/15-2/28/17 were reviewed. *Clostridioides difficile* positive patients were allocated into four groups depending on probiotic administration and time of initiation. Patients with a + tcdB gene were included. Patients with missing severity labs or time to formed stool were excluded. The primary outcomes were incidence of severe CDI and time to disease resolution.

Methods: Chi-square or Fisher's exact tests were used to compare groups for categorical variables; the Mann-Whitney or Kruskal-Wallis tests were used for continuous data. Time to CDI resolution was analyzed using standard methods of survival analysis. The groups were compared using the log-rank test.

Results: 210 CDI cases were analyzed, 65% of which were severe. 56% of patients were female and median age was 75 years (18.6-97.5). There was no difference in disease severity between the probiotics and no probiotics arms (P = 0.32). Median time to disease resolution was 4 days. No difference in time to disease resolution was observed between patients never on probiotics and patients on established probiotic regimens (P = 0.64). There was a significant increase in time to resolution in patients starting probiotics >24 hours after CDI diagnosis (P = 0.03).

Conclusion: Probiotics increase pill burden as well as cost to patients and healthcare systems, without ameliorating disease severity or time to disease resolution.

174 | Teaching old drugs new tricks: Combining cefepime with aminoglycosides for ESBL producing Enterobacteriaceae in febrile neutropenia

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Introduction: Cefepime is frequently used for the treatment of febrile neutropenia; however, increasing rates of extended spectrum beta-lactamase (ESBL) producing Enterobacteriaceae may begin to limit use. Traditionally, aminoglycoside and beta-lactam antibiotics demonstrate synergy; however, most of the data has been in *Pseudomonas aeruginosa*.

Research Question or Hypothesis: This study aimed to identify differential aminoglycoside synergy combined with cefepime in ESBL producing Enterobacteriaceae.

Study Design: We determined cefepime MICs and interpreted susceptibility with and without gentamicin, tobramycin, or amikacin in vitro against ESBL producing isolates. A Monte Carlo simulation of cefepime, incorporating synergistic effects with available aminoglycosides, for the treatment of ESBL producing *E. coli* and *Klebsiella* spp. was conducted.

Methods: 10,000 patient Monte Carlo simulation was conducted for cefepime at various doses and administration times. Pharmacokinetic data were extracted from previous literature and protein. (PTA) was calculated using a pharmacodynamic target of 65% f T > MIC. Susceptibility testing was performed on one ESBL producing *E. coli* and *Klebsiella pneumoniae* with cefepime+gentamicin, tobramycin, or amikacin. PTA was determined in combination with the revised cefepime MIC.

TABLE 1 MICs of ESBL producing Enterobacteriaceae

	Cefepime +Amikacin	Cefepime +Gentamicin	Cefepime +Tobramycin
E. coli	<0.125 mcg/mL	<0.125 mcg/mL	<0.125 mcg/mL
Klebsiella pneumoniae	<0.125 mcg/mL	≤2 mcg/mL	≤1 mcg/mL

Results: Monte Carlo simulation revealed that at an MIC of ≤4 mcg/mL, cefepime achieved a PTA >90% in 3 extended infusion regimens: 1 g every 6 hours, 2 g every 8 hours, and 2 g every 6 hours. All regimens (standard and prolonged) achieved PTA > 90% at an MIC of ≤2 mcg/mL.

Conclusion: Dose optimization of cefepime achieved a PTA >90% at an MIC ≤4 mcg/mL. The addition of an aminoglycoside to cefepime lowered ESBL producing *E. coli* and *Klebsiella pneumoniae* MICs so that all cefepime regimens achieved a PTA >90%. Amikacin +cefepime for ESBL producing Enterobacteriaceae was the most potent combination.

175 | Analysis of a ceiling effect on the association of new resistance development to antipseudomonal beta-lactam exposure in the critically ill

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Introduction: Each additional day of cumulative exposure to antipseudomonal beta-lactams (AP) has been associated with increased likelihood of new resistance emergence in the critically ill.

Research Question or Hypothesis: Our objective was to evaluate if the relationship of that association was strictly linear with each additional day or if there was a ceiling effect, where the associated increase in the risk of new resistance plateaus after a certain duration of exposure.

Study Design: Retrospective Cohort Study.

Methods: All adult patients with a discharge diagnosis for severe sepsis or septic shock between 2010 and 2015 at a tertiary care hospital

were retrospectively identified. Cohort entry was defined as the initiation date of AP, defined as any of the following: cefepime, piperacillin-tazobactam, or meropenem. Primary outcome was the development of new resistance to any AP three or more days after cohort entry. Patients with no outcome at day 60 or death were censored. The risk for incident AP resistance after cohort entry was assessed with stratified cumulative exposures comparing 1-3 days (reference) with 4-6 days, 7-9 days, 10-12 days, 13-15 days, 16-18 days, 19-21 days, and 22 or more days.

Results: The cohort consisted of 7,118 patients with 444 of them developing new resistance. Compared to the reference of 1-3 days of AP exposure, the risk of developing new resistance was hazard ratio (HR) 1.01 (95% CI 0.93-1.10) for 4-6 days, HR 1.85 (95% CI 1.69-2.02) for 7-9 days, HR 2.93 (95% CI 2.66-3.24) for 10-12 days, HR 3.94 (95% CI 3.54-4.39) for 13-15 days, HR 6.29 (95% CI 5.62-7.04) for 16-18 days, HR 7.05 (95% CI 6.19-8.02) for 19-21 days, and HR 8.52 (95% CI 7.62-9.53) for 22 or more days.

Conclusion: The associated rise in the risk of new resistance emergence with increasing duration of AP exposure in the critically ill does not appear to exhibit a ceiling effect.

176 | Pharmacist-led allergy evaluations reduced meropenem use in community hospital

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Introduction: Previous literature reveals documented β-lactam allergies is often inaccurate or incomplete, leading to unnecessary prescribing of broad-spectrum antibiotics. Meropenem utilization vastly increased at a community hospital following system-wide order set changes aiming to reduce aztreonam usage.

Research Question or Hypothesis: Can comprehensive allergy assessments performed by pharmacists reduce unnecessary meropenem prescribing in patients with documented β-lactam allergies?

Study Design: Quasi-experimental study

Methods: After a medication evaluation attributed increased meropenem usage to β-lactam allergies, the antimicrobial stewardship program developed an initiative for pharmacists to perform comprehensive allergy assessments of patients receiving meropenem with a concomitant β-lactam allergy. The pre-intervention group was compared to the post-intervention group to determine the impact of pharmacist-led allergy evaluations. The primary endpoint was the proportion of patients with **β**-lactam allergies whose order for meropenem was either de-escalated or discontinued due to a pharmacist-led allergy assessment. Secondary endpoints include missed opportunities in each intervention group, number of physician-led allergy assessments resulting in de-escalation, proportion of prescribing by physician specialty, and meropenem expenditures.

Results: A total of 210 patients receiving meropenem with a concomitant **β**-lactam allergy were evaluated during the pre- and post- intervention periods, 40 and 170 respectively. After implementation of pharmacist-led allergy assessments, the proportion of meropenem de-escalations in the post-intervention group significantly increased (27.5% to 47.6%, $P = 0.0329$). Meropenem use declined hospital-wide and resulted in a cost savings of almost $13,000 from year to year.

Conclusion: A large number of patients with documented β-lactam allergies were unnecessarily prescribed the broad-spectrum antibiotic meropenem. After pharmacists were educated about conducting allergy evaluations and began actively making recommendations to de-escalate, there was a decrease in meropenem use and a reduction in meropenem expenditures. A similar approach can be applied to other broad-spectrum agents prescribed as a result of documented β-lactam allergies.

177 | Evaluation of management of purulent and nonpurulent skin and soft tissue infections at a VA Medical Center: An opportunity for antimicrobial stewardship

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Introduction: Purulent and nonpurulent skin and soft tissue infections (SSTI) are common infectious diseases causing hospitalization and antimicrobial treatment. There are numerous evaluations outside the Veterans Health Administration documenting suboptimal antibacterial use for SSTIs. Identifying areas to optimize antimicrobials is prudent given frequency of SSTIs and known adverse effects associated with antimicrobials. Our site collaborated in a VA Center for Medication Safety and Antimicrobial Stewardship Task Force national medication use evaluation (MUE) to evaluate the management of SSTIs in inpatient veterans.

Research Question or Hypothesis: Is empiric antimicrobial selection and duration of therapy for SSTI concordant with practice guidelines from the Infectious Diseases Society of America (IDSA)?

Study Design: A retrospective chart review of hospitalized veterans diagnosed with SSTI from June 1, 2016-May 31, 2017.

Methods: The MUE utilized a database extraction and a multi-site retrospective chart review. Our site evaluated 150 patients to determine eligibility. Guideline concordant therapy defined as received only an MRSA-targeted antibacterial for purulent SSTI or a *Streptococcus* species-targeted antibacterial for nonpurulent SSTI for ≤10 days.

Results: Thirty-eight patients at our site were eligible and included in the multi-site MUE (N = 1,828). Guideline concordant therapy was met in 7% purulent (N = 15) and 12% nonpurulent (N = 23) SSTIs. Thirteen percent of purulent SSTIs missed empiric MRSA coverage and 76% of nonpurulent SSTIs had unnecessary empiric MRSA coverage. Unnecessary empiric broad spectrum coverage was seen in 60% purulent and 52% nonpurulent SSTIs. The total antibiotic duration

median was 12 days (IQR 10,20) with 67% >10 days of therapy in purulent SSTIs. The total antibiotic duration median was 12 days (IQR 9,15) with 52% >10 days of therapy in nonpurulent SSTIs.

Conclusion: There are multiple opportunities for improvement regarding IDSA guideline-adherent management of SSTIs. Further investigation into how antimicrobial stewardship can impact appropriate antimicrobial selection and duration of therapy is warranted.

178 | An evaluation of a sustained antimicrobial stewardship program (ASP) and antimicrobial stewardship education to medical and pharmacy trainees at a VA Medical Center

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Introduction: Interprofessional team practice education (IPE) is an essential component in educating medical and pharmacy trainees in providing patient centered care in a team environment. An ASP utilizing an IPE approach was established in 2012. In 2017, the Joint Commission implemented ASP standards requirement for hospitals, including the standard for education of ASP practices.

Research Question or Hypothesis: What is the impact of a sustained ASP on clinical interventions and acceptance rate, as well as the educational exposure on ASP to medical and pharmacy trainees?

Study Design: Retrospective review from 2012-2018.

Methods: ASP data on clinical interventions were prospectively documented in electronic medical record, ASP monitoring form, and Excel database. The ASP clinical interventions were analyzed for intervention type and acceptance rate. The interprofessional ASP team includes the ID attending physician, ID fellow physician, ASP pharmacist, medical resident physician, medical students, pharmacy resident and pharmacy students. Additionally, the ASP team intervenes with the primary team utilizing face-to-face communication to convey recommendations in an educational manner.

Results: The ASP team provided 2,267 interventions on 1,699 patients from 2012 to 2018. There were 1,755 (77.4%) interventions recommended an antimicrobial/antifungal therapy change, 329 (14.5%) interventions recommended additional cultures or other category, and 183 (8.1%) interventions recommended an ID consult. The ASP had a sustained high acceptance rate: 2012 89% to 2018 93% throughout the review time-frame. Fourteen ID fellows (84 rotation months), 23 pharmacy residents, 84 medical resident physicians, 91 pharmacy students and approximately 56 medical students have gained IPE experience with the ASP team. Additionally, approximately 1,260 resident physicians on other medical teams have been exposed to educational ASP practices.

Conclusion: The interprofessional ASP team demonstrated a sustained high acceptance rate since inception. Additionally, education on ASP practices has touched a noteworthy number of medical and pharmacy trainees.

179 | Procalcitonin-guided antibiotic therapy for suspected early-onset neonatal sepsis: A decision model analysis

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Introduction: Empirical antibiotic therapy is usually initiated for suspected early-onset neonatal sepsis (EOS) in the neonatal intensive care unit (NICU) setting. Timely discontinuation of antibiotics can improve the quality-adjusted life years (QALY) and cost outcomes.

Research Question or Hypothesis: We aimed to compare the cost-effectiveness of procalcitonin (PCT)-guided care versus standard care for antibiotic management of suspected EOS patients in the NICU.

Study Design: Decision tree modelling from perspective of Hong Kong public healthcare provider.

Methods: A decision tree model was designed to simulate the outcomes of procalcitonin-guided versus standard care for suspected EOS in the NICU. The outcome measures were sepsis-associated direct costs, QALY loss, and incremental cost per QALY saved (ICER) by PCT-guided care. The model inputs were estimated from literature. One-way and probabilistic sensitivity analysis were performed to evaluate the robustness of base-case results.

Results: In the base-case analysis, the PCT-guided arm cost more (HK $223,842 versus HK$215,052; US$1 = HK$7.8) and reduced QALY loss (0.02684 versus 0.02747) when compared to the standard care arm. The ICER of PCT-guided arm was HK$13,767,547 per QALY saved and it exceeded the willingness-to-pay threshold (3× GDP per capita in Hong Kong HK$1,018,593). One-way sensitivity analysis found that the base-case results were sensitive to the variation of prevalence of sepsis and odds ratio of length of NICU stay and the odds ratio of Clostridium difficile infection associated with PCT-guided care. The probabilistic sensitivity analysis of 10,000 Monte-Carlo simulations showed that the PCT-guided arm was the preferred option in 38.89% of the time.

Conclusion: The use of PCT surveillance to guide decision-making in antibiotic management of NICU neonates with suspected EOS is less likely a cost-effective option when compared to standard care.

180 | Comparative Monte Carlo analysis of cefepime/VNRX-5133 and meropenem/vaborbactam against resistant Gram-negative pathogens

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Introduction: VNRX-5133, a novel boronate-based beta-lactamase inhibitor (BLI), enhances the activity of cefepime against difficult-to-

treat pathogens, including cephalosporin- and carbapenem-resistant Enterobacteriaceae and Pseudomonas aeruginosa (PA). Cefepime combined with VNRX-5133 (FEP-VNRX), began Phase 3 trials in April 2019. A structurally similar BLI, vaborbactam, combined with meropenem (MEV), was approved in 2017.

Research Question or Hypothesis: Are there differences in target attainment (%TA) between FEP-VNRX-5133 and MEV against resistant Gram-negative organisms?

Study Design: Monte Carlo analysis (MCA)

Methods: MCA (n = 10,000) was performed for FEP-VNRX and MEV using pharmacokinetic parameters, pharmacodynamic (PD) targets, and recent MICs from peer-reviewed literature against 4 resistant organisms: cefepime non-susceptible PA (PA-FEP-NS), meropenem non-susceptible PA (PA-MEM-NS), NDM-producing Enterobacteriaceae (ENT-NDM), and KPC-producing Enterobacteriaceae (ENT-KPC). We analyzed 2 patient volumes of distribution, normal (V1) and burn/sepsis (V2), and 4 body weights (60-90 kg). Drug clearance was estimated using a CrCl vs. Cl regression and our inpatient CrCl distribution. Two extended-infusion dosage regimens (D1, D2) were assessed for each drug (FEP-VNRX = 2 h, MEV = 3 h). D1 for MEV was its product label (PL); all other regimens were modifications of the parent compound's PL. Low (stasis) and high (2-logs bacterial killing) PD targets (%fT > MIC) were used.

Results: Differences in %TA due to variables was low: ≤9%/≤7% (LT/HT) for volume, and ≤ 5%/≤10% (LT/HT) for weight.

	%TA for V1, 80 kg patient (Low/High Target)			
	MEV		FEP-VNRX	
	D1	D2	D1	D2
PA-FEP-NS	60/50	48/36	82/76	82/77
PA-MEM-NS	61/46	42/18	85/81	85/81
ENT-NDM	29/14	12/5	96/88	95/89
ENT-KPC	100/100	100/100	100/100	100/100

Conclusion: The high target attainment of FEP-VNRX for all 4 pathogens, and MEV for ENT-KPC suggests clinical utility for empiric therapy. MEV may not be appropriate for empiric monotherapy against PA-FEP-NS and PA-MEM-NS; however, it could be utilized as combination or directed therapy. Our results suggest that MEV should not be used for ENT-NDM, due to poor target attainment.

181 | The impact on empirical use of antibiotic coverage in atypical pathogens for adults hospitalized with community-acquired pneumonia

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Introduction: The IDSA guidelines for the treatment of community-acquired pneumonia (CAP) recommend empirical therapy with beta-lactam plus macrolide or respiratory fluoroquinolone (FQ). The addition of macrolide or FQ is to cover atypical organisms. Due to the increased macrolide and FQ resistance, coupled with the low detection rate of atypical pathogens infection, most physicians choose not to follow the CAP guideline. Therefore, whether it is necessary to use empirical anti-atypical antibiotics is a need for further evaluation.

Research Question or Hypothesis: To determine the efficacy of empirical use of anti-atypical antibiotics in patients with CAP.

Study Design: This is a retrospective, observational study in a 500-bed hospital in Taiwan.

Methods: We analyzed data from January 2018 to June 2018. Patients aged ≥18 years-old with a CAP diagnosis were included, and the patients were defined as anti-atypical group or non-anti-atypical group. We excluded patients with multiple infections. The study outcomes were the length of hospital stay, mortality and readmission rate within 30 days of discharge.

Results: Total of 676 patients were included during the study period, of which 151 patients were in anti-atypical group, 525 patients were in non-anti-atypical group. Length of hospital stay was 7.61 ± 4.52 days in anti-atypical group, and 10.07 ± 6.20 days in non-anti-atypical group, $P < 0.05$. Mortality rate was significantly lower in anti-atypical group (3.31% vs. 8.76%, $P = 0.025$). Readmission rate was also lower in anti-atypical group, but it fails to reach statistical differences (4.46% vs. 9.33%, $P = 0.065$). Subgroup analysis was done after the patients were further categorized into ICU admission or general ward admission. Both subgroups were significant difference in length of hospital stay ($P < 0.05$), no significant difference in mortality rate and readmission rate.

Conclusion: Empirical use of anti-atypical antibiotic was associated with improved clinical outcomes. Pharmacists should encourage physicians to follow the guideline recommendation and keep on monitoring the efficacy periodically.

182 | Minocycline promotes macrophage activation to enhance the activity against *Acinetobacter baumannii*

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Introduction: *Acinetobacter baumannii* (Ab) is a highly drug resistant gram-negative bacteria that predominantly causes nosocomial infections in critically-ill patients. Minocycline has emerged as a treatment option for these infections, as carbapenem resistance continues to escalate (1, 2). Some studies have demonstrated benefit of minocycline when used as mono- or combo-therapy, which appear to outsize its known *in vitro* potency against Ab (1, 3).

Research Question or Hypothesis: We hypothesized that along with its antibiotic effect, minocycline augments host innate immunity to optimize macrophage killing of Ab.

Study Design: *In vitro* minocycline modeling in co-culture with human macrophages and Ab 5075

Methods: THP-1 monocytes were stimulated to macrophages and conditioned in RPMI 1640 with GultaMAX™ at 10% FBS +/- minocycline or comparator antibiotics for 24 hours. Macrophages were washed to remove minocycline and included in time-kill assays and hollow fiber PK/PD models. For time-kills, Ab was added to each well and co-cultured for 6 hours. Culture supernatants were collected, serially diluted, and plated to determine bacterial load. Real-time PCR and ELISA determined changes in macrophage inflammatory signals.

Results: In co-culture, minocycline pre-conditioned macrophages resulted in complete bacterial eradication, while untreated macrophages had no effect ($P < 0.05$). The comparator antibiotics tetracycline, meropenem, piperacillin/tazobactam, colistin, and daptomycin as a negative control demonstrated no activity in macrophage co-culture. Pre-conditioned macrophages had increased expression of several inflammatory genes, but decreased production of IL-6, TNF-α, and MCP-1 when compared to non-pretreated samples ($P < 0.05$). Hollow fiber modeling will be used to confirm the pharmacodynamic effects of minocycline activity of macrophages.

Conclusion: The host activating effects of minocycline are crucial for its ability to clear Ab infections and may explain the positive response in this complex infection. Further investigation into the mechanism of this effect is needed in order to optimize therapeutic regimens.

183 | Dual vs triple antibiotic therapy for the treatment of carbapenem-resistant *Acinetobacter baumannii* infections

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Introduction: Carbapenem-resistant *Acinetobacter baumannii* (CRAB) infections remain some of the most difficult to treat due to extremely high rates of resistance. The purpose of this study was to compare the efficacy of dual vs triple targeted antibiotic regimens for CRAB infections.

Research Question or Hypothesis: Does triple therapy result in higher clinical cure (CC) and lower all-cause in-hospital mortality (ACIM) rates compared to dual therapy?

Study Design: Retrospective cohort study

Methods: The primary endpoints of the study were differences in ACIM and CC rates for patients treated with dual vs triple antibiotic therapy. The secondary endpoint results focused on difference in length of stay (LOS) between treatment groups. A sub-group analysis was performed for patients treated with tigecycline vs minocycline combination therapy to determine differences ACIM and CC, and LOS. A multi-logistic regression analysis (MLRA) was performed to determine risk factors associated with ACIM and CC.

Results: No differences in ACIM between dual vs triple antibiotic groups (9.5% vs 18.2%, $P = 0.59$). CC (63.6% vs 57.1%, $P = 1.0$) and LOS (12 vs 11 days, $P = 1.0$) were similar amongst patients treated with dual vs triple therapy. No differences seen in ACIM (15.4% vs 16.7% $P = 1.0$), CC (83.3% vs 69.2%, $P = 1.0$) and LOS (15 vs 14 days, $P = 1.0$) between tigecycline and minocycline combination therapy groups. MLRA showed positive association of increased serum creatinine and ACIM ($P = 0.00888$) as well as shorter time to appropriate antibiotic therapy and clinical cure ($P = 0.0414$). More CRAB isolates were susceptible to minocycline vs tigecycline (83% vs 18%, $P = 0.003$).

Conclusion: No differences were seen in ACIM, CC and LOS between dual vs triple antibiotic groups. Minocycline tends to sustain better susceptibility towards CRAB vs tigecycline. Elevated serum creatinine was found to be a predictor for ACIM while shorter time to appropriate antibiotic therapy was associated with CC.

184 | Use of antibiotic therapy for urinary tract infections in a primary care setting

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Introduction: Antibiotic resistance in the outpatient setting is an emerging public health concern. According to the Centers for Disease Control and Prevention (CDC), at least 30% of antibiotics prescribed in the outpatient setting are unnecessary. It was previously found that urinary tract infections (UTI's) were the most common indication, accounting for approximately one in six antibiotics prescribed by our practice in one year.

Research Question or Hypothesis: Does antibiotic prescribing align with clinical practice guidelines for management of UTI's in a primary care setting?

Study Design: A retrospective, single-site chart review of patients diagnosed with a UTI and were managed at one University Family Medicine Practice (UFP).

Methods: A chart review of patients who were diagnosed with a UTI and managed at UFP between dates January 1, 2017 and January 1, 2018, was completed. Patients were excluded if they were pregnant or if urologic abnormalities were present. The primary outcome was the proportion of patients who were prescribed guideline directed therapy. Primary and secondary outcomes were analyzed with descriptive statistics using proportions, means, and standard deviations as deemed appropriate. A logistic regression was performed to evaluate associations between the proportion of patients receiving guideline directed therapy and identified baseline characteristics.

Results: One-hundred and ninety-one patients were identified with a diagnosis of a UTI within the specified study period. Fifty-four patients were excluded from the statistical analysis. Ninety-seven (70.8%) patients were prescribed a guideline directed antibiotic. Of these 97 patients, 44 patients were prescribed guideline directed dose and duration of therapy (45.3%). The three most common antibiotics prescribed were nitrofurantoin (39.4%), sulfamethoxazole/trimethoprim (31.4%), or a fluoroquinolone (19.0%).

Conclusion: A large proportion of patients diagnosed with UTI's in this primary care setting were prescribed antibiotics that generally

followed guideline recommendations. Opportunities exist to improve guideline directed dosing and duration of therapy within the practice.

185 | Combining the current generation of antibiotics with zidovudine: Assessing its utility as salvage therapy

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Introduction: Options against carbapenem-resistant *Klebsiella pneumoniae* (CRKP) in critically ill patients are extremely limited. Zidovudine (ZDV) has previously demonstrated antibacterial activity in combinations against CRKP and may be a viable salvage therapy together with other agents. Here, we assessed bacterial killing of ZDV in combination with aztreonam/avibactam (ATM/AVI) against CRKP.
Research Question or Hypothesis: ZDV enhances bacterial killing in combination with an ATM/AVI regimen.
Study Design: The current study utilized a concentration-effect, Hill-type model to characterize and visualize trends in dose escalation from time-kill studies.
Methods: A *K. pneumoniae* (BT709) isolate harboring bla_{NDM-5}, $bla_{CTX-M-55}$, and *mcr-1* was utilized in static time-kill studies at a 10^6 CFU/mL inoculum over 24 hours. A comprehensive 5x1x6 treatment matrix was explored, including: a growth control, ATM (0.25, 1, 4, and 16 mg/L), AVI (4 mg/L), and ZDV (0.33, 1, 3, 9, and 27 mg/L). Bacterial killing was quantified through determination of total counts at 0, 1, 2, 4, 8, and 24 hours. Data were then analyzed by determining the Area Under the CFU/mL Curve ($AUCFU_{0-24}$) which was fit to a Hill-type function to quantify the optimal concentrations of ATM and ZDV in the presence of AVI and evidence of synergy.
Results: ATM, AVI, and ZDV monotherapies all resulted in complete regrowth by 24 hours. ZDV concentrations greater than 1 mg/L showed a 99% reduction in counts by 2 hours but regrew by 24 hours. Pharmacodynamic analyses showed dose-dependent bacterial killing with sharp decreases in the normalized $\log_{10}AUCFU_{0-24}$ of BT709 at lower concentrations of both ZDV and ATM. Of note, the estimated EC_{50} of ATM in the presence of clinically relevant concentrations of ZDV and AVI was 0.47 mg/L, well below the concentrations achieved with usual dosages.
Conclusion: The addition of ZDV to an ATM/AVI regimen is a promising combination for clinicians to consider against serious CRKP infections.

186 | Do traditional risk factors for MRSA skin and soft tissue (SSTI) infections apply today in a medically under-served population?

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Introduction: Increase in MRSA SSTI rates historically have led to over-prescription of empiric IV vancomycin. As the MRSA rates have recently started to decline, updated information on MRSA SSTI risk factors in a medically under-served population is needed to guide appropriate empiric vancomycin therapy. **Research Question or Hypothesis**: Does the medically under-served population have the same traditional risk factors for MRSA and is empiric anti-MRSA therapy for purulent SSTI needed?
Study Design: Retrospective cohort study
Methods: Medical charts were reviewed for hospitalized patients with S. aureus (SA) SSTI between August 2017 to February 2019; patients were grouped as MSSA vs. MRSA SSTI and compared for demographics and treatment outcomes.
Results: 144 patients were included (MRSA = 55; MSSA = 89). Overall, mean age was 48y and 75% were male. MRSA group had more non-Hispanic White (16% vs. 4%, $P = 0.03$) and cirrhotic patients (9% vs. 0%, $P = 0.01$) vs. MSSA group. MRSA group had more frequent history of hospitalization (61% vs. 44%, $P = 0.04$), MRSA infections (20% vs. 0%, $P < 0.01$), positive MRSA nares (75% vs. 0%, $P = <0.01$), and IV drug use (40% vs. 18%, $P < 0.01$). Rates of imprisonment, homelessness, dialysis, and prior antibiotic exposure were similar (P = ns). 30d mortality, re-admission, and length of stay (LOS) were not affected by methicillin resistance (P = ns). Within MRSA SSTI, lack of empiric anti-MRSA therapy did not compromise risk for re-admission (28% vs. 33%, $P = 1.00$) or prolong LOS (7d vs. 5d, $P = 0.30$) vs. those who received anti-MRSA therapy.
Conclusion: In the medically under-served population, traditional risk factors for MRSA SSTI were still more frequent, however prior antibiotic exposure, history of dialysis, homelessness, and imprisonment were not. Delay in initiating anti-MRSA therapy in MRSA SSTI did not compromise outcomes, thus an antimicrobial stewardship strategy could include reserving empiric vancomycin until susceptibility is available in clinically stable patients.

187 | Continuous intravenous administration of high-dose amoxicillin using an innovative non-electrically driven portable infusion pump

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Background: While treatment of serious infectious diseases may require high-dose amoxicillin, continuous infusion may be limited by lack of knowledge regarding the chemical stability of the drug. Therefore, we have performed a comprehensive study so as to determine the chemical stability of high-dose amoxicillin solutions conducive to safe and effective continuous intravenous administration using ANAPA®, an innovative portable pump. ANAPA® is a CO2 pressured infusion device containing a special relief valve for maintaining gas pressure and a glass capillary, allowing accurate flow rate.

Methods: According to previous data (submitted for publication) amoxicillin solutions were prepared at 25 mg/mL using saline to fill an ANAPA® device (240 mL-20 mL/h, EWHA, Asept InMed France) (n = 3), stored under conditions mimicking patient administration using a portable pump (device stored at ambient temperature and end-cap of the tube line maintained at 32°C). Amoxicillin stability over time was assessed by determination of amoxicillin concentrations at t = 0, 2, 4, 6, 8 10 and 12 h using a fully validated HPLC-UV stability-indicating method. At the same time, we have assessed the flow rate of the device by gravimetric method, taking into account the specific density of the amoxicillin solution and the evaporation process.

Results: The initial concentration of amoxicillin in ANAPA® was determined at 25.4 ± 0.3 mg/mL on average. Maintaining the portable pump at 23.6 ± 0.6°C and the end-cap at 31.2 ± 2.0°C, the amoxicillin remaining was greater than 90 % up to 12 hours (92.0 ± 1.9% at t = 12 h). In addition, the mean flow rate measured over the12 hour infusion period was 18.7 ± 1.2 mL/h.

Discussion: In conclusion, portable pump ANAPA® allows accurate administration of high-dose amoxicillin using continuous infusion of a 25 mg/mL solution chemically stable over 12 hours at room temperature.

Other: N/A

188 | Assessing the antibiotic management of HAP, VAP and HCAP across a healthcare system

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Introduction: Although the healthcare-associated pneumonia (HCAP) designation was removed from the 2016 ATS/IDSA hospital-acquired and ventilator-associated pneumonia (HAP/VAP) guidelines, such patients continue to present and require treatment.

Research Question or Hypothesis: What are the relative frequencies of HAP, VAP and HCAP and the associated antibiotic management strategies across a large healthcare system?

Study Design: Retrospective chart review

Methods: An electronic report was utilized to identify adults hospitalized on pre-specified ICU, medical, and surgical floors at one of four hospitals between October 2018 and January 2019 receiving antibiotics for HAP, VAP, or HCAP. Patients were excluded if they had community-acquired pneumonia or an alternative source of infection. HCAP risk factors included those listed in the 2005 ATS/IDSA guidelines. Manual chart review was performed to collect patient demographics, infection and antibiotic therapy details. Descriptive statistics were utilized to report results.

Results: 108 patients were included, with the majority (53.7%) prescribed antibiotics for HCAP, 41.7% for HAP, and 4.6% for VAP. With respect to potential risk factors for multidrug resistant pathogens, 49% of patients received IV antibiotics in the past 90 days and 58% had an HCAP risk factor with the two most common being recent hospitalization (58%) and receipt of oral antibiotics in the past 90 days (43%). Empiric anti-pseudomonal therapy was utilized in 98% of patients, and less than a quarter (23%) received dual gram-negative coverage. Empiric MRSA therapy was prescribed in 79% of all cases, including 88% of HCAP, 80% of VAP, and 67% of HAP patients. De-escalation by 72 hours occurred in 72% of cases. The median duration of therapy was 168 hours (IQR 144-240). Among culture positive patients (n = 30), empiric therapy was appropriate in 93%.

Conclusion: HCAP continues to be commonly identified and patients are generally treated in a manner consistent with HAP/VAP consensus guidelines.

189 | Empiric vancomycin for community-acquired meningitis in adults: A single-center retrospective analysis of need and risk

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Introduction: Clinical practice guidelines on the management of bacterial meningitis recommend empiric vancomycin with aggressive dosing to cover resistant Gram-positive organisms. Emerging evidence has identified that vancomycin trough levels >15 mcg/mL are associated with an increased risk of acute kidney injury (AKI). An understanding of the rates of resistant Gram-positive infection and AKI is needed to assess the risks and benefits of empiric vancomycin for community-acquired meningitis.

Research Question or Hypothesis: What are the rates of identification of resistant Gram-positive bacteria and AKI among adults receiving empiric vancomycin for community-acquired meningitis?

Study Design: This is a retrospective cohort study conducted at a single urban teaching hospital.

Methods: Adult patients with a cerebrospinal fluid culture collected between July 1, 2017 and December 31, 2018 treated with greater than one dose of vancomycin were included in the study. Patients who had health-care associated ventriculitis or meningitis were excluded. The primary outcome was the percentage of study patients with resistant Gram-positive bacteria identified from microbiological testing necessitating vancomycin use. Secondary outcomes were the rates of AKI among patients with greater than and less than 48 hours of vancomycin use. Descriptive statistics were calculated using Microsoft Excel.

Results: A total of 92 patients were excluded from 139 screened, primarily for receiving less than two doses of vancomycin. Of 47 patients, 24 (51%) were found to not have meningitis, 17 (36.2%) had an unknown cause, 3 (6.4%) had bacterial causes and none had resistant Gram-positive infection requiring vancomycin use. AKI occurred in 4 (8.5%) patients, including 2/20 (10%) and 2/25 (7.4%) of patient

receiving greater than and less than 48 hours of vancomycin, respectively.

Conclusion: Vancomycin was rarely required for community-acquired meningitis based on microbiological findings. However, its use was associated with AKI. Larger studies are required to confirm these outcome rates.

190 | Tapping into rapid diagnostics: Impact of the BioFire meningitis/encephalitis panel on antimicrobial stewardship

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Introduction: Rapid diagnostics have revolutionized antimicrobial stewardship. The BioFire FilmArray meningitis/encephalitis (ME) panel detects 14 common central nervous system (CNS) pathogens in approximately an hour.

Research Question or Hypothesis: Does the BioFire ME panel reduce time to targeted antimicrobial therapy in pathogen-detected CNS infections?

Study Design: IRB-approved retrospective cohort

Methods: Adult patients who underwent a lumbar puncture and had a pathogen consistent with CNS infection were included. Patients were excluded if they had a previous CNS infection or disorder that would interfere with testing. Patients were divided into two cohorts: patients with an ME panel (ME group) and patients without an ME panel (control). Baseline characteristics, patient demographics, and cerebrospinal fluid analysis were compared between cohorts. The primary endpoint was time to targeted antimicrobial therapy, including appropriate coverage and de-escalation. Secondary outcomes included length of stay, avoidable days of antimicrobial therapy and cost. Subgroup analysis by pathogen distribution was also performed.

Results: There were 18 patients in each group. Time to appropriate therapy decreased from 56.1 hours in the control to 8.2 hours in the ME group (difference of 47.9 hours, $P = 0.005$), with the greatest benefit seen in viral infections (81.5 hours), then bacterial (32.5 hours), then fungal infections (22 hours). Length of stay decreased from 12.5 days in the control to 7.5 days in the ME group ($P = 0.04$). There were 96 avoidable days of antimicrobial therapy ($1905) in the control group versus 15 days ($399) in the ME group (difference of 81 days and $1506, $P = 0.02$). One patient in the control was discharged prior to identification of *Herpes simplex* and was therefore excluded from analysis.

Conclusion: The BioFire FilmArray ME panel provided a significant reduction in time to targeted antimicrobial therapy, length of stay, avoidable antimicrobial days, and antimicrobial costs compared to conventional methods in patients with a detected pathogen.

191 | Examining the combination of cefixime and amoxicillin/clavulanate against extended-spectrum beta-lactamase (ESBL)-producing Escherichia coli isolates

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Introduction: Community acquired urinary tract infections (UTIs) caused by extended spectrum beta-lactamase (ESBL)-producing *Escherichia coli* have limited oral therapeutic options and pose significant clinical challenges. This study documented increased activity of cefixime (CFM) when used in combination with amoxicillin/clavulanate (AMC) with aims to identify an oral treatment option for clinicians to treat UTIs caused by ESBL *E. coli*.

Research Question or Hypothesis: AMC improves the activity of CFM against ESBL *E. coli*.

Study Design: This was *in vitro* study of 36 clinical *E. coli* isolates.

Methods: MICs for each isolate were determined by broth microdilution (BMD) and E-test for AMC and for CFM. Isolates were lawned on Mueller-Hinton agar plates with AMC in the agar at a concentration corresponding to serum concentrations. A CFM E-test was placed on the plates and were then incubated at 37° C for 18-24 hours. Isolates with CFM MIC ≤1 μg/mL in the presence of AMC were considered susceptible to the CFM + AMC combination based on CLSI breakpoints. Descriptive statistics were used to compare MICs between treatment groups.

Results: Of 36 isolates, the median AMC MIC determined by BMD was 32 μg/mL [IQR: 16-32 μg/mL] and 16 μg/mL [IQR: 12-24 μg/mL] by E-test. The median CFM MIC tested by BMD and E-test were 128 μg/mL [IQR: 64-128 μg/mL] and 96 μg/mL [IQR: 24-256 μg/mL], respectively. The median MIC to the CFM + AMC combination was 0.75 μg/mL [IQR: 0.25-1.125 μg/mL]. This corresponds to a median decrease of 128-fold in CFM MIC when CFM is in combination with AMC. In total 27 isolates (75%) were susceptible to the CFM + AMC combination.

Conclusion: ESBL *E. coli* rates are increasing worldwide with scant oral therapeutic choices. This study found that AMC improves the activity of CFM against ESBL *E. coli*. CFM in combination with AMC has potential use for UTIs caused by ESBL producing *E. coli* as an oral combination option.

192 | Association between infection type and antibiotic indication selected during order entry

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Introduction: Based upon the CDC's Core Elements of Antimicrobial Stewardship programs recommendation that all antibiotic prescriptions have a specified dose, duration and indication for use, our facility implemented a hard-stop requiring an indication during order entry. Following implementation, there was concern regarding the accuracy of the information obtained. Our study sought to assess the association between the indication selected during the ordering process and the treated indication. Additionally, we sought to identify any trends with a lower association between ordered and treated indication.

Research Question or Hypothesis: Does the indication selected during antibiotic order entry match the treated indication?

Study Design: Cross-sectional cohort study

Methods: Antibiotic orders during a 6-month time period post-implementation were selected. Orders were excluded if the patient was less than 18 years of age, the frequency was once, the antibiotic did not meet pre-specified criteria for required indication, or the order originated in a pediatric or outpatient unit. A random sample of all orders meeting criteria was selected. Orders were reviewed to determine physician group, ordered indication, treated indication, use of a pre-built order set and association between ordered and treated indication. Chi-squared analysis was used to evaluate for statistical significance for all categorical values.

Results: Of 99 orders reviewed, 80.1% matched ordered indication with treated indication (P = 0.00047). Of the orders with matching indications, 38.75% were ordered using pre-built order sets as compared to 31.57% without matching indications. The physician specialty with the highest association was surgery (100%) while the hospitalist orders had the lowest association (70.27%).

Conclusion: An assessment of required antibiotic indication revealed a statistically significant difference in ordered and treated indication. Use of a pre-built order set did not impact the association. This difference was most prominent among the hospitalist group. Further education to this group of providers may be warranted. This a potential area for pharmacist involvement and improvement.

193 | Vancomycin AUC/MIC and treatment outcomes in MRSA bacteremia

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Introduction: Recent studies support the conversion from trough to area under the curve (AUC) / minimum inhibitory concentration (MIC)-based vancomycin dosing due to improved treatment outcomes in Methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia.

Research Question or Hypothesis: The objective of this study is to assess vancomycin dosing at our institution in Long Beach, California and evaluate treatment failures. We hypothesize that there will be a correlation between AUC/MIC and treatment outcomes in MRSA bacteremia.

Study Design: A retrospective observational study was conducted on adult patients admitted to the institution from May 2016 through February 2019 with at least one blood culture positive for MRSA on vancomycin therapy.

Methods: Treatment failure was defined as 30-day all cause mortality, persistent bacteremia over 7 days, or recurrence of MRSA bacteremia within 30 days, and AUC/MIC was calculated to evaluate whether vancomycin was at therapeutic levels. Patients were excluded from analysis if they had acute kidney injury (AKI) at baseline or were on renal replacement therapy. Data was analyzed using the Fisher's exact test and Mann Whitney test on GraphPad Prism, and a *P*-value of <0.05 was considered statistically significant.

Results: Of 51 patients, 16 had treatment failure while 35 had treatment non-failure. 43.8% of patients with treatment failure did not reach target AUC/MIC, while 48.6% of patients with treatment non-failure did not reach target AUC/MIC (*P* = 0.772). Patients that failed treatment were found to have more deep-seated infections, although not statistically significant, which could have contributed to treatment failure.

Conclusion: AUC/MIC was not significantly different between treatment failure and treatment non-failure groups, however more patients that failed treatment had deep-seated infections. Source control may also be an important contributor to treatment failure but was not assessed in this study. Future studies with larger sample sizes are needed to further assess vancomycin dosing at our institution.

194 | Identifying potential de-escalation targets among patients prescribed fluoroquinolones on discharge from the hospital to long-term care facilities

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Introduction: Hospital-initiated antibiotics constitute a large proportion of overall long-term care facility (LTCF) antibiotic use, of which up to 75% may be inappropriate. We aimed to identify potential de-escalation targets among inpatients prescribed fluoroquinolones on discharge to LTCFs.

Research Question or Hypothesis: What are de-escalation opportunities among patients prescribed fluoroquinolones on hospital discharge to LTCFs?

Study Design: Retrospective cohort study of adult (age ≥ 18 years) inpatients discharged from Oregon Health & Science University Hospital to a LTCF between 1/1/2016 and 12/31/2018.

Methods: Patients receiving a fluoroquinolone prescription on hospital discharge were identified using electronic health record data. Patient characteristics of interest included comorbidities, length of stay, inpatient antibiotic exposures, duration of therapy, and primary diagnoses.

Results: Among 7,734 patients discharged to a LTCF, 2,219 (28.7%) were prescribed an antibiotic of which 335 (15%) were prescribed a fluoroquinolone. Mean (standard deviation) age was 67.2 (15.1) years and 45% were female. Median (interquartile range (IQR)) Charlson comorbidity index was 3 (1-5) and the most prevalent comorbidities were cancer (33%), chronic obstructive pulmonary disease (29%), and renal disease (27%). Median length of stay was 9 (IQR 5-16) days and 87% also received fluoroquinolones as an inpatient. Median inpatient fluoroquinolone duration was 4 (IQR 2-7) days and median prescribed fluoroquinolone duration at discharge was 7 (IQR 4-16) days. Only 37% of patients had a primary diagnosis code for a bacterial infection of which 35% were bloodstream infections, 17% were urinary tract infections, 12% were soft tissue infections, and 10% were pneumonia. Only 13% of patients received a specialty infectious disease consultation.

Conclusion: We identified potential de-escalation targets of fluoroquinolones on discharge to LTCFs including extended duration of therapy, potential lack of a bacterial infection, and lack of specialty infectious disease consultation. We will further evaluate these potential targets using manual medical record in future research.

195 | Risk factors for early treatment failure in patients with *Enterococcus* species bloodstream infections

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Introduction: Rapid identification of bloodstream isolates through multiplex polymerase chain reaction (PCR) provides novel opportunities for optimization of empirical antimicrobial therapy in patients with bloodstream infections (BSI).

Research Question or Hypothesis: What host or treatment factors are associated with early treatment failure in patients with *Enterococcus* species BSI?

Study Design: Retrospective cohort study

Methods: The study included adult patients hospitalized at Prisma Health-Midlands hospitals from January 1, 2015 to July 31, 2018 with a monomicrobial *Enterococcus* species BSI. Patients with vancomycin-resistant isolates were excluded. Early treatment failure was defined as death within 72 hours or meeting two of the following early clinical failure criteria between 72-96 hours from BSI: systolic blood pressure < 100 mmHg or vasopressor use, heart rate > 100 beats per minute, respiratory rate > 22 breaths per minute or mechanical ventilation, altered mental status, and white blood cell (WBC) count >12,000 cells/mm^3. Multivariate logistic regression was used to determine risk factors for early treatment failure.

Results: Among 144 unique patients with *Enterococcus* species BSI, median age was 67 years and 89 (62%) were men. The urinary tract was the most common source of infection (39; 27%), followed by intra-abdominal infections (32; 22%). Nearly all isolates (98.6%) were susceptible to ampicillin and 39 (27%) patients received penicillins for empirical therapy. Overall, 60 (42%) patients experienced early treatment failure. After adjustments in multivariate model, every one-point increase in Pitt bacteremia score was associated with a 56% increase in the odds of early treatment failure (OR 1.56, 95% CI 1.25-1.95, P < 0.001). Empirical penicillin therapy was associated with lower odds of early treatment failure (OR 0.40, 95% CI 0.17-0.94, P = 0.03).

Conclusion: Early streamlining of antimicrobial therapy to penicillins based on rapid diagnostic test results (detection of *Enterococcus* species and absence of Van A/B PCR) may improve clinical outcomes of patients with BSI.

196 | Evaluation of the clinical efficacy and safety of oral antibiotic therapy for uncomplicated *Streptococcus* spp. Bloodstream infections

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Introduction: Despite the frequency of *Streptococcal*bloodstream infections (BSI) the effectiveness of oral definitive therapy is unknown.

Research Question or Hypothesis: Is step-down oral antibiotic therapy for uncomplicated *Streptococcus* spp. BSI effective and safe compared to IV full course therapy?

Study Design: Retrospective cohort study

Methods: This was a retrospective cohort study of adult, hospitalized patients with streptococcalBSI between 6/2015-6/2017. Patients were excluded if received <48 h of antibiotic therapy, therapy started >48 h from first positive culture, or had endocarditis, osteomyelitis, or meningitis. Patients were grouped by receipt of step-down oral antibiotic therapy (PO group) vs IV therapy (IV group). The primary outcome was 30d mortality. The secondary outcomes were hospital LOS, 30d recurrence of BSI, and adverse events (AEs).

Results: Total 331 patients were included; median age was 53y, 67% were male. 117 (35%) received step down oral therapy. The most common source was pneumonia (24%). Comorbidities were similar between the groups except for liver dysfunction (IV 20% vs PO 6%, $P < 0.01$) and diabetes (IV 29% vs PO 7%, $P < 0.01$).Severity of illness was notable for higher Pitt Bacteremia Score (PBS) in IV group (PBS≥4 IV 22% vs PO 6%, $P < 0.01$). Ceftriaxone (39%) for the IV group and FQs (38%) for the PO group were the most common definitive therapy. The IV group had significantly higher mortality rate (17% vs 1%, $P < 0.01$) and longer LOS (median 10d [IQR 6-21] vs 5d [4-7], $P < 0.01$). 30d recurrence (IV 1% vs PO 2%, $P > 0.99$) and AEs (IV 1% vs PO 3%, $P = 0.67$) were similar. Patients with the most severe presentation (PBS≥4) had favorable outcomes of 30d mortality (IV 50% vs PO 0%, $P = 0.01$) with PO step down therapy.

Conclusion: In uncomplicated *streptococcal* BSI, step down oral antibiotic therapy was associated with a significantly shorter LOS vs IV therapy. Larger prospective trials evaluating step-down oral therapy are warranted to confirm our results.

197 | Short versus long course intravenous azithromycin for community acquired pneumonia in hospitalized adult patients

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Introduction: The optimal duration of azithromycin treatment for community acquired pneumonia (CAP) is not well established in hospitalized patients. While oral outpatient azithromycin is typically prescribed as a total 1500 mg dose given over 3 or 5 days, intravenous (IV) inpatient azithromycin use often exceeds this.

Research Question or Hypothesis: To determine whether short intravenous azithromycin courses of ≤1500 mg are comparable to longer courses of >1500 mg in hospitalized patients with CAP.

Study Design: Single center retrospective cohort study of hospitalized patients with pneumonia who received IV azithromycin and β-lactam therapy for at least 3 days from May 1, 2017 to May 1, 2019.

Methods: Short courses were defined as receipt of ≤1500 mg and ≤ 3 days of azithromycin therapy. Long courses were defined as receipt of >1500 mg and ≥ 3 days of azithromycin. Patients were excluded if they received antibiotic therapy with a macrolide other than azithromycin, a fluoroquinolone, or a tetracycline.

Results: Of the 428 patients included in this study, 99 patients received short course and 329 patients received long course azithromycin therapy. There were no statistically significant differences in baseline variables and no differences were found between short and long course cohorts for all-cause in-hospital mortality (4% versus 5.8%; $P = 0.618$). Statistically significant endpoints were seen in median hospital length of stay (4 days versus 6 days; $P < 0.001$) and median total antibiotic duration (3 days versus 5 days; $P < 0.001$).

Conclusion: Short courses of IV azithromycin in hospitalized patients with pneumonia were not associated with an increased risk of mortality. Patients who received ≤1500 mg of azithromycin had shorter hospital lengths of stay and total inpatient antibiotic treatment duration. These results encourage antimicrobial stewardship efforts to shorten IV azithromycin treatment duration.

198 | Impact of pharmacist-led antimicrobial stewardship educational initiatives on antibiotic prescription rates and duration in rural outpatient clinics

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Introduction: Antimicrobial stewardship (AS) interventions in the outpatient setting are necessary to improve antibiotic prescribing. Effective outpatient AS interventions are not currently well-established, particularly in rural settings that may have limited resources available.

Research Question or Hypothesis: Development of pharmacist-led AS educational seminars and resources will decrease antibiotic prescription rates and duration and modify prescribing patterns in rural primary care clinics.

Study Design: Single-center, quasi-experimental study at United Health Services (UHS) primary care clinics (n = 23) in the rural Southern Tier region of New York.

Methods: Medicare Part D claims data of unique prescriptions were used to identify fee-for-service beneficiaries with an oral antibiotic prescribed by UHS providers. Beneficiaries with end-stage renal disease and UHS specialty clinics were excluded. Data were compared between October 1, 2016 - March 31, 2017 (pre-intervention) and October 1, 2018 - March 31, 2019 (post-intervention). During the intervention period, pharmacists from UHS, Binghamton University, and IPRO, a national quality evaluation organization, collaborated to develop AS educational initiatives. Provider-targeted educational resources included outpatient infectious disease treatment guidelines, a fluoroquinolone warning card, and antibiotic information guides. Live, pharmacist-led AS seminars educated providers on AS concepts and delivered provider-specific antibiotic prescribing report cards. Statistical analyses were performed including Chi-squared and Students' t-test as appropriate.

Results: There were 3943 and 3834 beneficiaries in the pre- and post-intervention cohorts, respectively. Total antibiotic prescription rates per beneficiary were similar between the pre- and post-intervention cohort (1.54 versus 1.59; $P = 0.053$); however, total fluoroquinolone prescribing rates decreased (18.43 versus 15.28; $P < 0.001$). Antibiotic duration was also similar between cohorts (10.0 versus 10.1 days; $P = 0.769$).

Conclusion: Implementation of AS educational initiatives did not decrease total antibiotic prescription rates per beneficiary and duration among rural outpatient clinics, but resulted in fewer total fluoroquinolone prescriptions. Additional effective AS strategies are needed to improve antibiotic prescribing and duration of therapy in rural outpatient settings.

199 | National ambulatory care prescribing of fluoroquinolone antibiotics in the United States, 2009 to 2016

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Introduction: Oral fluoroquinolone (FQ) antibiotics are commonly prescribed to treat a range of infections. Since their discovery, they have been associated with antimicrobial resistance development and serious adverse events, including tendonitis and tendon rupture.

Research Question or Hypothesis: It is unclear whether recent FQ warnings have impacted prescribing practices. Our study aims to describe outpatient FQ prescription rates in the U.S. between 2009 and 2016.

Study Design: This was a cross-sectional study of the National Ambulatory Medical Care Survey between 2009 to 2016.

Methods: All patient visits were eligible for inclusion and patients were categorized by FQ use, as defined by their Multum codes. Non-oral FQs were excluded. The primary outcome was overall and longitudinal FQ prescription rates per 1,000 patient visits. Other outcomes included FQ prescription rates by U.S. Census Bureau region (Northeast, Midwest, West, and South) and by season. Data were presented descriptively.

Results: This study included 6.9 billion outpatient visits, of which 131 million visits (1.9%) included a FQ prescription. The median age was 56 years in the FQ group and 49 years in the non-FQ group. Overall, FQ prescribing rates increased from 18.9 per 1,000 visits in 2009 to 22.7 per 1,000 visits in 2015; thereafter, prescribing decreased through 2016 (14.9 per 1,000 visits). Regional FQ prescription rates were highest in the Northeast (18.0 per 1,000) and lowest in the West (15.0 per 1,000). Seasonal FQ prescription rates were highest in the winter (22.0 per 1,000) and lowest in the summer (17.0 per 1,000).

Conclusion: Overall FQ prescription rates increased between 2009 and 2015 and decreased in 2016. Prescription rates were also highest in the Northeast and in the winter. Although antibiotic prescribing is a routine part of clinical practice, FQs should be prescribed judiciously to minimize antibiotic resistance and prevent avoidable drug-related adverse events.

200 | Unit specific Monte Carlo simulations to optimize empiric anti-pseudomonal dosing

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Introduction: Among nosocomial infections, *Pseudomonas aeruginosa(PSA)* is a major cause of morbidity and mortality. Dose optimization based on pharmacokinetic/pharmacodynamic(PK/PD) Monte-Carlo modeling has improved patient outcomes in previous studies, yet few studies have evaluated unit-specific PK/PD modeling.

Research Question or Hypothesis: PK modeling can optimize Cumulative Fraction of Response (CFR) in a unit-specific manner.

Study Design: Retrospective, quantitative analysis

Methods: Monte Carlo simulation was employed using PSA isolates form collected from August 2017-June 2018 to determine pharmacodynamic target attainment rates for extended infusion (EI) piperacillin-tazobactam and cefepime compared with 30-minute intermittent infusion (II) regimens. Percentage free time above MIC was modeled for 10,000 patients and CFR was generated based on Unit MIC distribution. Analysis was stratified by ICU vs Non-ICU isolates given differing antimicrobial susceptibility patterns in these populations. Cefepime dosing evaluated was 1000 mg II q8h, 2000 mg II q8h, 1000 mg EI q8h, 2000 mg EI q12h. For piperacillin-tazobactam dosing evaluated was 3.375 q8h EI, 3.375 q6h, 4.5 gram q8h EI and 4.475 q6h. A CFR > 90% is considered optimal pharmacodynamic attainment.

Results: A total of 275 PSA isolates were analyzed. PSA isolates were susceptible to Cefepime, 87% and 82% on Floor Units and ICUs, respectively. In contrast, PSA isolates were susceptible to Piperacillin-Tazobactam 72% and 55% on Floor Units and ICUs, respectively. Including all isolates, simulations yielded CFR > 90% only for cefepime 2 gram q8h EI. For ICU isolates, using cefepime 2 gram q8h EI increased CFR from 71.8% to 88.1% compared to II. Dose increase from 3.375 grams EI to 4.5 grams EI for piperacillin-tazobactam improved CFR from 62 to 75%.

Conclusion: PK modeling with Monte Carlo simulation can be utilized as part of a unit-specific analysis to improve the probability of pharmacodynamic target attainment. Antimicrobial stewardship programs should utilize this tool in order to optimize dosing.

201 | Association between vancomycin area under the curve and clinical outcomes among patients with serious methicillin-resistant *Staphylococcus aureus* bacteremia

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Introduction: Methicillin-resistant Staphylococcus aureus (MRSA) bloodstream infections (BSI) are associated with significant morbidity,

mortality and healthcare expenditures. Vancomycin (VAN) remains the treatment of choice for invasive MRSA BSI. Current guidelines recommend a VAN AUC24h / MIC ratio ≥ 400 for MRSA infection. The Detroit Medical Center (DMC) instituted a 2-level AUC guided dosing strategy in 2015. However, data that shows an association between 2-level AUC24h and clinical outcomes in MRSA BSI are limited. We aimed to evaluate the association between VAN AUC24h and clinical outcomes.

Research Question or Hypothesis: There is a positive relationship between the AUC and clinical outcomes in patients with MRSA BSI

Study Design: Multi-center, retrospective cohort study

Methods: Adults with MRSA BSI treated with VAN 2015-2018 were included. Patients were excluded if 1) skin and skin structure infections was the sole source of BSI or 2) AUC monitoring had not been completed. The primary outcome was VAN failure defined as: (1) 30-day mortality; (2) 60-day recurrence; or (3) persistent bacteremia defined as >72 hours. Classification and Regression Tree (CART) analysis was performed to determine the AUC24h breakpoint (BP) predictive of failure in the cohort. The independent association between AUC24h BP was then examined through multivariable logistic regression analysis. Results: Ninety-seven patients were included. Endocarditis and pneumonia were the most common sources (50%). Patients with AUC24h ≤ 598 were more likely to have clinical failure compared to those with AUC24h > 598 (57.5% and 23.5%, respectively; P = 0.003). After controlling for independent predictors of clinical failure; AUC of ≤598 (aOR 4.397, 95% CI 1.318-14.674) was independently associated with clinical failure.

Conclusion: An AUC24h BP of <598 was associated with over 4 folds the risk of clinical failure in MRSA BSI. Future studies should be directed to investigate a global endpoint that combines clinical efficacy with safety.

202 | Evaluation of risk factors and clinical outcomes of patients with vancomycin-resistant Enterococcus infections

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Introduction: Vancomycin-resistant *Enterococci* (VRE) occurs with enhanced frequency in hospitalized patients and is usually associated with poor clinical outcomes.

Research Question or Hypothesis: What are the risk factors and clinical outcomes of patients with VRE infections?

Study Design: This was an IRB approved multi-center retrospective chart review conducted at a three-hospital health system between August 2016-November 2018. Inclusion criteria were patients ≥18 years and admitted for ≥24 hours with cultures positive for VRE. Patients pregnant or colonized with VRE were excluded.

Methods: The primary endpoint analyzed the association of potential risk factors with all-cause in-hospital mortality (ACM) and 30-day readmission; subgroup analysis focused on the association of risk factors with VRE bacteremia. The secondary endpoint evaluated the impact of different treatment groups of high-dose daptomycin (HDD) vs. low-dose daptomycin (LDD) vs. linezolid (LZD) on ACM and 30-day readmission; subgroup analysis focused on difference of length of stay (LOS), length of therapy (LOT), duration of bacteremia (DOB) and clinical success (CS) between the treatment groups.

Results: Final analysis included 81 patients; overall mortality was observed at 16%. Utilizing multivariate logistic regression analyses, patients presenting from long-term care facilities (LTCF) were found to have increased risk for mortality. No specific risk factors were associated with 30-day readmission. Patients with previous exposure to fluoroquinolones (FQ) and cephalosporins (CPS), nosocomial exposure and history of heart failure (HF) showed association with VRE bacteremia. ACM was similar between HDD vs. LDD vs. LZD (16.7% vs. 15.4% vs. 0%, P = 0.52). No differences were seen between LOS, LOT, CS, and DOB between the groups.

Conclusion: Admission from LTCFs was a risk factor associated with in-hospital mortality in VRE patients. Individuals with history of FQ, CPS and nosocomial exposure as well as history of HF showed increased risk of acquiring VRE bacteremia. There were no differences in ACM, LOS, LOT, and DOB between HDD, LDD & LZD.

203 | Are FabH inhibitors worth pursuing as potential antimicrobials?

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Introduction: *Staphylococcus aureus* synthesizes fatty acid via the prototypical bacterial type II system (FASII). β-ketoacyl-acyl carrier protein synthase III (FabH) initiates the FASII pathway. FabH is thought to be essential to initiate fatty acid synthesis, which makes it a potential target for antimicrobial drug discovery. Recently published work identified a natural product, amycomicin, that inhibits FASII.

Research Question or Hypothesis: Amycomicin blocks fatty acid synthesis by inhibition of FabH. *S. aureus* is unable to generate sufficient fatty acid via an alternative pathway when FabH is inhibited.

Study Design: Characterization of FabH inhibition using purified protein and *S. aureus fabH* deletion strains.

Methods: Fatty acid and CoA profiles were determined for the *fabH* mutant strains by mass spectrometry. Gene and protein expression of enzymes in the FASII pathway were determined by qPCR and immunoblot respectively.

Results: Amycomicin blocks FASII via inhibition of FabH based on genetic analysis and in vitro assays. Phosphatidylglycerol molecular species in an *S. aureus* Î”*fabH* strain showed that the *de novo* synthesis of straight-chain fatty acids continued in the Î”*fabH* strains and these fatty acids are paired with exogenous oleate to synthesize membrane phospholipids. Acyl chain elongation was reduced in the Î”*fabH* strains. The *fabF* gene is co-transcribed with *fabH* and the reduced elongation correlated with an immunoblot showing a reduced level of FabF protein in the Î”*fabH* strains. The Î”*fabH* strains require fatty acid supplementation to grow in vitro, but do not proliferate in animals indicating that the abundance of fatty acids at the infection site is not sufficient to support pathogenesis.

Conclusion: We show the existence of a FabH-independent pathway to initiate FASII. However, this pathway cannot produce branched-chain fatty acids and lacks the capacity to support enough phospholipid synthesis for growth, meaning that FabH inhibitors remain a promising area for development of novel antimicrobials.

204 | Introduction of a pharmacist-driven antimicrobial stewardship and culture follow-up program in the emergency department

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Introduction: Pharmacist-driven emergency department (ED) culture follow-up programs lead to reduction in time to culture review, repeat ED encounters, and hospital admissions when compared to non-pharmacist-driven programs. A pilot pharmacist-driven culture follow-up program was implemented at this institution in November 2018.

Research Question or Hypothesis: Will the implementation of a pharmacist-driven culture follow-up program at a tertiary teaching hospital demonstrate patient benefit through reduction in time to culture review and intervention?

Study Design: This study was a single-center, pre- and post- service-implementation, cohort study. Adult patients discharged from the ED with positive cultures and/or microbiological laboratory data over two 90-day periods, pre-implementation and post-implementation, were screened for inclusion.

Methods: Data collection occurred prospectively during the pilot and retrospectively for the comparator. The primary endpoint was time from ED discharge to culture review. Secondary endpoints included antimicrobial prescribed, repeat ED encounters, and hospital admissions. Descriptive statistics were used to characterize patients and culture types. Wilcoxon signed-rank tests were used to analyze time-to-event endpoints.

Results: A total of 127 patients were enrolled, 64 in the pre-implementation group and 63 in the post-implementation group. The mean time to culture review was reduced by 36.3% (75.18 hours vs. 47.87 hours, $P < 0.001$) in the post-implementation period. The mean time to completion of outpatient intervention decreased, although not significantly (110.67 hours vs. 89.40 hours, $P = 0.114$). There was a significant reduction in fluoroquinolone prescribing in the post-implementation period (15.6% vs 3.2%, $P = 0.0362$). The proportion of patients who had a repeat ED encounter or hospital admission within 30 days was not significantly different between groups (15.6 vs. 19.1%, $P = 0.783$ and 9.4% vs 7.9%, $P = 1.0$, respectively).

Conclusion: Introduction of a pharmacist to a culture follow-up program at this institution demonstrated a reduction in time to culture review, time to outpatient intervention, and fluoroquinolone prescribing during outpatient follow-up.

205 | Effect of pharmacist led weekend antimicrobial stewardship on vancomycin utilization

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Introduction: Prior research has demonstrated that the rate of broad-spectrum antimicrobial discontinuation declines over the weekend. A proposed contributing factor has been antimicrobial stewardship services often being limited to the weekdays.

Research Question or Hypothesis: Does expanding pharmacist-driven antimicrobial stewardship to the weekend decrease duration of intravenous vancomycin use?

Study Design: Single-center, IRB-approved, retrospective cohort study.

Methods: Pharmacist-driven antimicrobial stewardship was expanded in two phases. Phase I involved the addition of a critical care, rounding pharmacist on weekends. Phase II involved expansion of weekend antimicrobial stewardship to all hospital floors utilizing pharmacy residents and clinical pharmacists. The primary endpoint was the difference in duration of vancomycin use over the weekends pre-implementation (December 2017 through March 2018), post-implementation of phase I (June 2018 through August 2018), and post-implementation of phase II (December 2018 through March 2019). Secondary endpoints included attempted interventions, reason

for discontinuation, intervention acceptance rates, number of vancomycin concentrations obtained, and pharmacist notes written. ANOVA test was used to analyze change in duration of vancomycin use. Descriptive statistics were used to characterize interventions.

Results: A total of 152 patients receiving vancomycin were randomly selected per group. Mean duration of vancomycin use decreased from 47.2 hours (standard deviation [SD] ± 46.9) pre-implementation to 40.7 hours (SD ± 27.6) and 37.8 hours (SD ± 29.4) after phases I and II, respectively (P = 0.06). This represented a relative reduction in duration of vancomycin use by 19.9% between pre-implementation and phase II. The number of attempted de-escalations increased from 31 (20.1%) to 38 (24.7%) (P = 0.002) with a non-significant decline in acceptance rate from 83.9% (26/31) to 76.3% (29/38) (P = 0.84).

Conclusion: There was a non-significant decrease in duration of vancomycin use over weekends after the expansion of pharmacist-driven antimicrobial stewardship. This supports further efforts to increase availability of antimicrobial stewardship interventions to improve institutional antimicrobial utilization.

206 | Pharmacokinetic-pharmacodynamic target attainment of cefilavancin and vancomycin: A Monte Carlo analysis

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Introduction: Cefilavancin is a glycopeptide-cephalosporin in Phase III development for Gram-positive infections. Monte Carlo analysis (MCA) assessed the potential therapeutic utility of cefilavancin compared to vancomycin.

Research Question or Hypothesis: Do differences exist in percentage target attainment (%TA) between cefilavancin and vancomycin against Gram-positive organisms?

Study Design: MCA

Methods: Pharmacokinetic (PK) parameters, pharmacodynamic (PD) targets, and MICs (MSSA, MRSA, VISA/hVISA, and Corynebacterium spp.) were collected from peer-reviewed literature. A population pharmacokinetic (PPK) model was constructed for cefilavancin to estimate drug clearance (Cl_T) from a creatinine clearance (CrCl) distribution from our institution; a known PPK model was used for vancomycin. Protein binding of 0% was used since PD efficacy targets for both drugs are based on total 24-hour AUC/MIC. Low PD targets (LT; ≥37.2, representing 1-log bacterial killing) and high PD targets (HT; ≥51.8, representing 2-log killing) were used for cefilavancin. Similar target endpoints were chosen for vancomycin, based on in vitro and clinical data (LT ≥400, 1-log killing; HT ≥900, 2-log killing). Dosage regimens were based on clinical trials (2 mg/kg, cefilavancin) and typical clinical practice guidelines (vancomycin). First-order, one-compartment simulations were performed (n = 10,000), integrated with MIC distributions, and %TA was calculated.

Results:

	% Target Attainment (80 kg patient shown)			
	Cefilavancin		Vancomycin	
Organism	LT	HT	LT	HT
MSSA	100	100	95	48
MRSA	100	100	95	47
VISA/hVISA	100	100	33	1
Corynebacterium spp.	100	99	100	100

Conclusion: Cefilavancin has high TA (>90%), and likely clinical utility, against all organisms and PD targets studied. Vancomycin has lower TA depending on the organism and PD target being evaluated, however, high TA at the lower target for MRSA and MSSA suggests vancomycin may still have a role in empiric therapy. As expected, vancomycin has poor target attainment against VISA/hVISA and its empiric use could become problematic if the prevalence of these organisms increases.

207 | Short versus prolonged course of antibiotic treatment for gram-negative blood stream infections

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Introduction: Gram-negative bacteremia is a major cause of morbidity and mortality in hospitalized patients. There is limited consensus on the optimal duration of antibiotic therapy for these infections. Additionally, antibiotic exposure is associated with development of resistant organisms, *Clostridioides difficile* infection, and adverse effects. Few studies have evaluated antibiotic duration for gram-negative bacteremia, though existing evidence suggests shorter durations are as efficacious as longer durations. This study aims to identify the optimal duration of antibiotic therapy for gram-negative bacteremia.

Research Question or Hypothesis: Are short courses of antimicrobial therapy as effective as prolonged courses of therapy in the treatment of gram-negative bacteremia?

Study Design: This was a retrospective cohort study conducted in patients admitted to the Ochsner Health System who had a positive blood culture with a gram-negative bacterium between July of 2018 and January of 2019.

Methods: This study compared outcomes in patients receiving a short duration of therapy (≤10 days) to those receiving a prolonged duration of antibiotic therapy (>10 days). The primary outcome was a composite of 30-day readmission, all-cause mortality, and recurrent infection. Secondary outcomes included emergence of multidrug resistance and *Clostridioides difficile* infections within 30 days of therapy completion. Chi-square test and t-test were used for categorical and continuous variables, respectively.

Results: Seventy-nine patients met criteria and were included in the study. Twenty patients received a short duration and 59 received a prolonged duration of antibiotics. There was no difference in the rate of the primary outcome in the short duration versus long duration cohorts (30% vs. 27%, $P = 0.8$). Emergence of multidrug resistance (5% vs 1.7%, $P = 0.44$) and *Clostridioides difficile* infections (0% vs 1.7%, $P = 0.74$) were also similar.

Conclusion: This study suggests that shorter antibiotic courses have similar outcomes as prolonged courses. Larger, prospective studies are needed to confirm these results.

208 | Depression and antidepressant medications may increase *Clostridioides difficile* infection risk

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Introduction: Prior studies have found an association between gut microbiome dysbiosis and depression, likely mediated by the gut-brain-microbiota axis. Furthermore, certain antidepressant medications have antimicrobial effects that may impact gut microbiome composition. Together, these effects may increase risk for *Clostridioides difficile* infection (CDI), a predominately microbiome-mediated infection; however, evidence supporting the association between depression or antidepressant use and CDI are lacking. The objective of this study was to evaluate the impact of depression and antidepressant use on CDI risk in a national cohort of veterans.

Research Question or Hypothesis: Depression and antidepressant use are associated with CDI risk.

Study Design: Retrospective case-control study of inpatients and outpatients in the national United States Veterans Health Administration (VHA).

Methods: CDI patients included those 18-89 years old with an ICD-9-CM code for CDI (008.45), a positive stool test, and CDI active therapy between 2002 and 2014. The control group included a random sample of patients without a CDI ICD-9-CM code during the study period and were matched by visit setting and fiscal year. Risk factors for CDI were evaluated using multivariable logistic regression models with CDI as the dependent variable, depression or antidepressant use as the independent variable, and 28 covariates.

Results: A total of 85,451 patients were included (26,149 in the CDI patients and 59,302 controls). The proportion of patients with depression was significantly higher in the CDI cohort (8.9%) compared to controls (6.8%) ($P < 0.0001$). The proportion of patients using antidepressants was also higher among the CDI cohort compared to controls (34.8% vs. 21.4%, $P < 0.0001$). Depression was an independent predictor of CDI (OR 1.32; 95% CI 1.23-1.43). Antidepressant use was also a significant predictor of CDI (OR 1.26, 95% CI 1.20-1.32).

Conclusion: In a national cohort of veterans, depression diagnosis and use of antidepressant medications were both independent predictors of CDI.

209 | Effect of renal-preserving empiric antibiotic regimens on acute kidney injury

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Introduction: Empiric antibiotic regimens targeting methicillin-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa* often consist of vancomycin with an anti-pseudomonal beta-lactam (APBL). Literature suggests a synergistic nephrotoxicity with specifically vancomycin and piperacillin-tazobactam (VPT) combination therapy. A renal preservation protocol may reduce the incidence of nephrotoxicity from empiric therapy.

Research Question or Hypothesis: Through pharmacist intervention, using a renal preserving empiric antibiotic regimen may reduce incidence of acute kidney injury (AKI).

Study Design: Pre-post cohort study.

Methods: An IRB approved study from January 15, 2019 to April 1, 2019 identified patients treated empirically with combination APBL and vancomycin therapy. An empiric regimen protocol was developed utilizing results of our retrospective analysis. We aimed to reduce the use of VPT combination therapy and encourage use of renal-preserving APBLs. Pharmacists monitored a web-based clinical surveillance program daily to identify patients qualifying for protocol-based intervention. The primary outcome was incidence of AKI. Secondary outcomes include: time to AKI, duration of AKI, length of stay (LoS), and number of patients initiated on hemodialysis. Student t-test was used for continuous data, and chi-square was used for nominal data.

Results: One hundred and thirty nine patients were compared to a prospective cohort of 26 patients following implementation of a renal-preserving protocol. Prior to pharmacist intervention, incidence of AKI was 27.3% vs 15.4% prospectively (OR 0.56, 95% CI 0.16-1.49, $P = 0.2$). Mean time to AKI decreased from 4.5 days to 1.6 days prospectively ($P = 0.04$). Mean duration of AKI increased from 5 to 10 days ($P = 0.21$). LoS increased from 16 to 17 days ($P = 0.7$). Four patients were initiated on hemodialysis vs 1 patient prospectively ($P = 0.79$).

Conclusion: Our study was underpowered to detect if the use of renal-preserving empiric regimens through pharmacist intervention decreased incidence of AKI. An ongoing continuation of this study will collect a large enough sample size to power hypothesis testing.

210 | Impact of area-under-the-curve monitoring for vancomycin on incidence of acute kidney injury in orthopedic patients

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Introduction: Traditional monitoring of vancomycin has been through the evaluation of trough concentrations. However, recent data has demonstrated that area-under-the-curve (AUC) monitoring is more appropriate and leads to less acute kidney injury.

Research Question or Hypothesis: AUC monitoring of vancomycin will lead to less acute kidney injury than trough monitoring.

Study Design: Orthopedic patients receiving vancomycin for ≥96 hours at an university academic medical center between October 2016-December 2018 were reviewed.

Methods: Patient demographics (age, gender, weight, BMI) and clinical parameters (baseline and highest serum creatinine, vancomycin levels, concurrent antibiotics, and culture information) were obtained from the University of Kentucky Center for Clinical and Translational Science or chart review. AUC0-24 was calculated using 2 levels and an approved institutional calculator. Acute kidney injury (AKI) was determined using the RIFLE criteria (R = risk, I = injury, F = failure, L = loss, E = End-stage kidney disease). Creatinine clearance was determined using the modified Cockcroft-Gault. Therapeutic targets for trough and AUC groups were 15-20 mcg/mL and 400-600, respectively. This study was approved by the local IRB.

Results: Overall, 103 patients were evaluated (trough n = 58; AUC n = 45) with an average age (SD) of 49.6 ± 15.1 yrs. The majority of patients were male (62.1%) with a creatinine clearance of 113 ± 42 mL/min. There were no significant differences in any demographics between the groups (trough vs AUC). The overall incidence of AKI was 21.4% (20.7% trough vs 22.2% AUC). Although no significant difference existed between groups for acute kidney risk (lowest level of kidney injury), there was a significant difference in injury and failure (10.3% trough vs 0% AUC, $P = 0.018$). The therapeutic target level was accomplished significantly more often in the AUC group than trough group (66.7% vs 37.9%, $P = 0.0079$).

Conclusion: Implementation of AUC monitoring for vancomycin dosing in orthopedic patients led to significantly less moderate to severe acute kidney injury than trough monitoring.

211 | Incidence and risk factors associated with acute kidney injury related to lipid-associated formulations of amphotericin B

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Introduction: Amphotericin is associated with high rates of acute kidney injury (AKI), but less so with lipid-associated formulations of amphotericin B (LFAB). Strategies to prevent AKI have been extrapolated from amphotericin B deoxycholate to LFAB without supporting evidence.

Research Question or Hypothesis: What is the incidence and associated risk factors of AKI from LFAB?

Study Design: Multicenter, retrospective study

Methods: Adult, hospitalized patients who received at least one dose of LFAB between January 2012 and December 2017 were eligible for inclusion. Patients who presented with an AKI or end-stage renal disease were excluded. The primary outcome was the incidence of AKI, defined and stratified by the RIFLE criteria. Patients were then divided based on presence of AKI where patient characteristics and treatments were compared. Nominal and continuous variables were compared using chi-square and Mann-Whitney U, respectively.

Results: Ninety-six patients were analyzed and 32 (33%) developed AKI. 31% were classified as Injury and 13% as Failure and the mean time to AKI development was 2.9 ± 2.2 days. Creatinine returned to baseline by hospital discharge in 16% of patients. When comparing AKI and non-AKI groups, average days of LFAB therapy was similar, 4.5 ± 0.6 and 4.8 ± 0.7, respectively. Baseline creatinine clearance (CrCl) was higher in the AKI group, 82 vs 62 mL/min ($P < 0.05$). Concomitant use of intravenous vancomycin and supratherapeutic vancomycin trough concentrations were similar between groups, $P = 0.15$ and $P = 0.65$, respectively. Administration of bolus and maintenance intravenous fluids (IVF) did not differ between the AKI and non-AKI groups (38% and 56% vs 36% and 44%, respectively).

Conclusion: Approximately one-third of patients receiving LFAB develop AKI. While baseline CrCl was higher in the AKI group, patient characteristics were otherwise similar. Use of IVF was common in both groups, but its effect on LFAB-associated AKI warrants further investigation.

212 | Evaluation of health care workers' medical waivers for the seasonal influenza vaccine at an academic health system

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Introduction: The influenza vaccination rate for healthcare personnel (HCP) in 2017-18 was 78%, well below the Healthy People 2020 goal of 90% among HCP. Poor acceptance of the influenza vaccine based on misconceptions and outdated information—is a major contributor to low vaccination rates.

Research Question or Hypothesis: What are common reasons and factors for claiming medical waivers to the mandatory influenza vaccine?

Study Design: This was a retrospective case cohort study at a single academic center

Methods: Employee Health medical charts of those who had medical exemption for influenza vaccine were reviewed to collect demographics and the reason for medical exemption.

Results: Among 15,135 employees, 131 (0.9%) HCP filed medical waivers. Demographics include age 41.4 ± 12.4 years and 13 (10%) male. Allergic reaction was the most commonly cited reason. Employees born 1946-64 and (Baby Boomers: OR 1.7; 95%CI 1.2-2.4) and 1965-79 (Generation X: OR 1.7; 95%CI 1.2-2.3) were more likely to have a medical waiver than any other age cohort. At least 4 individuals with medical waivers on file received the influenza vaccine in subsequent seasons, and 59% have waivers that are not compliant with ACIP guidelines.

Allergic reaction*	41	31%
Egg reaction	23	18%
Guillain Barre*	13	10%
Flu-like symptoms	16	31%
Exacerbation of an inflammatory condition	9	18%
Other condition	9	18%
Injection site reaction or SIRVA	7	14%
Temporary contraindication	6	12%
Other reaction	4	8%
Personal waiver	3	2%
Total	131	

*ACIP endorsed reasons for medical exemption.

Conclusion: As a result of this project, the medical waiver for the influenza vaccine for employees of UW Health was updated to reflect current ACIP recommendations. In addition, a guiding document to aid in the approval of medical waivers was created according to ACIP guidelines. These changes aim to improve HCP influenza vaccination rates at UW Health.

213 | Impact of a pharmacist driven vancomycin de-escalation guideline

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Introduction: Overutilization of vancomycin is common in patients with suspected infection or worsening clinical status. Unnecessary or prolonged antibiotic use is a risk factor for the development of antimicrobial resistance and can have additional sequelae including increased healthcare costs, increased length of hospitalization, and hospital readmission.

Research Question or Hypothesis: How would implementation of a vancomycin de-escalation guideline affect the duration of vancomycin therapy.

Study Design: Single center, quasi-experimental pre-post cohort study.

Methods: A vancomycin de-escalation guideline was developed and education was provided to the Departments of Pharmacy and Internal Medicine. Adult patients were included if they were admitted to an internal medicine teaching service and received intravenous vancomycin during December 2017 to February 2018 (pre-intervention) or December 2018 to February 2019 (post-intervention). Patients were excluded if they were initially admitted to another service, if vancomycin was ordered only by the emergency department, or if only given for surgical prophylaxis. The primary outcome of this study was vancomycin duration of therapy.

Results: A total of 326 patients met inclusion criteria (162 patients in the pre-intervention and 164 patients in the post-intervention group). Median duration of therapy in both groups were similar (4 vs. 4 days, $P = 0.4$), as was length of stay (4 vs. 5 days, $P = 0.2$). The median vancomycin doses received in both groups were similar (21.3 vs. 20.1 milligrams per kilograms per day, $P = 0.48$). Pathway compliance in the post-intervention group was 64%.

Conclusion: No difference in duration of therapy or length of stay was found with the development of an institutional vancomycin de-escalation guideline. Active interventional strategies may be required to improve pathway compliance.

214 | Evaluating outcomes and appropriateness of gastrointestinal multiplex polymerase chain reaction (PCR) testing at a single center

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Introduction: BioFire's FilmArray® Gastrointestinal (GI) Panel uses multiplex Polymerase Chain Reaction (PCR) technology for rapid detection of 22 pathogens commonly causing infectious diarrhea. The panel contains primarily community acquired pathogens with the exception of *Clostridioides difficile*. The goal of employing this technology is to increase efficiency in achieving targeted therapy in patients with infectious diseases and must be weighed against the cost to the institution and to the patient.

Research Question or Hypothesis: This study evaluates results and appropriateness of the BioFire GI Panel testing at a community-teaching hospital.

Study Design: This was a single-center, retrospective, observational cohort study.

Methods: All hospitalized patients over 18-years-old at Prisma Health Midlands - Richland Hospital who had the FilmArray® GI multiplex PCR Panel run from January 2015 through August 2018 were identified and included in the analysis. Inappropriate use of GI Panel was defined as a test obtained after >3 days of hospitalization or a redundant order with other diagnostic tests already included in the GI Panel. Descriptive statistics were used to summarize the data.

Results: During the study period, a total of 442 GI Panels were ordered in hospitalized adults, of which 141 (31.9%) were positive. The most commonly identified pathogens where *C. difficile* (53.2%, n = 75), Enteropathogenic *Escherichia coli* (17.7%, n = 25), and *Norovirus* GI/GII (12.1%, n = 17). Overall, 184/442 (41.6%) orders were deemed 'inappropriate' due to ordering greater than 3 days of hospitalization (n = 87), having a duplicate *C. difficile* PCR test ordered during the same hospital admission (n = 118), or both (n = 21).

Conclusion: Application of diagnostic stewardship may optimize the use of FilmArray® GI multiplex PCR Panel in this setting and reduce costs related to inappropriate and redundant orders.

215 | A review of baseline prescribing patterns for acute, uncomplicated upper respiratory tract infections to focus antimicrobial stewardship efforts at a Federal Healthcare Facility (FHCC)

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Introduction: In 2016, a study revealed nearly 50% of outpatient antibiotics prescribed in the United States for acute respiratory infections (ARIs), including sinusitis, pharyngitis, and bronchitis, were inappropriate. The Veterans Affairs Academic Detailing Service (ADS) developed a dashboard to capture antibiotic use for uncomplicated ARIs. The FHCC is unique, treating both VA and active duty military personnel. Educational campaigns must target the needs of the facility to bring about impactful change for antimicrobial stewardship.

Research Question or Hypothesis: This study was conducted to determine the accuracy of the ADS ARI dashboard at the FHCC to focus antimicrobial stewardship educational campaigns.

Study Design: A retrospective chart review of dashboard-identified uncomplicated ARIs was performed.

Methods: Fifteen percent of dashboard-identified cases of sinusitis, bronchitis, and pharyngitis were randomly selected for chart review between October 1 and December 31, 2018. Chart review was performed utilizing standardized diagnostic and treatment algorithms. Descriptive statistics were used to assess dashboard accuracy.

Results: Sixty nine dashboard-identified cases were reviewed across three uncomplicated ARI diagnoses. Among sample cases, the dashboard identified the antibiotic prescribing rate as 25%; however, chart review revealed the prescribing rate as 58%. Approximately 78% of sinusitis (dashboard-identified 28%), 35% of pharyngitis (dashboard-identified 6%), and 61% of bronchitis (dashboard-identified 34%) cases received antibiotics. An appropriate first or second line therapy was prescribed in 62% of cases receiving antibiotics. The most common cause of discrepancy was the inability of the dashboard to capture prescriptions filled for active duty patients who were included in the overall case report.

Conclusion: The ADS ARI dashboard is not a useful tool in estimating antibiotic use for uncomplicated ARIs at the FHCC given the blend of two patient populations and prescription processing systems. Antibiotics are prescribed significantly more than the dashboard identifies. Future educational interventions to reduce ARI antibiotic prescribing will be tailored based on the results of this study.

216 | Improved latent tuberculosis (LTBI) therapy completion rates in refugees through implementation of a pharmacist-run LTBI Clinic

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Introduction: Nearly 300 refugees arrive in Philadelphia each year; having lived in refugee camps for most of their lives, modern medicine is foreign and adherence to medications is a challenge. Approximately 40% are diagnosed with latent tuberculosis infection (LTBI) upon arrival. The risk of conversion to active tuberculosis (TB) is highest in the first two-years after migration, which warrants expeditious treatment to prevent transmission.

Research Question or Hypothesis: LTBI completion rates are consistently low and tend to be even lower in refugee and immigrant populations due to low health literacy. The purpose of this study is to

assess the impact of a clinical pharmacist-run LTBI clinic on treatment completion rates in refugee patients.

Study Design: In 2012, a pharmacist-run LTBI clinic was established at Penn Center for Primary Care (PCPC) in attempts to improve adherence and completion rates among refugees. Prior to 2012, LTBI treatment completion rates were less than 20%. A structured model was developed to efficiently track patients and ensure successful completion. Interventions made by the pharmacist were recorded.

Methods: A retrospective chart review was conducted on refugees screened at PCPC between 2012 and 2019. Data elements collected included demographics, date of arrival, diagnosis of LTBI, LTBI treatment initiation and completion, appointments with the pharmacist, and any issues that affected adherence.

Results: Between 2012 and 2016, 179 (20.5%) of 874 refugee patients screened were diagnosed with LTBI and 156 patients were referred to the pharmacist-run LTBI clinic. Of those referred, 92% successfully completed LTBI treatment; 40% of these patients required an intervention from the pharmacist in order to remain adherent.

Conclusion: LTBI treatment completion rates more than quadrupled after implementation of a pharmacist-run LTBI clinic. This successful model indicates that incorporating clinical pharmacists into interdisciplinary healthcare teams can enhance medication adherence and completion rates, leading to improved public health outcomes.

Medication Safety

217 | Pharmacists' perceptions of the autoverification of medication orders in hospitals

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Introduction: The Joint Commission allows autoverification of medication orders to replace prospective pharmacist order review in the emergency department and procedural areas in the hospital. There is debate on whether to expand or limit autoverification due to its potential impact on workflow and patient safety. This is the first study assessing individual pharmacists' perceptions of autoverification.

Research Question or Hypothesis: What are pharmacists' perceptions of the value and safety of the autoverification of medication orders in hospitals?

Study Design: An anonymous survey was electronically distributed to pharmacists practicing in hospitals in Mississippi.

Methods: The University of Mississippi Institutional Review Board determined this study to be exempt. Pharmacists who practice ≥10 hours per month in a hospital setting in Mississippi were included. The 26-item survey collected demographic and perception data. A 5-point Likert-type response was used to assess participants' level of agreement with statements regarding the potential impact of autoverification and with criteria of a proposed risk stratification method. Data were collected via Qualtrics®. Descriptive statistics were used to analyze responses.

Results: A total of 77 eligible respondents completed the survey. Of these, 84% were at least somewhat familiar with autoverification prior to the survey, and 64% stated that their hospital used this functionality. While 55% agreed that autoverification can positively impact pharmacist workload, the majority also agreed that autoverification could adversely impact patient safety (86%) and quality of care (82%). Seventy-five percent agreed that drugs that are emergently needed should be autoverified, while 58% disagreed with using prespecified weight or age as a criterion for risk stratification.

Conclusion: Most respondents perceived value in autoverification but believed it could negatively impact patient safety and quality of care. Further research is needed to identify strategies to address these concerns and to assess perceptions on a national level.

218 | Therapy interruption of nonformulary hepatitis C and HIV medications during inpatient admission

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Introduction: Treatment of Human Immunodeficiency Virus (HIV) and Hepatitis C Virus (HCV) with antivirals is advancing rapidly. This, with high cost and infrequent use, may lead to hospitals lagging in adding HIV and HCV therapies to formulary. Interruptions due to medications being unavailable during admission may lead to harm, including concern for ineffective viral clearance. The purpose of this study was evaluation of antiviral interruption in hospitalized on nonformulary HCV and HIV antivirals and impact on viral rebound.

Research Question or Hypothesis: What is the frequency and duration of HCV and HIV antiviral therapy interruption in hospitalized patients on nonformulary agents?

Study Design: Retrospective, cohort analysis

Methods: 112 patients with HIV and HCV on nonformulary antivirals admitted between 2011 and 2018 were reviewed. Included patients received at least one dose of a nonformulary HCV or HIV antiviral while admitted. The primary outcome was frequency and duration of HIV or HCV antiviral interruption during admission. Secondary outcomes included viral rebound with ≤48 hours interruption versus >48 hours. Descriptive statistics were utilized to evaluate demographics and the primary outcome. Secondary outcomes were analyzed via the Fisher's exact test via Microsoft Excel, with a *P*-value <0.05 indicating statistical significance.

Results: Median duration of nonformulary therapy interruption was 1 day (IQR 0-2 days), ranging from 0 to 8 days. 72% of patients

experienced ≥24 hours of antiviral interruption. In patients with interruptions >48 hours, 71% were attributed to lack of availability of the nonformulary antiviral. There was no statistically significant difference in the incidence of overall viral rebound in patients with interruptions ≤48 hours versus >48 hours (7.8% v. 11.1%, $P = 0.56$).

Conclusion: Formulary limitations of HIV and HCV antivirals result in drug therapy interruptions. Despite the high frequency of therapy interruption, durations were generally limited and this did not lead to significant viral rebound within 3 to 12 months after discharge.

219 | Impact of safety warning on domperidone prescribing for geriatric patients in South Korea: Analysis of national insurance claim data

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Introduction: Domperidone is a dopamine antagonist used for the symptomatic management of nausea and vomiting. Many countries banned or add black box warning due to an increased risk of serious adverse cardiac effects such as QT prolongation. In 2014, the Korea Ministry of Food and Drug Safety also released a safety warning to carefully consider adverse cardiac effects when prescribing domperidone for elderly patients.

Research Question or Hypothesis: Is there impact of safety warning on domperione prescribing for geriatric patients?

Study Design: Cross-sectional study

Methods: This study included patients 65 years or older who used national health insurance services in the years 2011 and 2016, using national patient sample dataset in South Korea. We analyzed the characteristic of domperidone prescribing patterns and compared on pre- and post- safety warning.

Results: Prescribing frequency of domperidone was significantly reduced from 603,962 cases in 2011 to 24,623 cases in 2016. In 2011, 53,272 (8.8%) prescriptions were for greater than 30 mg/day, whereas only 200 (0.8%) prescriptions were in 2016. The number of patients with one or more comorbidities and ECG (electrocardiogram) monitoring showed positive changes after safety warning. However, OR of number of co-prescribing medication that increase risk of QT prolongation due to interaction and maximum continuous treatment duration was increased in 2016.

Conclusion: In elderly patients, after the 2014 safety letter was issued, domperidone was more safely prescribed in various aspects, including frequency of prescribing, maximum daily dose and duration of continuous prescription.

220 | A stepwise analgesics use in post-myocardial infarction is effective for preventing subsequent cardiovascular events

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Introduction: Whereas current guidelines recommend avoiding non-steroidal anti-inflammatory drugs (NSAIDs) as initial treatment for musculoskeletal analgesic treatment in myocardial infarction (MI), real-world evidence on stepwise approach is limited.

Research Question or Hypothesis: Therefore, we aimed to examine the association between optimal adherence to stepwise analgesics use in post-MI and risk of cardiovascular outcomes.

Study Design: a retrospective cohort study using a longitudinal national database

Methods: We conducted a retrospective cohort study using the National Health Insurance Service database in Korea. Among patients who were prescribed analgesics for musculoskeletal diseases after 30 days from discharge from incident MI during 2008-2015, â€˜guideline-concordant' patients who started without NSAIDs and 'guideline-discordant' patients who started with NSAIDs were matched 1:1 using propensity score (n = 10,882 in both group). Cox proportional hazard models were used to investigate the association between guideline concordance and risk of major adverse cardiovascular events (MACE), including re-hospitalization due to MI, ischemic stroke, or death.

Results: Starting with NSAIDs as analgesics in post-MI patients was significantly associated with increased risk of MACE, compared with the patients who started analgesics including AAP and opioids (HR = 1.77 [95% CI, 1.24-2.53]). The increased risk was significant in patients started MSK analgesics within 180 days from MI discharge. In addition, the increased risk of in higher MPR of NSAIDs or COX-2 inhibitors compared to no use of the drugs was observed.

Conclusion: Guideline adherence to avoid NSAIDs for initial analgesic treatment for musculoskeletal disorders in patients with history of MI, needs to be emphasized, especially who experienced incident MI in previous 180 days

221 | Phenytoin dosing practices in traumatic brain injury in the absence of therapeutic drug monitoring availability in Uganda

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Introduction: Phenytoin is used for seizure prophylaxis in neurosurgical patients with traumatic brain injury (TBI) at Mulago National Referral Hospital in Kampala, Uganda. Therapeutic drug monitoring to achieve target phenytoin levels is not feasible in this low resource setting nor is weight-based dosing due to lack of weighing scales. Anecdotes of seizures in patients on phenytoin prompted a chart audit to

determine current phenytoin dosing practices and identify improvement strategies.

Research Question or Hypothesis: How is phenytoin dosed in neurosurgery patients with TBI and are patients experiencing breakthrough seizures or adverse effects?

Study Design: Qualitative retrospective chart audit

Methods: All available medical charts for adult patients admitted to the neurosurgical ward in November 2016 and April 2017 were included if: TBI diagnosis, prescribed phenytoin, and had neurosurgery. Patients with known seizure disorder prior to TBI were excluded.

Results: 29 patients fit inclusion criteria. Mean (range) age was 41 (18-80) years with 72% male. 250 mg BID comprised 40% of 81 phenytoin orders placed. 62% of patients were ordered maintenance doses greater than 400 mg/d. 10 seizures after hospitalization were noted in 6 patients; 80% occurred while on phenytoin. No adverse effects were noted. Only 48% of patients had administration documented in their charts, with an average of 2.9 doses/patient despite an average length of stay of 10.5d. 41% of patients were prescribed duplicate anticonvulsants, primarily lamotrigine, while in hospital; however, only one patient had a seizure on phenytoin before the additional anticonvulsant was added.

Conclusion: This data reveals opportunities for improving anticonvulsant prescribing practices. Despite high maintenance doses—typically recommended is 300-400 mg/d—some patients still seized. As a loading dose, phenytoin 250 mg BID may not be adequate—usual is around 1000 mg (20 mg/kg). Unnecessary duplicate therapy was common. Lack of dosage documentation limits interpretation of this data. Next steps include developing dosing protocols to optimize therapy and encouraging documentation to better evaluate efficacy.

222 | The effect of proton pump inhibitor therapy on the risk of incident dementia among the elderly populations

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Introduction: Proton pump inhibitors (PPIs) are extensively used for the treatment of acid-related gastrointestinal diseases, especially among the elderly population; however, PPIs are thought to have a role in dementia development. To date, several studies report the results of association between the use of PPIs and risk of dementia, but are still under debate.

Research Question or Hypothesis: PPIs could increase the risk of dementia in the elderly people and would have a dose-dependent relationship.

Study Design: Retrospective population-based cohort study

Methods: This study was conducted by analyzing the Taiwan National Health Insurance Research Database from 1996 to 2010. We included people who aged 65 years or older in 2000 and divided into PPI user and non-PPI user, and then these two groups were matched at a ratio of 1:1. The study outcome was all-cause dementia. Cox proportional hazard model was used to estimate hazard ratios (HRs) with 95% confidence interval (CI) for the association between PPIs and dementia. The cumulative duration and dose of PPIs were calculated and stratified for examining dose-dependent response on the risk of dementia.

Results: A total of 97,727 individuals aged 65 years or older and free of dementia at baseline were analyzed. PPI user group (n = 2936; mean follow-up time: 3.20 years) had a significantly increased risk of incident dementia compared with non-PPI user group (n = 2936; mean follow-up time: 4.13 years) (adjusted HR [aHR] 1.68; 95%CI 1.26-2.24). We also observed a trend for dose-dependent response of PPIs on the risk of dementia. (*P* for trend: 0.017 in cumulative PPI duration; 0.032 in cumulative PPI dose).

Conclusion: PPI users may have a higher risk of dementia among the elderly population, and we also observed a dose-dependent relationship. Further study is required for clarifying the actual relationship between PPI use and risk of dementia.

223 | Medication safety knowledge, attitude and practice among antihypertensive medication users in Cairo, Egypt: A cross- sectional study

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Introduction: Hypertension is one of the major causes for mortality associated with cardiovascular diseases. Elevated blood pressure is a critical health issue among the Egyptian population. The Assessment of Knowledge (K), Attitude(A), and Practice (P) of Egyptian hypertensive patients is crucial to improve their hypertension management and treatment.

Research Question or Hypothesis: To Evaluate the self-care practices, knowledge and attitude of Egyptian hypertensive patients.

Study Design: A cross-sectional survey based study among the Egyptian hypertensive patients.

Methods: A cross-sectional study was made among 324 hypertensive patients from community pharmacies while purchasing their antihypertensive medications in Cairo, Egypt from October 2018 to March 2019. Data was collected using pretested structured face-to-face

interview after taking informed written consent. A verified questionnaire of knowledge, attitude and practice on hypertension used to determine the KAP scores.

Results: A total of 324 patients were males (60%), had received primary education (87%) and had hypertension for ≥5 years (53.2%). The blood pressure measures ranged from 100-180/60-110 mmHg. K, A and P median scores were found 8 (6), 5 (2) and 6 (4) respectively. K and A were statistically associated with sex both at $P < 0.001$ and level of education (K at $P < 0.001$ and A at $P = 0.013$). Surprisingly, (57%) of the participants knew that hypertension is defined as high blood pressure. Among those hypertensive patients, only 16.6% consulted their doctor once or twice per month. The most commonly risk factor identified by the hypertensive participants was "Too much salt intake".

Conclusion: There is an inadequate general knowledge about hypertension nor the outcomes of elevated BP levels among Egyptian patients; It is essential to initiate programs aiming to increase public awareness about uncontrolled blood pressure and its long term complications.

224 | Knowledge, attitudes and practices of Egyptian patients with diabetes mellitus: A cross sectional study

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Introduction: One of the crucial non-communicable diseases that cause significant threats to global public health is diabetes mellitus. In Egypt, there is limited information on diabetes related knowledge (K), attitudes (A), practices (P) and their associated factors in the community level. It is crucial to assess the KAP before initiating any educational or management programs.

Research Question or Hypothesis: To capture the current level of knowledge, attitudes and practices of adult Egyptian diabetic patients Type 2.

Study Design: A cross-sectional study among Egyptian diabetic patients.

Methods: Between September 2018 and January 2019, 188 adult patients with diabetes mellitus were enrolled from community pharmacies while purchasing their diabetes medications. A structured interviewer administered questionnaire was used for data collection.

Results: The mean age of the participants was 57.8 ± 15.3 years, 46.8% are females. The mean knowledge score was 2.22 ± 0.83 points (out of 6). Only few participants (12.4%) knew their current medication side effects. The mean practice score was 4.52 ± 1.33 points (out of 8). Only 13% of patients reported current physical activity. Multivariate linear regression analysis showed that those with a high education level had a significantly higher knowledge (Beta = 0.424, $P = 0.001$) and practice score (Beta = 0.488 $P = 0.047$) than those with a school degree. A high knowledge score (Beta = 0.433, $P < 0.001$) was found in diabetic patients following a special diet than those who didn't follow one. There is a high correlation between knowledge score and practice score. (Beta = 0.792, $P < 0.001$). There no association between gender and age with knowledge and practice scores.

Conclusion: Based on the results found, Egyptian diabetic patients have limited knowledge, attitudes and practices about diabetes mellitus. Thus, a community based diabetic educational programs is required to enhance the perception of diabetic patients.

Nephrology

225 | Comparison of antimicrobial dosing recommendations in intermittent hemodialysis between four drug information resources

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Introduction: Patients with intermittent hemodialysis (IHD) are at an increased risk of infection due to their immunocompromised state and permanent intravenous access. Infection remains the second leading cause of mortality and bacterial resistance is prevalent in IHD patients. Tertiary drug information resources are frequently consulted among healthcare providers, however, there may be significant discrepancy in dosing recommendations between resources.

Research Question or Hypothesis: How consistent are antimicrobial dosing recommendations for IHD patients among four different tertiary resources and how relevant are their referenced pharmacokinetic studies?

Study Design: Retrospective data analysis from four tertiary resources

Methods: Dosing recommendations of 29 commonly prescribed antimicrobial agents in IHD patients were collected from Micromedex, LexiComp, Clinical Pharmacology, and Drug Prescribing in Renal Impairment to compare the total daily dose (TDD). Significant dosing discrepancies were defined as >30% difference between the highest and lowest estimated TDDs. As the secondary outcomes, referenced pharmacokinetic (PK) studies in four tertiary resources were evaluated for sample size, hemodialyzer types, the incorporation of best known pharmacokinetic/pharmacodynamic (PK/PD) index, and the consideration of different interdialytic dosing period to assess their relevance in contemporary clinical practice.

Results: A significant dosing discrepancy between resources was found in 44.8% of study drugs. Among a total of 48 referenced PK studies, 46 were evaluated. Most studies were conducted with small patient numbers with mean of 13 [range: 3-70]. Only 65% and 31% of studies utilized conventional (e.g. high-flux or high-efficiency) hemodialyzers and the best-known PK/PD index respectively. Eighty-six percent of studies did not consider different interdialytic period for dosing recommendations.

Conclusion: Inconsistent antibiotic dosing recommendations for IHD patients exist among four well-established resources. Most of their referenced PK studies utilized outdated or irrelevant study methods. Future PK studies consistent with current practice are warranted to provide more relevant antibiotic dosing recommendations for IHD patients.

226 | Influence of patient's weight on meropenem probability of target attainment in critically ill patients receiving CRRT

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Introduction: Critically ill patients receiving continuous renal replacement therapy (CRRT) have mortality rates of ~50%. Meropenem is commonly used in these patients, but recommended meropenem doses are not adjusted for patient size. CRRT patients are often overweight due to fluid overload. This *in-silico* study evaluates the influence of patient weight on probability of meropenem pharmacodynamic target attainment (PTA) in critically ill patients receiving CRRT.

Research Question or Hypothesis: Heaviest patients will attain lower PTA compared to the lightest patients.

Study Design: Monte Carlo Simulations (MCS)

Methods: Previously published pharmacokinetic data from patients with acute kidney injury and/or receiving CRRT were used to generate pharmacokinetic profiles. Patient weight, delivered CRRT treatment delivered, and effluent rate data from the Acute Renal Failure Trial Network Study were incorporated. Meropenem 500 mg q12h, 500 mg q8h, 1 g q12h, 1 g q8h and 2 g q12h were each dosed in 10,000 virtual subjects. These dosing regimens were chosen because they are commonly used in the clinical practice. The pharmacodynamic target of meropenem was free concentration ≥ MIC (and 4 × MIC) for ≥40% (≥40 fT≥MIC or 4 × MIC) for the first 72 h of therapy using a MIC of 2 mg/L (P. aeruginosa breakpoint). The PTA were analyzed in patient weight quartiles [Q1 (lightest)-Q4 (heaviest)]. A PTA of ≥90% was considered as an acceptable regimen.

Results: The PTA were > 95% with all dosing regimens for pharmacodynamic target of ≥40 fT≥1 × MIC in both weight quartiles. Meropenem 2 g q12h and 1 g q8h also reached >95% with the higher (≥40 fT≥4 × MIC) target in both quartiles. With either target, PTA was higher in the smaller patients for all doses.

Conclusion: The MCS showed that all regimens reached the pharmacodynamic target of ≥40%fT > MIC regardless of patient's weight. Meropenem 2 g q12h and 1 g q8h achieved acceptable PTA for ≥40% fT > 4 × MIC, but lower doses did not. Patient weight does influence PTA when conventional meropenem doses are used to reach high pharmacodynamic targets.

227 | Vancomycin peak concentrations and risk of acute kidney injury in critically ill children

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Introduction: Vancomycin is associated with acute kidney injury (AKI) in critically ill children but the mechanism and associated risk factors remain unclear. Vancomycin trough concentrations (C_{min}) above 15mcg/mL are a known risk factor. Recent data suggests intra-tubular obstruction caused by vancomycin crystallization may play a causative role in AKI. Therefore, peak vancomycin concentrations (C_{max}) may provide an early marker of AKI risk as a higher C_{max} is more likely to crystallize and cause intra-tubular obstruction.

Research Question or Hypothesis: Vancomycin C_{max} will be elevated in critically ill children before development of AKI.

Study Design: Retrospective cohort study

Methods: AKI was identified in children (≥2 months of age) admitted to the pediatric intensive care unit treated with ≥48 hours of vancomycin. AKI was defined as a 50% increase in serum creatinine from baseline within 48 hours. C_{max} was estimated using a population pharmacokinetic model validated in children to determine the elimination rate constant (k_e) with subsequent individual estimation of C_{max} as $C_{max} = C_{min}/e^{-k_e t}$. Bivariate analysis compared C_{max} between AKI and non-AKI groups with the Wilcoxon test. A multivariable logistic regression model was fit for AKI including covariable analysis. Statistical analysis was completed using SAS v9.4 with alpha = 0.05.

Results: The study included 87 patients that were 7.7 ± 6.6 years old, 47 (54%) female, and 31.0 ± 25.7 kg. Baseline renal function was 81.1 ± 28.7 ml/min. Initial vancomycin dosing was 49.2 ± 12.1 mg/kg/day with corresponding measured C_{min} of 12.5 ± 8.2mcg/mL. 18 patients (20.7%) developed AKI. Extrapolated initial vancomycin C_{max} was 38.2 ± 19.6mcg/mL in patients with AKI compared to 33.7 ± 32.7mcg/mL in patients without AKI (P = 0.046). After controlling for age, concomitant piperacillin/tazobactam, and vasopressor use, a vancomycin C_{max} > 40mcg/mL was associated with a significantly increased risk of AKI (adjusted odds ratio 4.1, 95%CI: 1.1-15.8, P = 0.040).

Conclusion: Estimated vancomycin C_{max} are associated with AKI in critically ill children. Vancomycin C_{max} may provide an early, mechanism-based risk factor for vancomycin AKI and should be evaluated in prospective studies.

228 | Evaluation of epoetin use in chronic kidney disease at an academic medical center

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Introduction: KDIGO guidelines recommend erythropoiesis stimulating agents (ESA) for the treatment of anemia due to chronic kidney disease (CKD). Due to adverse cardiovascular outcomes and thrombotic events (TE) associated with high hemoglobin targets, guidelines and updated FDA labeling recommend using the lowest effective dose. Also, the benefit of ESA use in CKD patients during an acute inpatient admission is unknown but is associated with high cost.

Research Question or Hypothesis: The purpose of this study was to assess inpatient epoetin prescribing practices and identify opportunities for therapeutic optimization.

Study Design: Single-center, retrospective, cross-sectional study.

Methods: Adult patients admitted from May to July 2018 were included if they received ≥1 dose of epoetin for anemia of CKD. The primary objective was to characterize the patient population receiving epoetin. Secondary objectives included: appropriateness of epoetin use, hemoglobin change, and rates of adverse events. Descriptive statistics were utilized to represent the data.

Results: Of 246 patients included, 62% were on hemodialysis, 11% did not have CKD, and 52% had a length of stay ≤7 days. The median dose was 123 (98-147) units/kg and 14% of patients received >3 doses per week. The median change in hemoglobin from baseline to hospital discharge was 0.2 g/dL. Only half of the patients requiring iron supplementation received therapy and 23% of patients received ≥1 unit of packed red blood cells. There were 8 incidences of TE, 2 incidences of myocardial infarction, and mortality was 10% during hospitalization.

Conclusion: Based on inappropriate dosing and administration frequency, proposed institutional changes include: adjusting target hemoglobin, limiting frequency to 3 doses per week, and modifying from fixed-dose to standardized weight-based dose. These changes will result in an estimated 15% reduction in epoetin use and annual cost-savings of $125,000. Risks versus benefits of ESA use in the acute setting need to be considered, as demonstrated by the incidence of TE.

229 | Comparison of renal function estimation in transgender adults

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Introduction: Renal function assessment-an essential step in patient care-typically relies on equations such as Cockcroft-Gault (CG) and Modification of Diet in Renal Disease (MDRD) which consider age, weight, and sex, in addition to serum creatinine (SCr). In transgender patients, factors including sex assigned at birth and hormone therapy (HT) may influence SCr generation and subsequent renal function estimation.

Research Question or Hypothesis: Does creatinine clearance (CrCl) calculation method affect renal function estimation among transgender patients with or without HT?

Study Design: Retrospective, observational, matched case-control study

Methods: All patients >18 years receiving care through June 2018 from a local transgender clinic with at least one SCr measurement and no history of chronic kidney disease were included as cases. Controls were matched based on age and weight from a nearby primary care clinic and a subgroup was matched on sex assigned at birth. Comparisons of SCr and CrCl as calculated using CG and MDRD between cases and controls, sex, and HT were completed.

Results: A total of 248 transgender and 248 control patients were included in the final analysis, with 123 pairs matched on sex assigned at birth, age, and weight. Of transgender cases, 148 (60%) were transgender women (male-to-female). Between matched pairs, there was no significant difference in SCr or CrCl estimation using CG or MDRD, regardless of sex assigned at birth. Transgender women taking feminizing HT significantly affected SCr ($P < .01$) and CrCl estimation using MDRD ($P < .01$), but not CG ($P = .21$). Transgender men taking HT (testosterone) had significant differences in SCr and CrCl estimation based on CG and MDRD calculations ($P < .01$).

Conclusion: Among transgender patients taking sex hormones, discrepancies in renal function estimates may occur based on equation type and HT use. Clinicians should be prudent when utilizing renal function estimates to adjust renally-excreted medications in this population.

230 | Utility of cystatin C in assessing renal function in patients on trimethoprim/sulfamethoxazole

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Introduction: An accurate estimate of glomerular filtration rate (GFR) is critical to patient care. Traditionally, GFR estimates have relied on serum creatinine (SCr) as the primary biomarker. Studies have demonstrated that trimethoprim/sulfamethoxazole (Bactrim) competes with SCr filtration at the glomerulus, resulting in an approximately 20% rise in SCr that is not reflective of true GFR. Thus, Cockcroft-Gault

estimation of renal function may be unreliable following Bactrim exposure, because it relies on SCr. Cystatin C may be a valuable alternative biomarker for estimating renal function. The Dade Behring calculation, which utilizes cystatin C measurement, has been shown to provide an accurate renal function estimation in instances where SCr is unreliable, including decreased muscle mass. Moreover based on its clearance, independent of tubular secretion, it is expected that cystatin C would not be affected by Bactrim exposure.

Research Question or Hypothesis: To date, no literature has evaluated Dade Behring estimation of renal function following Bactrim exposure.

Study Design: Retrospective review

Methods: A random sampling captured 31 patients who had a cystatin C measured while receiving Bactrim therapy. Renal function estimation prior to Bactrim exposure (using Cockcroft-Gault) was compared to renal function estimation post antibiotic exposure (using Cockcroft-Gault and Dade Behring calculation).

Results: Pre-antibiotic GFR averaged 81.1 mL/min, using Cockcroft-Gault estimation. Post-antibiotic GFR averaged 66.7 mL/min when calculated using Cockcroft-Gault and 55.8 mL/min when calculated using Dade Behring estimations, respectively. A total of 52% patients received Bactrim at a prophylactic dose, while 48% patients received Bactrim at a treatment dose. Post-antibiotic GFR averaged 46.9 mL/min and 64.7 mL/min when calculated using Dade Behring estimations for treatment doses and prophylactic doses, respectively.

Conclusion: This is the first article to evaluate the estimation of GFR using Dade Behring estimation following Bactrim exposure. The Dade Behring consistently estimated a lower GFR than Cockcroft-Gault estimation.

231 | The exclusive use of unadulterated bags in continuous venovenous hemodialysis (CVVHD)

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Introduction: The customization of Continuous Venovenous Hemodialysis (CVVHD) bags is needed to account for changes in electrolytes over time in patients requiring continuous renal replacement therapy (CRRT). There are however disadvantages with this practice, including the increased burden of time and cost. At Cleveland Clinic Florida (CCF), CVVHD bags were either compounded or provided in batches of up to 12 for patients requiring at least 24 hours of therapy. Order changes often led to an increased waste of customized bags. In addition, an increase in the shortage of electrolytes for compounding led to the exclusive use of standardized bags. Standard concentrations of PrismaSol® Solution BGK 0/2.5 (K+: 0 mEq/L; Ca2+: 2.5 mEq/mL) and BGK 4/2.5 (K+: 4 mEq/L; Ca2+: 2.5 mEq/mL) were strategically interchanged to meet patient needs, with or without the administration of bolus potassium.

Research Question or Hypothesis: The use of standard composition dialysate will result in no clinically significant difference in the average serum potassium over time, as compared to the use of customized dialysate to which potassium concentration has been manipulated.

Study Design: Retrospective Cohort (n = 62)

Methods: Patients who received customized CVVHD bags were compared to patients who exclusively received standardized bags using retrospective chart review.

Results: The average serum potassium was 4.16 mEq/mL(95%CI 3.94 - 4.38) and 4.30 mEq/mL (4.12 - 4.38) in the customized and standard group respectively (P = 0.29); the percent of patients who experienced hyperkalemia at least once was 16% and 13% respectively (P = 0.74). The maximum serum potassium observed was 6.9 mEq/L and 5.9 mEq/L respectively. The all-cause mortality rate was similar between both groups with 58% and 57% (P = 0.80).

Conclusion: The exclusive use of standard CVVHD bags did not result in clinically significant differences in the occurrence of hyperkalemia. Furthermore, bypassing customization of bags has cost and time-saving implications, however further research is necessary needed to confirm these benefits.

232 | Evaluation of erythropoiesis-stimulating agent dose adjustments for target hemoglobin attainment in hemodialysis patients

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Introduction: Dosing protocols for erythropoiesis-stimulating agents (ESA) in end-stage renal disease (ESRD) patients fail to consistently achieve target hemoglobin (10-11 g/dL). Deviations from the protocol may be inappropriately reactive to fluctuating hemoglobin, which can reduce time in therapeutic range.

Research Question or Hypothesis: Is protocol-consistent ESA dose adjustment and dose change timing optimal for achieving the target hemoglobin for ESRD patients on hemodialysis?

Study Design: Retrospective, single-center, cross-sectional study

Methods: Demographic, laboratory, and medication data was collected for 50 ESRD-hemodialysis patients receiving epoetin alfa over a one-year period. Institutional dosing protocol is consistent with epoetin alfa product labeling which recommends a 25% adjustment in dose every 4 weeks to a target hemoglobin of 10-11 g/dL. ESA dose adjustments were individually evaluated, categorized as protocol-compliant or non-compliant, and grouped according to hemoglobin prior to dose adjustment (<10 g/dL or > 11 g/dL). Percent change in ESA doses (U/kg/week) were calculated. The hemoglobin value nearest 6 weeks from dose change was used to evaluate hemoglobin

target attainment. Statistical analysis was done using SAS v9.4 with appropriate hypothesis testing.

Results: 105 dose adjustments in 43 patients were evaluated. For dosing adjustments within the 25% range, target hemoglobin was achieved in 76.7% compared to 54.8% of dosing adjustments that were not within the 25% range (P = 0.022). When hemoglobin>11 g/dL, dose adjustments made more frequently than 4 weeks (mean 15.1 ± 2.6 days) resulted in target hemoglobin 71.4% of the time compared to 71.1% for protocol-compliant adjustments (P = 1). When hemoglobin<10 g/dL, dose adjustments made more frequently than 4 weeks (mean 13.9 ± 7.0 days) attained target hemoglobin 44.4% of the time, compared to 69.2% for protocol-compliant adjustments (P = 0.069), and 100% that did not attain target hemoglobin were > 11 g/dL.

Conclusion: ESA dose adjustments of ~25% appear effective for achieving target hemoglobin. Timing between dose adjustments should be re-evaluated. When up-titrating the dose, changes more frequent than 4-week intervals are discouraged.

Neurology

233 | Dimethyl fumarate disposition likely to altered by alcohol consumption

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Introduction: Dimethyl fumarate (DMF) is first-line treatment for relapsing forms of multiple sclerosis. DMF is a prodrug that undergoes rapid pre-systemic hydrolysis by esterases to the active metabolite monomethyl fumarate (MMF). The esterases responsible for the metabolism of DMF to MMF are unknown.

Research Question or Hypothesis: Based on DMF structure (small alcohol ester group), DMF is likely hydrolyzed by hepatic carboxylesterase-1 (CES1) suggesting its metabolism will be inhibited by alcohol, and that it will undergo transesterification with alcohol to form ethyl methyl fumarate (EMF).

Study Design: in vitro metabolic studies were performed in human recombinant carboxylesterase enzymes (CES1 and CES2) and in human intestinal microsomes (HIM).

Methods: Dimethyl fumarate (50 μM) was incubated in CES1 (10 μg/mL), CES2 (25 μg/mL), or HIM (50 μg/mL) to determine the DMF metabolic pathway. Increasing concentrations of alcohol were incubated with DMF in CES1 to determine inhibition potency. Concentrations of DMF and MMF were determined by mass spectroscopy.

Results: DMF was rapidly hydrolyzed by CES1 to MMF. No significant hydrolysis of DMF to MMF occurred in CES2 or HIM. Alcohol produced concentration-dependent inhibition of CES1-mediated DMF hydrolysis to MMF (IC_{50} = 19.7 mM). Transesterification of DMF occurred with alcohol resulting in formation of the DMF-alcohol transesterification product EMF.

Conclusion: CES1-mediated hydrolysis is the major metabolic pathway responsible for conversion of DMF to its active metabolite MMF. Alcohol inhibits the CES1-mediated formation of MMF and results in the formation of a new ethylated DMF metabolite with unknown pharmacologic activity. Thus, the co-ingestion of alcohol is likely to significantly alter the disposition of DMF, which could affect the efficacy and toxicity of DMF therapy in patients with multiple sclerosis.

234 | Impact of obesity on fosphenytoin concentrations after a loading dose for patients in status epilepticus

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Introduction: Prolonged status epilepticus (SE) can result in irreversible neurologic damage requiring prompt treatment. Fosphenytoin can be administered as a loading dose to rapidly achieve therapeutic plasma concentrations. Previous data suggest the volume of distribution for fosphenytoin is larger in obese patients, requiring significant dose adjustments. Obesity is increasing in prevalence, and understanding optimal weight-based dosing in these patients can improve outcomes. This study compared total plasma phenytoin concentrations after a loading dose of fosphenytoin in obese and non-obese patients with SE.

Research Question or Hypothesis: Does obesity impact achievement of therapeutic plasma concentrations after a loading dose of fosphenytoin?

Study Design: Retrospective, multi-center, cohort study utilizing review of electronic medical records.

Methods: This study included adults with SE treated with fosphenytoin. Patients who received phenytoin in the previous 7 days were excluded. Obese and non-obese patients were paired 1:1 based on age within 15 years, sex, and fosphenytoin dose (mg Phenytoin Equivalents/kg) based on actual body weight. Obesity was defined as body mass index (BMI) greater than 30. Peak total plasma concentrations were collected within 4 hours from time of administration. The primary outcome compared the difference between the total plasma phenytoin concentrations between groups (Wilcoxin signed-rank). Secondary clinical outcomes included seizure cessation within 24 hours and need for additional antiepileptic medications. All statistics were performed using SigmaPlot®.

Results: Thirty-eight non-obese and obese patients were enrolled. The median [IQR] BMI for each group was 25.1 [22.6-26.8] and 34.2 [32.5-42.9], respectively ($P < 0.001$). Median [IQR] total plasma concentration was similar in non-obese versus obese patients (13.4 [10.6-19] v 15.3 [13.5-18.9], $P = 0.49$). Achievement of a therapeutic concentration was similar between groups (58% v 74%, $P = 0.49$). Obesity had no

impact on seizure cessation within 24 hours (79% v 63%, $P = 0.47$) or need for additional antiepileptic drugs (79% v 47%, $P = 0.09$).

Conclusion: Obesity had no impact on plasma concentration after fosphenytoin loading dose.

235 | Medical cannabis in the treatment of Parkinson's disease

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Introduction: Preclinical data and observational reports have suggested a potential for medical cannabis (MC) to provide benefit in treating some Parkinson's disease (PD) motor and non-motor symptoms; however, data from controlled studies is scarce and mixed, and concerns exist regarding possible adverse effects (AEs). Due in part to regulatory barriers restricting clinical research on cannabis, robust efficacy and safety data, as well as long-term real world and outcomes data, are lacking.

Research Question or Hypothesis: What impact does MC have on the symptomatic treatment of PD?

Study Design: Single center retrospective chart review.

Methods: Analysis includes idiopathic PD patients treated with MC through the NYS Medical Marijuana Program. Objective and subjective data pertaining to PD symptoms, MC treatment, and concomitant medications were collected following initiation of MC. AEs considered related to MC and reason for discontinuation were also recorded.

Results: Sixty-nine (46 = Male, 23 = Female) patients aged 72 ± 9 years were included. Primary indication for MC treatment included PD (97%), chronic pain (1%), and cancer (1%). Eighty-eight percent (n = 61) reported improvement in at least one PD motor symptoms, most commonly in tremor and spasticity; improvements in pain, rigidity, gait instability, dyskinesia, sleep, mood, anxiety and nausea/vomiting were also noted. Of patients reporting chronic pain, 61% reported decreased pain with MC therapy. Twenty-five patients were taking an opioid at MC therapy initiation, and a significant proportion (56%, $P < 0.001$) either discontinued or reduced the opioid during treatment. Forty-six percent of patients reported at least one AE, most commonly somnolence or fatigue (n = 15), followed by confusion or cognitive impairment (n = 8) and dizziness (n = 6). MC was tolerated well in this population, with only 2 patients (2.9%) discontinuing due to AEs.

Conclusion: Use of MC may improve both motor and non-motor symptoms in PD patients.

236 | Ocrelizumab infusions preferred over oral therapies in an MS clinic

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Introduction: New guidelines addressing the use of disease modifying therapies (DMTs) in MS were published in March 2018, however, no guidance was given in choosing between the 15 FDA approved DMTs. We compared the use of first choice DMTs, specifically Aubagio® (teriflunomide), Tecfidera® (dimethyl fumarate), Gilenya® (fingolimod), and Ocrevus® (ocrelizumab) at the AUMC MS Clinic.

Research Question or Hypothesis: We hypothesized that first choice DMT would favor oral agents, due to their ease of administration and tolerability.

Study Design: A single site retrospective chart review was completed for new patients presenting to the MS Clinic from March 2017 to December 2018.

Methods: Patient demographics, diagnoses, and treatments prescribed were recorded. Toxicities, switching of treatment options, and the rationale for switching were also collected.

Results: 178 patients were included in the study. Of 69 treatment naive patients, 25 were started on ocrelizumab (36%) (more frequently than any other agent), as were 27 out of 33 (81%) patients with aggressive onset of disease or heavy lesion burden on MRI. Of 144 patients with relapsing-remitting MS (RRMS), 42 (29%) were started on ocrelizumab, the most of any agent, as well as 10 (83%) of the patients with primary progressive MS (PPMS). Of the patients diagnosed with secondary progressive MS, 12 patients (66.7%) were off DMT, but 3 patients (17%) chose to be treated with ocrelizumab to slow progression of disease. Adverse effects were experienced with fingolimod (8), dimethyl fumarate (17), teriflunomide (10), and ocrelizumab (7). However, there were no discontinuations of ocrelizumab, but 8 discontinuations of fingolimod, 18 of dimethyl fumarate, and 5 of teriflunomide.

Conclusion: IV ocrelizumab was overwhelmingly preferred over oral agents for MS patients with RRMS or PPMS both when initiating and switching treatment. Use of ocrelizumab challenges the notion that oral agents are easier to administer and better tolerated.

Nutrition

237 | Weight-based caloric calculations versus indirect calorimetry in neurocritically ill patients

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Introduction: Evidence regarding adequate caloric requirements of critically ill patients with acute brain injuries is lacking. Furthermore, hypermetabolic states have been reported following traumatic brain injuries suggesting potential risk of caloric debt in neurocritically ill patients. The primary objective of this study was to determine whether guideline recommended weight-based dosing provides adequate caloric requirements compared to indirect calorimetry (IC) measurements in this population.

Research Question or Hypothesis: We hypothesized that guideline recommended lower-weight based nutrition will not match the caloric demand of patients with acute brain injuries.

Study Design: This was a single center, retrospective, observational case-crossover study that included adults admitted to the neurocritical care unit between February 2018 and May 2019 and received a metabolic study within 14 days from admission.

Methods: We compared resting energy expenditure (REE) determined via IC to the lower (BMI < 30 kg/m^2: 25 kcal/kg and BMI 30-50 kg/m^2: 11 kcal/kg) and higher (BMI < 30 kg/m^2: 30 kcal/kg and BMI 30-50 kg/m^2: 14 kcal/kg) actual body weight-based dosing guideline recommendations.

Results: A total of 70 metabolic studies were performed in 61 patients (33% ICH, 16% non-traumatic SAH, 24% ischemic stroke, 17% TBI, 9% status epilepticus, 1% other etiologies). The mean age was 58+/--18 years, mean weight 90+/-31 kg with a BMI of 30+/-10 kg/m^2, and had mean baseline GCS of 7+/-4. On average IC was obtained on day 5 of admission. Lower weight-based recommended nutrition did not provide adequate caloric needs as measured by IC adjusted for obesity (1623+/-454 vs 1915+/-592 kcal/day, P < 0.001). However, higher weight-based recommendation matched the caloric demand as measured by IC (1976+/-528 vs 1915+/-592, P = 0.277).

Conclusion: In this preliminary analysis, higher weight-based dosing for nutrition matched the caloric demand of critically ill patients with acute brain injury. Our results need to be confirmed in future larger prospective studies.

238 | Nutrition during pregnancy and lactation

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Introduction: Maternal, fetal and neonatal health during pregnancy and lactation is dependent on appropriate maternal nutrition. Both excessive and inadequate intakes are associated with complications for the mother, fetus, and neonate.

Research Question or Hypothesis: The objectives were to compare daily nutritional intake during pregnancy and lactation and compare average nutritional intake with the NIH Office of Dietary Supplements' recommendations.

Study Design: This is a prospective, longitudinal, controlled study.

Methods: 23 healthy women, 18-50 years of age with singleton pregnancies completed 3 study windows: 25-28 weeks gestation (S1), 28-32 weeks gestation (S2) and > 3 months postpartum during lactation (S3). Average daily nutritional intake was determined from 3-day dietary food-logs during each study window utilizing Fooducate®. Statistical analysis utilized repeated measures ANOVA (RStudio). Results are reported as mean ± SD.

Results: Significant differences were found in daily sugar intake (S1: 97.1 ± 32.3 grams, S2: 102.5 ± 37.4 grams, and S3: 71.4 ± 29.3 grams, P = 0.0003) and daily protein intake (S1: 84.7 ± 26.4 grams, S2: 68.9 ± 19.5 grams, and S3: 77.7 ± 21.5 grams, P = 0.02). During pregnancy and lactation, average dietary consumption exceeded recommended daily allowances by 25% or more for carbohydrates (pregnancy only), sodium, iron (lactation only), vitamin A, and vitamin C (pregnancy only). In contrast, the average daily consumption of potassium, iron (pregnancy only), and vitamin D were below recommendations by 25% or more.

Conclusion: Insufficient dietary potassium during pregnancy and lactation is not replaced with prenatal vitamins and likely contributes to maternal leg cramps. Low dietary iron during pregnancy is adequately replaced by common prenatal vitamins. However, low dietary vitamin D is only adequately replaced by some prenatal vitamins. Prenatal vitamins with at least 430 IU of vitamin D are needed to get the average intake to meet dietary recommendations during pregnancy and lactation. Some women require the full 600 IU as supplementation as their diet did not contain any vitamin D.

Oncology

239 | Association of plasma dehydroepiandrosterone, its sulfated form [DHEA(S)] and chemotherapy-associated cognitive impairment in early-stage breast cancer patients: A prospective, longitudinal study

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Introduction: Dehydroepiandrosterone (DHEA) and its sulfated form (DHEAS)—jointly referred to as DHEA(S)—are neurosteroids known to regulate brain development and function. We previously reported that patients with higher pre-chemotherapy DHEAS levels had lower odds of developing self-perceived cognitive impairment. However, it is unknown whether DHEA(S) levels change over time after initiation of chemotherapy, and whether the change is associated with onset of chemotherapy-associated cognitive impairment (CACI).

Research Question or Hypothesis: To evaluate the association between plasma DHEA(S) levels in chemotherapy receiving patients and onset of CACI.

Study Design: A multi-center, prospective cohort study.

Methods: Patients completed FACT-Cog v.3.0 for assessment of self-perceived cognitive function before (T1), during (T2), and after (T3) chemotherapy. Changes of cognition throughout chemotherapy were compared against the baseline. At each time point, plasma DHEA(S) levels were quantified by using ultra-high-performance liquid chromatography-tandem mass spectrometry. Changes of DHEA(S) levels were analyzed using ANOVA, and longitudinal associations between DHEA(S) levels and CACI were assessed using Generalized Estimating Equations. All statistical analyses were performed with STATA version 15, and two-sided *P* values <0.05 were considered statistically significant.

Results: A total of 247 early-stage breast cancer were recruited (mean age ± SD = 50.8 ± 9.1 years), with self-perceived cognitive impairment observed in 71 (28.7%) patients. A statistically significant reduction of mean (±SD) DHEAS levels was observed over time (T1: 2.79 ± 1.93 μmol/L, T2: 2.04 ± 1.55 μmol/L and T3: 1.96 ± 1.50 μmol/L, $P < 0.001$) but not with mean (±SD) DHEA levels (T1: 14.45 ± 10.85 nmol/L, T2: 13.38 ± 12.57 nmol/L and T3: 12.17 ± 10.98 nmol/L, $P = 0.09$). After adjusting for confounding factors, change of DHEA levels was associated with poor multitasking (adjusted OR 1.02, 95% CI 1.00-1.04).

Conclusion: Reduction of plasma DHEAS levels was observed after chemotherapy, and DHEA should be further evaluated as a mechanistic mediator of CACI.

240 | Systemic complications of the bidirectional intraoperative chemotherapy with intravenous ifosfamide and hyperthermic intraperitoneal chemotherapy (HIPEC) using cisplatin plus doxorubicin

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Introduction: Ifosfamide is recently used as the intravenous component of bidirectional intraoperative chemotherapy (BDIC) with hyperthermic intraperitoneal chemotherapy (HIPEC) using cisplatin plus doxorubicin.

Research Question or Hypothesis: Little is known about the systemic toxicities of the intravenous ifosfamide based BDIC regimen. Therefore, this study aimed to thoroughly assess the toxicities of this new treatment.

Study Design: Prospective, cohort study

Methods: Patients with peritoneal carcinomatosis who underwent the BDIC using intravenous ifosfamide 1300 mg/m^2 and a HIPEC regimen of cisplatin50 mg/m^2 plus doxorubicin 15 mg/m^2, at King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Incidences and severity of leukopenia, neutropenia, thrombocytopenia, and erythrocytopnia were assessed over 45 days after BDIC. Nephrotoxicity was assessed according to the RIFLE (Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease) classification system. Hemorrhagic cystitis was assessed by cystoscopy.

Results: A total of 18 patients were enrolled in the study. Grade 1 leukopenia developed in 11.1% of the patients, with 5.5% developed neutropenia. Thrombocytopenia developed in 61.1% of patients; it was grade 1 or 2 in most patients but grade 3 in 1 (5.5%) patient. All patients developed erythrocytopenia after BDIC. Leukopenia, neutropenia and thrombocytopenia resolved without treatment in all patients. Nephrotoxicity developed in 33.3% of the patients. One patient progressed to the End stage kidney disease classification. No patient developed haemorrhagic cystitis.

Conclusion: Intravenous ifosfamide combined with HIPEC using cisplatin plus doxorubicin yielded low rates of mild leukopenia. Mild thrombocytopenia was frequent, but severe suppression of platelets was uncommon. Nephrotoxicity developed in one-third of the patients, and hemorrhagic cystitis was absent.

241 | Impact of trastuzumab reload infusion duration on the incidence of infusion related hypersensitivity reactions

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Introduction: The humanized monoclonal antibody, trastuzumab, is associated with infusion-related hypersensitivity reactions. The highest risk for a reaction is during the first dose, but prolonging the infusion duration decreases frequency of reactions. The package insert states reloading doses should be administered over "approximately 90 minutes.

Research Question or Hypothesis: To determine if there is a difference in the number of infusion-related hypersensitivity reactions between trastuzumab reload doses infused over 30 minutes versus 90 minutes.

Study Design: Retrospective

Methods: IRB approval was obtained and a chart review was conducted from 1/1/2011 to 8/27/2018 for adult patients that received trastuzumab reloading doses from two Fairview infusion centers. Inclusion criteria: age ≥ 18 years and 30 or 90 minute infusion duration. The primary outcome was infusion-related hypersensitivity reactions. Fisher's Exact test was used to compare the count of infusion reaction rates between the two approaches, and a logistic regression model was developed to determine the odds ratio of developing an infusion reaction as it relates to the reload rate.

Results: A total of 244 events were included, 205 of which were in the 90 minute group and 39 in the 30 minute group. There were 9 reaction events within the 90 minute infusion duration group (4.4%) and 0 reaction events within the 30 minute infusion duration group (0%). The odds ratio of experiencing a reaction with 30 minutes compared to 90 minutes was 6.93*10^-8, with a *P*-value of 0.992 via

logistic regression, while it was 0, with a 95% confidence interval of 0 to 2.668 and a *P*-value of 0.3617, using Fisher's Exact test.

Conclusion: Administering trastuzumab reloading doses over 30 minutes versus 90 minutes is likely safe, as it doesn't increase the risk of infusion-related hypersensitivity reactions. By standardizing reloading infusion duration to 30 minutes instead of 90 minutes, the change is expected to increase chair utilization and patient satisfaction.

242 | Association of patient and prescription characteristics with oral chemotherapy adherence follow-up calls

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Introduction: Follow-up patient calls are frequently used to augment care and encourage oral chemotherapy adherence. However, limited data are available on response rates to follow-up calls in cancer patients. Understanding key drivers behind patient responsiveness to follow-up calls can help optimize interventions.

Research Question or Hypothesis: Identify characteristics which influence cancer patients' responsiveness to follow-up calls.

Study Design: Single-center, retrospective, cohort study

Methods: Follow up calls for adult patients receiving oral chemotherapy or hormonal therapy from December 2018 to May 2019 were included. We excluded patients who did not receive their first fill from their pharmacy, relocated to another facility before taking their first fill, or underwent radiation and required oral chemotherapy for less than six months. To evaluate response, calls were categorized as successful (> 3 monthly interactions) or unsuccessful (< 3 monthly interactions We evaluated factors including call times, days, and months as well as patient demographics, diagnosis, clinical stage, medication type, day supply, and insurance provider.

Results: 348 follow-up calls across 143 patients were identified with a success rate of 94.54%. Race was a significant predictor with differences between Blacks and Whites (OR = 0.213), Hispanics and Whites (OR = 0.240) and Race Unknown and Whites (OR = 0.169) but no difference between Whites and Asians (OR = 0.479). Similarly, patients who filled their prescription at their oncology center pharmacy compared to an external pharmacy were 60% less likely to have successful calls (OR = 0.40). Sex, age, insurance type, diagnosis, clinical stage, medication received, and day supply showed no differences. Time and day of the call were not significant, but call success decreased by 55% for month two.

Conclusion: Additional strategies are needed for minorities and patients filling their medications at community oncology center pharmacies to ensure patients benefit from services offered through follow-up calls.

Other

243 | Mental health and political party control of state governments

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Introduction: Poor mental health is an epidemic in the United States. As pharmacists' role in mental health grows, understanding how state governments address mental health through funds and policies is critical. Due to differences in political philosophies, Democrat and Republican states likely have different perceptions and approaches towards solving the mental health crisis.

Research Question or Hypothesis: Do Democrat and Republican controlled states differ in mental health outcomes?

Study Design: Retrospective analysis using publicly available, quantitative data of state-level political affiliations and mental health outcomes.

Methods: State representatives' party affiliations from 2009-2018 were collected from the National Conference of State Legislatures. A political party controlled state government for a particular year if it had a trifecta, which constituted control of ≥50% House, ≥50% Senate, and the Governorship. To be deemed “Red” (Republican) or “Blue” (Democrat), the state must have had a trifecta for ≥7 of the 10 years. States with <7 trifectas were deemed “Divided”. Mental health outcomes included mental health expenditures per capita, suicide rate, depression prevalence, binge drinking prevalence, and poor mental health prevalence from 2009 - 2017 and were abstracted from the BRFSS, CDC, and Kaiser Family Foundation. ANOVA tests compared outcomes among states.

Results: Political categorization yielded 20 Red, 5 Blue, and 25 Divided states. Expenditures per capita was the only outcome with significant difference (*P* = 0.007). Although not statistically significant, Red states had higher depression prevalence and suicide rates. Alternatively, Blue states had higher binge drinking prevalence, poor mental health prevalence, and expenditures per capita.

Conclusion: Results indicate no clear differential pattern in mental health outcomes between Red and Blue states. Future efforts should explore additional mental health outcomes and the effectiveness of partisan driven approaches, including the possibility that neither

political party is a thought leader and that the crisis requires a bipartisan approach.

244 | Teaching cultural awareness to pharmacy students through a refugee education training session

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Introduction: The US population is expected to grow ethnically and racially diverse as immigration and migration rise. Exposure to culturally diverse populations can develop cultural sensitivity among pharmacy students and is a recommended co-curricular experience in the American Council for Pharmacy Education standards.

Research Question or Hypothesis: To determine which Center for the Advancement of Pharmacy Education (CAPE) outcomes can be taught through a refugee education training and its' impact on pharmacy students.

Study Design: The University at Buffalo developed a medication health-literacy program for refugees in the community. As part of this co-curricular experience, first- through fourth-year students attended a 4-hour training on refugees and culture. Problem-based learning, videos, hands-on demonstrations and discussion were used to prepare students. A pre/post-assessment was performed to assess the change in student knowledge of general and medication culture, and to assess the change in their confidence in dealing with culturally diverse populations (5-point Likert).

Methods: De-identified student survey responses were linked to the CAPE outcomes and Consortium of Universities for Global Health (CUGH) competencies. Student responses were analyzed using descriptive statistics and Wilcoxon Signed Rank test.

Results: This training session addressed five CAPE outcomes: knowledge, population-based care, cultural sensitivity, communication, and professionalism; and four CUGH domains: social and environmental determinants of health, collaboration-partnering-communication, professional practice, and health equity/social justice. Seventy-four students participated in the training. Increase in pre-/post-scores was observed for "knowledge of whom a refugee is" (9% vs. 62%) and "persecution knowledge" (16% vs. 30%). Students could identify one additional non-pharmacy (70%) and pharmacy (78%) issue after the training session. Student confidence increased with "eliciting customs/healing practices" and "interpreter use", and was unchanged for "eliciting beliefs", "language barriers", and "comfort with differing beliefs".

Conclusion: Interactive cultural awareness programming for pharmacy students can achieve co-curricular outcomes while increasing student knowledge of culture and confidence in their ability to deal with culturally diverse populations.

245 | Effect of lipid compounded Gramicidin on *S. aureus*, S. epidermis, and *E. coli*

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Introduction: Sebaceous glands found throughout all areas of the skin contain a mixture of fatty acids, neutral lipids, and waxy substances called sebum. These compounds play a role in restricting the growth of micro biota. Gramicidin is a group of antimicrobial peptides obtained from soil bacterium *Bacillus brevis* active against most Gram-positive bacteria and against select Gram-negative organisms.

Research Question or Hypothesis: Therapeutically, Gramicidin topical ointment utilizes mineral or synthetic oil as delivery vehicles for peptide antimicrobials. While traditional use of mineral or synthetic lipid is effective in delivering these peptide agents using a bio-compatible vehicle may potentially improve the delivery of these peptide agents.

Study Design: In this study, Gramicidin was compounded in naturally occurring skin lipids (palmitoleic[C16:1], squalene and waxy fatty acid esters) such as in neatsfoot oil, in an *in vitro* assay, to investigate the effectiveness of delivering its antimicrobial peptide agents against bacterial skin flora.

Methods: The serial dilution method was used to find a minimum inhibitory concentration (MIC) to dose sterile filter discs (10 mm) with 10 microliter volumes as well as controls of the lipid alone. The Kirby-Bauer, disc diffusion method was used to analyze the effectiveness of delivering lipid compounded Gramicidin antimicrobial peptide against bacterial skin flora on nutrient agar plates.

Results: The results revealed that lipid compounded Gramicidin was more effective on *S. aureus*, but not as effective on *S. epidermis* and *E.coli*.

Conclusion: It is hoped that this study will become a platform for further developing future studies that include testing and formulating a new topical antibiotic from peptides extracted from local honey to potentially limit the current rise in bacterial antibiotic resistance as well as help the discipline of clinical pharmacy improve and advance health and quality of life globally.

246 | Characterizing medication-related rehospitalizations in palliative care patients: An exploratory study

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Introduction: An estimated 10% of hospital 30 day readmissions are caused by drug-related problems. Recent literature suggests 21% of palliative care patients are readmitted within 30 days of hospital discharge, however little is known about if or how medications play a role.

Research Question or Hypothesis: What is the causality and preventability of medication related 30 day readmissions in palliative care patients?

Study Design: This is an IRB approved, retrospective, observational study. To be included in this study adult (≥18 years) palliative care patients needed to readmit within 30 days of discharge within calendar year 2017. Each readmission was assessed for medication causality and preventability by at least two independent reviewers using standardized approaches (Naranjo algorithm and Schumock and Thorton score, respectively).

Methods: Descriptive statistics were used to describe results.

Results: During study dates, 292 cases from 285 unique patients met inclusion criteria. Patients had a mean age of 60 [+/- 38] years and a median Charlson Comorbidity Index score of 6 [+/- 4] points, 80% were Caucasian and 44% were female. Upon readmission patients were prescribed on average 11.4 [+/- 13.6] scheduled and 5.1 [+/- 13.8] as needed medications. Eighteen (N = 18, 6%) readmissions were classified as probably or definitely medication related, and of those only 8 readmissions were probably or definitely preventable (3%). The most common causative drugs were oncologic agents (N = 5), tacrolimus (N = 3) and anticoagulants (N = 3). Limitations of this study include retrospective design, small sample size, and high prevalence of other possible causes for reactions due to the population's comorbidities.

Conclusion: A small, retrospective study suggests few palliative care patients suffer from medication related 30 day hospital readmissions and most readmissions are not preventable. Pharmacists should consider these results when developing or adapting services for such patients.

247 | Gender disparities within pharmacy journal editorial boards

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Introduction: Gaps exist in women serving leadership roles within the profession of pharmacy. Editorial boards of pharmacy journals can drive and shape the nature and quality of publications reflecting issues that impact the profession.

Research Question or Hypothesis: The purpose of this study was to evaluate the distribution of gender across pharmacy journal editorial boards.

Study Design: In this cross-sectional study, a total of 20 pharmacy journals were selected based on impact factor and prominence across various organizations within the discipline.

Methods: The official website of each respective journal was evaluated in March 2019 to determine the proportion of males and females serving as members of the editorial board. If gender could not be determined based on the first name alone, an Internet search was conducted to confirm this demographic. Descriptive statistics were used to quantify qualitative variables, and linear regression analysis was used to ascertain the relationship between quantitative variables.

Results: Across the 20 pharmacy journals, 813 individuals were identified to serve on editorial boards (mean = 40.65; SD = 26.5), of which 326 (40%) were female. Only seven of the 20 (35%) journals had at least 50% of their editorial board comprise of females. In addition, four journals had a female editor-in-chief, and the proportion of females to males serving on the editorial board was either nearly equal or slightly greater relative to those journals with a male editor-in-chief. There was no relationship observed between the presence of impact factor and the proportion of females serving on editorial boards (r_s = −0.3 [P = 0.3711]).

Conclusion: Gender disparities exist among editorial boards of pharmacy journals. Future efforts should focus on increasing the proportion of women serving as both members of the editorial board and as editor-in-chief to drive diversity, minimize bias, and enhance the content and quality of publications in pharmacy journals.

248 | Self-care strategies for diabetes management in rural Honduras: A qualitative evaluation

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Introduction: Low- and middle-income countries bear a disproportionate and growing burden from non-communicable diseases. In Honduras, the prevalence of diabetes has doubled in the last 30 years. While treatments for diabetes have diversified, diet and exercise remain at the core of management. To be effective at supporting lifestyle change for patients, health care providers must consider traditional practices especially in rural isolated communities.

Research Question or Hypothesis: What are common self-care practices and perceptions among people with diabetes in rural Honduras?

Study Design: Cross-sectional, qualitative study using semi-structured interviews to elicit participants' perspectives of diabetes self-care, adherence to medications and cultural practices.

Methods: An interview guide was developed using Theory of Planned Behavior and the Social Ecological Model as frameworks. Participants were recruited in spring 2019 from a medical clinic in rural Honduras. This project was approved by the local health committee in Honduras and the University's IRB. Interviews were audio recorded and transcribed verbatim. After a codebook was developed, each interview

was coded independently by two investigators. Themes were developed from the codes providing insight into the primary outcome.

Results: Six interviews were conducted with six themes identified. 1) Herbal remedies are relied upon when medications seem inadequate for symptom relief; 2) Poor mental health influences medication adherence more than finances; 3) Faith in a Higher Power facilitates adherence and trust when seeking medical attention; 4) Participants obtain majority of health care information from family and friends rather than health care providers; 5) Participants describe misconceptions about specific dietary changes to improve diabetes control; 6) Participants describe their daily activities as their main form of exercise.

Conclusion: Potential interventions can come out of this research, including the need to better integrate cultural practices, beliefs and mental health support into health education for patients with diabetes in this community.

249 | Real-world effectiveness of secukinumab for psoriatic arthritis patients: A multi-institutional cohort study in Taiwan

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Introduction: Secukinumab, an anti-interleukin-17A monoclonal antibody, is approved for the treatment of psoriatic arthritis (PsA). However, most evidence regarding secukinumab is derived from Caucasian populations, and its effectiveness in Asian populations remains unclear.

Research Question or Hypothesis: What is the effectiveness of secukinumab in Asian populations in a real-world setting?

Study Design: Retrospective cohort study.

Methods: We analyzed the electronic medical records database from four branches of Chang Gung Memorial Hospitals covering 0.7 million patients (8% of the population of northern Taiwan). We included adult patients with a diagnosis of PsA newly initiating secukinumab over 24 weeks during 2016-2018. We evaluated the treatment effectiveness by the mean of tender joint counts (TJC, 0-78 joints), swollen joint counts (SJC, 0-76 joints), patient's global assessment (PTA, 0-5 scores), physician's global assessment (PHA, 0-5 scores), C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) before and after secukinumab therapy.

Results: We identified a total of 16 patients with a mean age of 47.3 ± 12 years old, of whom 62.5% were female. Before treatment, patients' mean TJC, SJC, PTA, PHA, CRP and ESR were 17.6 ± 9.5, 11.4 ± 6.3, 3.8 ± 1.0, 3.8 ± 1.0, 9.0 ± 11.6 mg/L, and 26.1 ± 22.5 mm/hr, respectively. After the 24-week treatment, patients' mean TJC, SJC, PTA, PHA, CRP and ESR were 9.1 ± 12.8, 5.9 ± 6.5, 2.3 ± 1.0, 2.3 ± 1.0, 4.8 ± 5.7 mg/L and 19.9 ± 17.3 mm/hr, respectively.

Conclusion: Secukinumab exhibited clinical effectiveness for the treatment of PsA in clinical practice in Taiwan. More studies in Asian populations with larger sample size and longer follow-up periods are suggested to confirm our findings.

250 | Role of angiotensin converting enzyme inhibitors, angiotensin II receptor blockers and/or diuretics in the development of acute kidney injury following total knee arthroplasty and/or total hip arthroplasty

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Introduction: Angiotensin-converting enzyme inhibitors (ACEI), angiotensin II receptor blockers (ARBs) and diuretics play an unknown role in acute kidney injury (AKI) development following total knee arthroplasty (TKA) and/or total hip arthroplasty (THA). Given the paucity of literature in this area, we aimed to evaluate the effect of preoperative ACEI, ARB and/or diuretic administration on patient outcomes.

Research Question or Hypothesis: Does preoperative ACEI, ARB and/or diuretic administration increase the risk of AKI following TKA and/or THA

Study Design: This retrospective cohort compared adults that developed AKI following TKA and/or THA to those that did not. Patient charts were screened for ACEI, ARB and/or diuretic administration preoperatively.

Methods: Exclusion criteria included lack of documentation, pregnancy and pre-established end-stage renal disease (ESRD). The primary objective was to evaluate the impact of preoperative administration of ACEI, ARBs and/or diuretics on the development of AKI following TKA and/or THA. Secondary objectives included analyzing concomitant nephrotoxins, blood pressure variability, length of stay (LOS) and inpatient mortality.

Results: After review, 400 patients (n = 200 no AKI, n = 200 AKI) were included. Notable differences in baseline characteristics included older age ($P = 0.002$), more African Americans ($P = 0.004$), and higher preoperative serum creatinine in the AKI group ($P = 0.001$). More patients in the AKI group received preoperative administration of ACEI, ARB and/or diuretic (AKI 8% vs 2.5% No AKI; $P = 0.014$). Patients in the AKI group were more likely to receive a concomitant nephrotoxin in combination with ACEI, ARB and/or diuretics (AKI 4.5% vs no AKI 1%; $P = 0.032$). Postoperative hypotension ($P < 0.001$) and blood administration ($P < 0.001$) occurred more frequently in the AKI group. AKI resulted in longer LOS ($P < 0.001$) but did not increase mortality ($P = 0.317$).

Conclusion: Preoperative administration of ACEI, ARB and/or diuretics in patients undergoing TKA and/or THA may be associated with an increased risk of AKI development. However, additional studies are needed to determine the role of potential confounders.

251 | Facilitators and barriers to communication between pharmacists during transitions of care (TOC)

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Introduction: The National Transitions of Care Coalition reported 60% of medication errors occur during care transitions with half attributed to poor communication. This study explored pharmacists' existing communication methods and identified facilitators and barriers to communication during TOC.

Research Question or Hypothesis: What facilitators and barriers to communication exist between pharmacists across healthcare settings?

Study Design: Cross-sectional, descriptive.

Methods: A convenience sample of pharmacists participated in an anonymous Qualtrics® survey disseminated via email by state pharmacy organizations in California, Connecticut, Illinois, Massachusetts, New Jersey and Texas. Survey items included: demographics, communication methods and barriers, and resources to support TOC. Data collection occurred February 2, 2019 to August 1, 2019. Results were summarized using means and standard deviation for continuous data; frequencies and percentages for categorical data. Respondents could select multiple facilitators/barriers. Open-ended questions were analyzed using thematic approach. Stratified data analysis will be performed using different states and healthcare settings.

Results: Results included 361 pharmacists' responses from CA (31.6%), MA (18.6%), IL (11.9%), NJ (11.6%), CT (9.7%), TX (0.6%), other (2.8%), unspecified (12.7%). Healthcare setting included inpatient (38.5%), community (21.8%), ambulatory care (8.8%), other (30.9%). Communication barriers included insufficient personnel (17.6%), difficulty obtaining information (13.9%), and poor hand-off communications (13.4%). Communication facilitators included pharmacies with close hospital proximity (78.9% ≤5 miles), number of pharmacists involved in TOC services (2.1 ± 1.9), electronic health records as primary method to send (55.5%) and receive (66.1%) health information across healthcare settings. On a scale from 1 = strongly disagree to 7 = strongly agree, mean agreement to the following statements was: "Having adequate time to provide TOC" (3.5 ± 1.72), "Current communication method is efficient" (4.7 ± 1.6), "Health information I receive is useful" (5 ± 1.6).

Conclusion: Although exploratory and not nationally representative, study results highlight important communication issues and needs during TOC in various healthcare settings. Future research will incorporate study information to develop a handoff template to improve pharmacists' communication during TOC.

252 | The role of community pharmacists in providing oral healthcare services across Kuala Lumpur and Selangor States, Malaysia

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Introduction: The practice of pharmacists has developed over the years from traditional dispensing of medicine to more profound public and professional involvement in multiple health care services which is valuable to the community.

Research Question or Hypothesis: This study aimed to explore and assess the community pharmacists' attitudes, beliefs and practices regarding the oral health services in the Malaysian setting.

Study Design: A Cross-sectional study design was used to conduct this project.

Methods: An anonymous self-administered questionnaire was developed and distributed among community pharmacists in Malaysia. The data collection was carried out from beginning of November to the end of December 2018.

Results: The overall response rate was 80.78% (206/255). Of the 255 pharmacists, 206 agreed to participate in the study, yielding a response rate of 80.8%. Overall, approximately half of the pharmacists provided two to five oral health consultations per week and two to five over the counter (OTC) oral health products recommendations per week. The main services provided by community pharmacists in were the provision of OTC treatments (93.7%), referral of consumers to dental or medical practitioners when appropriate (82.5%) and identify signs and symptoms of oral health problems in patients (77.2%). Additionally, more than 80% of the pharmacists viewed positively and supported integrating oral health promotion and preventive measures into their practices. The most commonly reported barriers to extending the roles of pharmacists in oral healthcare include lack of knowledge or training in this field, lack of training resources and lack of oral health educational promotion materials.

Conclusion: The Findings highlighted the need of an inter-professional partnership between the Malaysian pharmacy professional bodies with Malaysian dental associations to develop, implement, expand

and evaluate evidence-based resources, guidelines, scope of oral health in pharmacy curricula and services to deliver improved oral healthcare within Malaysian communities.

253 | Awareness, knowledge, attitudes, sources of information Vitamin D among Malaysian adults

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Introduction: Vitamin D deficiency is becoming a global epidemic which is still undertreated despite all the medical advances in this current age.
Research Question or Hypothesis: This study aimed to explore the awareness, knowledge, attitude and practices regarding Vitamin D among the general public in Malaysia.
Study Design: A cross-sectional study was performed on Malaysian adults aged 18 years and above.
Methods: Anonymous self-administered questionnaire was used to achieve the objectives of the study. It was conducted over a period of two months, which was between November 2018 to January 2019. This study was carried out around Selangor and Kuala Lumpur shopping malls area.
Results: Although 90.5% of the participants have heard/learnt about Vitamin D. About 78% of them showed limited knowledge about some aspects of Vitamin D with (mean ± SD = 1.78 ± 0.894). Additionally, there was a negative attitudes towards Vitamin D and sunlight exposure. For instance, nearly 70% of the respondents did not like to expose themselves to sunlight. Only 30% of the participants had taken Vitamin D supplement before. There is a small, positive correlation between the knowledge score and education level, rho = 0.124, n = 400, P = 0.013, with a higher score associated with higher education level.
Conclusion: The findings provided a contemporary real-world evidence on the lack of knowledge and negative attitude and practices of Vitamin D among the Malaysian people. Therefore, extensive health educational campaigns for the public should be implemented by the government to raise their awareness and knowledge on the importance of Vitamin D.

Pain Management/Analgesia

254 | Does early physical therapy intervention reduce opioid burden and improve functionality in the management of chronic lower back pain?

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Introduction: Chronic lower back pain (CLBP), defined as pain persisting ≥3 months, is a leading cause of disability in US adults and loss of workdays. Opioids in the management of chronic, non-malignant pain continues to be controversial due to potential for tolerance and addiction. Current Centers for Disease Control (CDC) guidance on chronic pain management suggests both non-pharmacologic and nonopioid pharmacologic therapy.
Research Question or Hypothesis: Does early physical therapy (PT) for patients with CLBP reduce opioid use and objectively improve functionality based on Oswestry Disability Index (ODI)?
Study Design: Single center retrospective chart review.
Methods: Ambulatory care patients ≥18 years of age with CLBP, received ≥6 PT visits, and treated with either opioid first (OF) and/or PT first (PTF) were included. Concomitant use of non-opioid and non-pharmacological therapy was permitted. The primary outcome was to determine if PT alone improves ODI. Descriptive statistics were applied.
Results: Enrolled 180 patients. More patients in the OF group had depression (53% vs 30.8%), substance use disorder history (30% vs 20%, P = <0.001), fall history within past 12 months (45% vs 15.8%, P = <0.001), and greater average number of falls (1.1 ± 1.6 vs 0.3 ± 0.6, P = <0.001). The PTF group improved functionality with a mean ODI decrease of 11.9% (P = <0.001). A higher portion of OF patients were lost to follow-up (68.3%) compared to the PTF group (38.3%). Only 3.3% of patients in the PTF group failed PT and required opioids, as opposed to 60% of patients in the OF group, who failed PT and required opioids (P = <0.001). Both opioid and non-opioid medication use decreased among each group. Subjective pain scores decreased among all groups but were not statistically significant.
Conclusion: This study highlights the benefit of PT when used first along with non-opioid modalities for the management of CLBP to improve pain and functionality while reducing need for opioid use.

255 | Characterization of perioperative methadone prescribing and respiratory depression

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Introduction: Over 80% of surgery patients experience acute postoperative pain and less than half feel their pain is adequately controlled. Patients receiving chronic opioids, including methadone, are at highest risk. Guidelines do not provide specific recommendations for analgesia management in this population.

Research Question or Hypothesis: The purpose of this study was to describe perioperative methadone prescribing practices and identify risk factors for associated respiratory depression.

Study Design: This study was a single center retrospective, cohort study of adult patients admitted July 2016 to September 2018.

Methods: Medical records of adult inpatients with an operative procedure who received perioperative methadone were reviewed. Preoperative opioid use was evaluated for all patients. Postoperative methadone dosing was compared to preoperative methadone dosing. Postoperative respiratory depression and the use of naloxone were evaluated. Logistic regression was performed to identify risk factors for respiratory depression.

Results: Two hundred ninety-eight patients were included in the study. Patients were divided into three groups based on preoperative opioid use. Over 90% of patients were on preoperative methadone. There were no significant differences in baseline characteristics between groups. Fifty-eight percent of the patients on preoperative methadone were given within 10% of their preoperative dose. In the initial seven postoperative days, 13.8% of patients had documented respiratory depression and 1.3% of patients required naloxone. Respiratory depression was more common among patients who were methadone-naïve preoperatively. In the multivariate logistic regression, factors associated with respiratory depression included male sex, increased age, and being methadone-naïve preoperatively.

Conclusion: Most patients administered postoperative methadone were on preoperative methadone. The majority of patients on preoperative methadone were resumed on similar doses postoperatively. Male sex, increased age, and being methadone-naïve preoperatively were associated with respiratory depression.

256 | Gabapentin effect on opioid usage in traumatic open fracture patients

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Introduction: Gabapentin has been associated with a reduction in pain scores and opioid usage during the perioperative period. However, this benefit has not been consistent throughout the literature. The addition of gabapentin to Vanderbilt University Hospital's pain regimen for traumatic open fracture patients provides an opportunity to study its effects.

Research Question or Hypothesis: Addition of scheduled gabapentin will reduce the use of opioids during the first five days of hospitalization following a traumatic open fracture.

Study Design: Single-center, retrospective cohort study.

Methods: Adult patients admitted between January 1, 2015 and May 1, 2017 with open fractures were identified using the Trauma Registry of the American College of Surgeons. Patients receiving at least 600 mg of gabapentin daily for 48 hours or more were included in the gabapentin group. The primary outcome was oral morphine milligram equivalents (MME) per patient day received within the first five days of hospitalization for the gabapentin versus control group. Secondary outcomes include pain scores, median oral MME prescribed at discharge, and hospital length of stay. A multivariate analysis to determine factors associated with higher daily MME was conducted.

Results: After evaluation of 913 patients, 200 patients met inclusion criteria (gabapentin group, n = 100 and control group, n = 100). On univariate analysis, median MME per day was similar between the gabapentin and control group (93 mg vs. 91 mg, $P = 0.41$). On multivariate analysis, gabapentin use was associated with a higher daily MME, as were white race, lower age, lower grade of fracture, lower injury severity score, and higher pain scores. Patients in the gabapentin group had a longer length of stay compared to the control group (median 5.5 vs. 3.7 days, $P < 0.001$). No differences were observed for pain score or oral MME prescribed at discharge.

Conclusion: In patients with traumatic open fractures, the addition of gabapentin did not result in a reduction in opioid requirements or improved analgesia.

257 | We have clinical pharmacists in the pain clinic, but what do they do?

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Introduction: Multiple approaches are being employed to address appropriate chronic pain management in the setting of the rising opioid epidemic, including the addition of clinical pharmacists to the pain management team. The study system has two pharmacists supporting three chronic pain clinics. These pharmacists perform comprehensive medication reviews (CMRs) prior to initial patient visits and as referred. The aim of this study was to evaluate the pharmacists' time requirements in addition to the number and type of medication therapy problems (MTPs) and interventions encountered when performing CMRs.

Research Question or Hypothesis: What is the time commitment and benefit provided by a pharmacist completed CMR in chronic pain clinics

Study Design: This is a retrospective observational study of pharmacist CMR documentation in chronic pain clinics.

Methods: CMRs completed within chronic pain clinics from 9/1/2018 to 4/30/19 were reviewed. MTPs and interventions were recorded in

a standardized tracking form within the electronic health record. Time documented and MTPs identified during the CMRs were analyzed and described.

Results: CMRs were completed for 100 unique patients with a total of 603 MTPs identified. The most common MTP was "missing information in medical record" (63%). Other MTP categories identified include: indication (2%), effectiveness (4%), adherence/access (6%), and safety (24%). Medication education was the most common action taken (19%), followed by switching to an alternative medication (14%), ordering monitoring (13%), and initiating a medication (13%). The total amount of pharmacist time spent was 143.5 hours with an average of 86.1 minutes per patient. Majority of visits were between 1-2 hours in duration (86%) and conducted telephonically (70%).

Conclusion: Completing a CMR occupies a significant amount of time and the majority of MTPs was missing information in the medical record. Pharmacists contributed by educating, modifying therapy, and ensuring monitoring for these patients.

258 | Acetaminophen, pregabalin, and celecoxib in reducing post-operative opioid utilization

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Introduction: The opioid epidemic is an issue facing communities and hospitals alike. The American Pain Society recommends multimodal pain management with non-opioid pharmacologic agents to reduce opioid exposure. There is a need to validate specific agents and dosing in different patient populations to optimize therapeutic outcomes. The purpose of this study is to evaluate the effect of acetaminophen 975 mg, pregabalin 75 mg, and celecoxib 200 mg pre-operatively (TLC protocol) in reducing the utilization of opioids post knee or hip arthroplasty.

Research Question or Hypothesis: Does the TLC protocol decrease opioid use in patients post knee or hip arthroplasty?

Study Design: Retrospective, single-center, chart review

Methods: Data was collected from January to December 2018 from electronic medical records. Patients were included if they had undergone a knee or hip arthroplasty, and were excluded if they had chronic kidney disease greater than stage 2 or Child Pugh score greater than stage A. Two cohorts were compared, those who received the TLC protocol and those who did not. The primary endpoint was average total post-operative opioid utilization in morphine milligram equivalents (MME). Secondary endpoints included length of stay and instance of naloxone utilization. A T-test was performed for specified endpoints.

Results: In total 186 patients were included, 97 had received the TLC protocol and 89 had not. Those who received the TLC protocol had a trend towards lower average total MME utilization post-operatively (47.58 v 56.69 P = 0.4314). Those who received the TLC protocol had a significantly shorter length of stay (1.35 days v 1.76 days P = 0.0116). There were no instances of naloxone utilization in either group.

Conclusion: Utilization of acetaminophen, pregabalin, and celecoxib pre-operatively to knee or hip arthroplasties significantly decreased length of stay and trended towards lowering post-operative MME utilization. Further studies incorporating different multimodal pain management regimens may be needed to further optimize opioid reduction in this patient population.

259 | Evaluation of controlled substance agreements in patients with cancer

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Introduction: Approximately 10% of the general population are diagnosed with a substance use disorder (SUD). Controlled substance agreements (CSAs) are often used when patients have a history of SUD or aberrant medication use; however, little is known of their role in patients with cancer. Patients with cancer are not immune to the risks of controlled substances, with at least 8% being diagnosed with a SUD.

Research Question or Hypothesis: How are CSAs utilized in patients with cancer prescribed opioids?

Study Design: Single center, retrospective review of patients with cancer pain treated with an opioid

Methods: Adult cancer patients seen at Michigan Medicine (01/01/2014-12/31/2017) that received an opioid were included. Pertinent demographic and clinical data were extracted from the medical record. The primary outcome was the proportion of cancer patients with a CSA. Secondary outcomes include the proportion of patients with a SUD, signed CSA before SUD diagnosis, and reasons for initiation of CSA. Data was analyzed using descriptive statistics.

Results: During the study period, 34,667 patients were seen as an outpatient in the cancer center. The majority of patients were male (63.4%), Caucasian (86.2%), and married (50.7%). A CSA was signed in 1.4% of patients (n = 491). Four-percent of patients had a diagnosed SUD (n = 1404). Of patients with a signed CSA, only 12.4% had a diagnosed SUD (n = 61). Ninety-percent of patients signed the CSA after SUD diagnosis (n = 55). The reasons for CSA were high risk (45%), not documented (35.4%), diagnosed or presented with behaviors concerning for or consistent with SUD (13.4%), and medication misuse (6.1%).

Conclusion: CSAs are rarely used in patients with cancer. Most patients signed the CSA after SUD diagnosis, thus CSAs are a reaction to the development of a SUD. Future research should be completed to determine if CSAs can be used as a tool to prevent SUD development.

260 | Pain control during the IV opioid shortage: A natural experiment

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Introduction: There is a national intravenous (IV) opioid shortage due to manufacturing delays and Drug Enforcement Agency-mandated reductions in opioid production. Our hospital initiated a pharmacist-driven adult IV opioid restriction, limiting supply to 24 hours. Following 24 hours, patients were converted to enteral opioids.

Research Question or Hypothesis: The intent of this study was to determine if a pharmacist-driven IV-to-oral opioid restriction affected acute pain control.

Study Design: Retrospective, non-inferiority, observational cohort study

Methods: Adult patients who received IV opioids during a minimum 24 hour hospitalization were eligible for inclusion. Patient populations exempt from the opioid restriction were excluded. Patients admitted two months prior to the restriction were in the pre-intervention group, while patients admitted two months after the restriction were in the post-intervention group. Fifty patients from each group were randomly selected for chart review and data collection was censored at seven days. Quality of analgesia—as measured by visual analog pain scores, average daily morphine equivalents, multi-modal pain regimens, and safety endpoints were collected. Non-inferiority of pain scores was assessed by the one-sided t-test with a non-inferiority margin of one. Ordinal and categorical data were evaluated using Mann-Whitney U and Chi-squared with an alpha of <0.05.

Results: There was no difference in average daily pain scores between patient groups (3.99 ± 2.14 versus 4.10 ± 1.80; 90% CI: -0.76 to 0.55). The restriction resulted in a 25% decrease in total morphine milligram equivalents (364.5 versus 272.5; $P = 0.15$) and a median four day decrease in hospital length of stay in the post intervention group (10 versus 6 days; $P = 0.02$). There was a 12% and 14% increase in the use of acetaminophen and tramadol, respectively ($P = 0.05$). Finally, there was no difference in naloxone administration, altered mental status, respiratory depression, or sedation scores between both groups ($P = 0.90$).

Conclusion: The pharmacist-driven IV-to-oral opioid conversion resulted in equivalent pain scores and reduced hospital length of stay.

261 | Evaluating multimodal pain care engagement among veterans in an integrated pain team clinic compared to usual VA primary care at San Francisco Veterans Affairs Health Care System

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Introduction: Guidelines recommend interdisciplinary approaches and multimodal therapies, including non-opioid medications and non-pharmacologic treatments, for management of chronic pain. However, limited evidence exists demonstrating impact of interdisciplinary pain care (primary care provider, pain psychologist, pain pharmacist) on use of multimodal therapies.

Research Question or Hypothesis: Among veterans prescribed long-term opioids for pain, does engagement with an Integrated Pain Team (IPT) compared to usual primary care (UPC) lead to increased trials with non-opioid pain medications and non-pharmacological (behavioral, physical, procedural) therapy visits?

Study Design: Prospective matched cohort quality improvement study.

Methods: Using a clinical dashboard, veterans prescribed opioids receiving care through IPT (n = 81) were prospectively matched to veterans receiving UPC (n = 81) at San Francisco Veterans Affairs Health Care System 10/2015 through 12/2016. Veterans were matched on age, sex, psychiatric diagnoses and baseline opioid dose. Veterans prescribed opioids for cancer/terminal pain, ≥1000 mg morphine equivalents, opioid use disorder pharmacotherapy or receiving Home-Based Primary Care were excluded. Retrospective chart reviews evaluated new trials with non-opioid pain medications and non-pharmacological therapy visits. Descriptive statistics examined between-group differences at baseline and six months follow-up. Analyses included Wilcoxon signed-rank test for continuous variables and McNemar's chi square test, Exact McNemar's chi square test, or symmetry test for categorical variables.

Results: The IPT and UPC groups had similar demographic and clinical characteristics; however, prevalence of opioid use disorder was >7 times higher in IPT compared with UPC. Compared with the UPC, the IPT group completed more trials with non-opioid pharmacotherapy at both baseline (87.7% vs. 69.1%), $P = 0.011$) and 6 months (97.5% vs. 74.1%, $P < 0.001$). Similarly, the IPT group completed more visits with non-pharmacological therapy at both baseline (71.6% vs. 59.3%, $P = 0.086$) and 6 months (91.4% vs 67.9%, $P < 0.001$).

Conclusion: Veterans with chronic pain prescribed long-term opioids receiving care through IPT had more trials of multimodal therapies, including non-opioid pain medications and non-pharmacologic treatments, compared to UPC patients.

262 | Decreasing frequency of opioid prescribing on discharge to hospice care

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Introduction: Practices to prevent potential misuse of opioid medications may have unintended prescribing effects for patients with serious illness or at end-of-life. We assessed trends in opioid prescribing on discharge to hospice care from an acute care medical center.

Research Question or Hypothesis: We hypothesized that opioid prescribing would decrease over time independent of changes in demographics or cancer diagnosis.

Study Design: Retrospective cohort study of adult (age ≥ 18) inpatients discharged to hospice care from Oregon Health & Science University Hospital between January 1, 2010 and December 31, 2018.

Methods: Data were collected from a repository of electronic health record data. We examined trends in opioid prescribing on discharge to hospice care adjusting for age, sex, receipt of opioids on the first day of the index admission, and cancer diagnosis using logistic regression. Adjusted proportions were estimated by calculating predicted values from the adjusted model.

Results: Over the 9-year study period, 2,647 adult patients were discharged to hospice care. Mean (standard deviation) age was 65.8 (16.0) years, 46.3% were female, and 60.6% had a cancer diagnosis. The overall frequency of opioid prescribing on discharge was 84.5%. Opioid prescribing decreased significantly from 90.1% (95% confidence interval (CI) = 86.9% to 93.8%) in 2010 to 73.0% (95% CI = 67.7 to 77.8%) in 2018 (P < 0.001). Additionally, independent of calendar year, patients without a cancer diagnosis (76.5% vs. 89.7%, *P* < 0.001) and patients receiving an opioid on the first day of the index admission (79.8%, vs. 86.3%, *P* < 0.001) were significantly less likely to receive an opioid prescription on discharge to hospice care.

Conclusion: These data support that opioid prescribing is decreasing on discharge to hospice care independent of changes in demographics or cancer diagnoses. Current opioid users may be less likely to be a prescribed an opioid on discharge. Further research is needed to ensure optimal prescribing for pain management on discharge to hospice care.

263 | Opioid tapering in sickle cell disease after hematopoietic stem cell transplantation

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Introduction: There is limited evidence available to guide treatment strategies for chronic opioid use. Sickle cell disease (SCD) is characterized by chronic and acute pain which may require high doses of opioids to control the pain. Allogeneic hematopoietic stem cell transplantation (HSCT) is a curative treatment for SCD patients and provides a unique model for studying opioid use and tapering methods.

Research Question or Hypothesis: To investigate the opioid tapering pattern in patients with SCD cured by HSCT.

Study Design: A retrospective cohort study.

Methods: Fourteen adult SCD patients cured by HSCT with chronic opioid usage and two-years of follow up were identified. The patients who still required opioids were compared to those whose opioids were successfully tapered off.

Results: The median (interquartile) daily dose of opioids one year pre-HSCT was 28.3 (2.3-59) mg oral morphine equivalents (OME), which decreased to 24 mg and 3.4 mg during the first and second year post-HSCT. Those patients that were unable to be tapered off opioids (n = 8) had significantly higher opioid use one year pre-HSCT compared to those that were off opioids (n = 6) (55 vs. 5.7 mg, *P* = 0.039). One patient on 30 mg OME daily who had approximately 20 admissions for uncontrolled pain during the year proceeding HSCT was tapered off opioids using buprenorphine/naloxone under the supervision of addiction psychiatry in eight months. The patient experienced 4 withdrawal episodes that were managed with IV hydration in the inpatient (n = 1) or outpatient (n = 3) setting.

Conclusion: After being cured by HSCT, 43% of SCD patients were weaned off opioids. Using buprenorphine/naloxone in collaboration with addiction psychiatry, we were able to successfully taper a high-opioid utilizer completely off opioids. Future studies integrating an interdisciplinary team including addiction psychiatry may help us to be more successful in minimizing opioid requirements of SCD patients undergoing HSCT.

264 | Evaluating the effectiveness and safety of ketamine in refractory pain on the palliative care service

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Introduction: While opioids are the mainstay treatment option for chronic pain they are associated with adverse events and risk of tolerance leading to a plateau in analgesic effect. Ketamine is a dissociative anesthetic with analgesic properties which has been evaluated in phantom limb, postoperative, neuropathic, and complex regional pain. Limited case series exist regarding ketamine's effectiveness in neoplasm pain in the palliative care setting.

Research Question or Hypothesis: Evaluating the effectiveness and safety of Ketamine in Refractory Pain on the Palliative Care Service.

Study Design: Multicenter, concurrent and retrospective cohort

Methods: Patients with refractory pain from August 2018-April 2019 who received ketamine on the palliative care service were evaluated. Refractory pain was defined as moderate to severe pain despite ≥150 mg oral morphine equivalence (OME)/day for two weeks and/or history of ≥3 multimodal analgesic regimens. Patients with unstable cardiovascular disease or active psychosis were excluded. The primary outcome was reduction in daily OME at 24 hours from ketamine initiation. Secondary outcomes were change in numeric pain score and adverse reactions (psychotomimetic phenomena, hemodynamic instability, sedation, salivation, visual changes, and death).

Results: A total of 14 patients received ketamine. All patients had neoplasm-related pain and the majority were Caucasian (78.7%) females (85.7%) with severe pain (92.9%). Daily OME average prior to ketamine administration was 272 mg. Reduction in daily OMEs at 24 hours from initiation of ketamine was 132 mg (48.5%); $P < 0.0003$. Mean numeric pain scores were reduced from 8.4 to 5.0; $P < 0.0003$. No adverse outcomes occurred.

Conclusion: Ketamine administration for refractory pain significantly reduced OME requirements, improved numeric pain scores, and no adverse events. This cohort is the largest reported to date and highlights the significant impact ketamine can have on refractory pain. Future studies to evaluate long term outcomes are warranted.

265 | Opioid stewardship reduces opioid utilization without compromising patients' pain outcomes: A single center study

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Introduction: Evidence supports that opioid use in the hospital is common and is correlated with increased risks to patients, including the development of chronic opioid use and opioid use disorder. In light of the opioid epidemic, providers in the hospital face the dual challenges of treating pain adequately while also being mindful of these untoward consequences.

Research Question or Hypothesis: What is the impact of an opioid stewardship program on opioid utilization and patients' pain outcomes?

Study Design: Prospective, single center, cohort study

Methods: The opioid stewardship program entailed a six-month of daily pharmacy stewardship rounds, provider education, and opioid pocket cards. Medicine patients of 18 years old and above with the following diagnoses: Abdominal pain, acute pancreatitis, acute non-surgical musculoskeletal pain including back pain, and cellulitis were included in the pharmacy stewardship rounds. Pharmacy stewardship rounds evaluated patients for multi-modal therapy, IV-to-PO, de-escalation, and pain consult. Primary outcomes included provider adherence to multi-modal therapy and opioid utilization compared with the six-month pre-intervention period using descriptive statistics. Secondary outcomes included patients' mean pain scores and provider education assessment compared with the six-month pre-intervention period using descriptive statistics. This study was exempt from IRB review.

Results: Compared between the pre- and post-intervention periods, provider adherence to multi-modal therapy increased from 44% to 76%, opioid use per patient per hospital stay decreased from an average of 151 MME to 91 MME, and opioid prescriptions at discharge was decreased by 64%. There was no difference in the mean pain scores between the pre- and post-intervention. Provider knowledge assessments were similar between the pre- and post-intervention.

Conclusion: An opioid stewardship program emphasizing multi-modal therapy and provider education effectively reduced opioid utilization without compromising patients' pain outcomes. Providers were knowledgeable about multi-modal therapy; providing them added support with pharmacy stewardship rounds and educational conferences reinforced their implementation of best practices.

266 | Medicine in search of evidence: The use of acetaminophen in patients receiving strong opioids for cancer pain

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Introduction: The mainstay of treatment in advanced cancer pain is opioids; however, non-opioid medications such as acetaminophen continue to be included in guidelines despite clear, convincing evidence for their use.

Research Question or Hypothesis: The objective of this study was to determine if acetaminophen improves pain control, reduces length of stay (LOS), or decreases opioid requirements in hospitalized patients receiving strong opioids for cancer pain.

Study Design: This was a single-center retrospective cohort study.

Methods: A chart review was conducted of adult (>18 years) cancer patients seen by the palliative care consult service and receiving strong opioids from January 1, 2017 through December 31, 2017. Patients were excluded if they received methadone or buprenorphine or had primarily neuropathic pain. Patients who received acetaminophen were compared to those who did not. The primary outcome was a 30% reduction in average daily pain score from admission to discharge using a numeric rating scale. Secondary outcomes included the number of patients with a 50% reduction in pain, LOS, and opioid use in oral morphine equivalents (OME). Demographic data was reported using descriptive statistics. Groups were compared using univariate and multivariable regression using R statistical software.

Results: A total of 194 patients were included, 81 who received acetaminophen and 113 controls. There was no difference between groups in achieving a 30% reduction in pain (35.8% vs. 35.4%,

adjusted odds ratio [aOR] 0.89, 95% confidence interval [CI] 0.48 to 1.65). Similarly, there was no difference in those that achieved a 50% decrease in pain, change in OME, or discharge OME. Acetaminophen was associated with a longer LOS (8 days vs. 6 days, relative risk 1.56, 95% CI 1.20 to 2.02).

Conclusion: In this study of cancer patients receiving strong opioids, acetaminophen use was not associated with improved pain control or reduced opioid utilization, but was associated with a greater LOS.

Pediatrics

267 | Comparison of time within therapeutic range using anti-xa vs apTT monitoring of unfractionated heparin therapy in non-ECMO pediatric patients

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Introduction: Heparin monitoring in children currently lacks a standardized parameter. Studies demonstrate poor correlation between activated partial thromboplastin time (aPTT) and anti-factor Xa activity (anti-Xa), as well as confounders that interfere with both. Several assessments found utilizing anti-Xa results in quicker time to therapeutic levels.

Research Question or Hypothesis: Heparin monitoring using the anti-Xa assay will result in a greater percentage in time within therapeutic range in the pediatric population.

Study Design: Single center, retrospective chart review conducted at a large academic medical center

Methods: Included were pediatric patients on therapeutic unfractionated heparin (UFH) infusion with measured levels of either aPTT or anti-Xa between October 2016 and October 2018. Excluded patients were those on extracorporeal membrane oxygenation (ECMO), continued renal replacement therapy (CRRT), concomitant anticoagulants, prophylactic UFH, UFH orders without a stated goal, and UFH administered for <12 hours. Primary outcome was percentage of time in therapeutic range. Secondary outcomes: time to first therapeutic level, range of UFH doses, and bleeding or thrombosis while on UFH. For statistical significance ($P < 0.05$), student's t-tests and Fisher's exact tests were conducted for continuous and categorical variables and a mixed effects ANOVA model.

Results: Higher mean percentage of time in therapeutic range was seen in the anti-Xa group vs aPTT group (50% vs 35%, $P = 0.09$). Shorter mean time to first therapeutic level was noted in the anti-Xa group vs aPTT group (10 hours vs 22 hours, $P = 0.14$). Minimum and maximum doses were similar between groups. Three bleeding events occurred in the aPTT group vs none in anti-Xa group. Both groups had one patient with new or worsening thrombosis while on UFH infusion.

Conclusion: While not statistically significant, a clinically significant difference was seen between nomograms with anti-Xa nomogram showing greater percentage of time within therapeutic range and shorter time to reach therapeutic level.

268 | Predictors and treatment patterns influencing outcomes in hospitalized pediatric patients with pericarditis

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Introduction: Pericarditis is the most frequent form of pericardial disease and is associated with significant morbidity. Majority of pericarditis studies have been conducted in adults. However, there is limited evidence on predictors of outcomes, and treatment patterns in hospitalized children inflicted with pericarditis.

Research Question or Hypothesis: What are predictors of outcomes and treatment characteristics associated with pericarditis in hospitalized children?

Study Design: IRB-approved, single-center, retrospective cohort of patients <18 years with an index admission for pericarditis from 1/01/2000-7/31/2018.

Methods: Patients were identified via diagnosis codes for pericarditis. The primary composite endpoint included readmission for pericarditis within 18 months from discharge, cardiac tamponade, or constrictive pericarditis. Secondary endpoints included incidence of and time to recurrence, incessance, and readmission within 7 days, as well as pharmacologic and procedural treatment received. Inferential statistics between treatment groups (pharmacologic, procedural, or neither) were made using either Exact Pearson Chi-Square or Kruskal-Wallis. Significance was defined as $P < 0.05$ and SAS v9.4 for Windows was used for all analyses.

Results: Sixty-six patients were included for analysis. The primary outcome occurred in 18 (27.3%) patients, including five (7.6%) readmissions. The most commonly used pharmacologic agents during admission were non-steroidal anti-inflammatory drugs in 44 (66.7%) patients. Twenty-eight (42.5%) patients underwent procedural interventions. Differences between treatment groups (pharmacologic, procedural, or neither) were noted in length of stay (LOS) >4 days ($P = 0.0038$), fever ($P = 0.0457$), and median baseline C-reactive protein (hs-CRP) ($P = 0.0236$). Rates and medians for these variables were highest among patients undergoing procedures, followed by pharmacologic then no modality.

Conclusion: Readmission for pericarditis, cardiac tamponade, or constrictive pericarditis occurred in about 30% of patients. Rates and medians for hospital LOS >4 days, fever, and baseline hs-CRP were highest among individuals who received procedural treatment modalities. Further studies are warranted to elucidate predictors of outcomes and treatment patterns in hospitalized children with pericarditis.

269 | Vancomycin versus linezolid for the treatment of acute pulmonary exacerbations of cystic fibrosis

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Introduction: Based on recent survey data, vancomycin or linezolid appear to be the most common antibiotics used to treat individuals hospitalized with acute pulmonary exacerbations (APEs) of cystic fibrosis (CF) secondary to methicillin-resistant *Staphylococcus aureus* (MRSA). However, recommendations to use either vancomycin or linezolid are based on guidelines that did not include individuals with CF. Limited data exist supporting the use of either antibiotic in CF.
Research Question or Hypothesis: Is there a difference in the change in lung function in individuals hospitalized with APEs and treated with either vancomycin or linezolid?
Study Design: Retrospective cohort study
Methods: Return to baseline lung function, defined as a follow-up FEV1 ³90% of baseline within four weeks of hospital discharge, was compared between those treated with either vancomycin or linezolid. Changes in lung function from hospital admission to discharge, as measured by other pulmonary function tests, were also compared between treatment groups. Appropriate hypothesis tests (Wilcoxon or Chi-Squared) compared treatment groups using SAS v9.4 with alpha = 0.05.
Results: Individuals treated with linezolid (n = 66) were older [19 (17-21) vs. 17 (10-10) years; $P < 0.0001$] and had a lower baseline FEV1 [69 (63-86) vs. 80.5 (73-95); $P = 0.0002$] compared to those treated with vancomycin (n = 66). There was no difference in return to baseline lung function between those treated with linezolid versus vancomycin [50 (75.8%) vs. 53 (80.3%); $P = 0.53$]. The change in lung function from admission to discharge, as measured by pulmonary function testing, were similar between treatment groups. More patients treated with vancomycin experienced an adverse effect (10 (15%) vs. 1 (1.5%); $P = 0.0021$) compared to linezolid.
Conclusion: Treatment with vancomycin or linezolid was associated with similar improvements in lung function among individuals hospitalized for an APE of CF. When considering antibiotics to treat an APE of CF secondary to MRSA, patient and drug-specific variables should be considered, including outcomes and tolerability with previous courses of antibiotic therapy.

270 | Medication errors in adolescents using asthma controller medications

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Introduction: An estimated six million children are diagnosed with chronic asthma. Little research has been performed regarding the number and types of errors that adolescents make in using asthma control medications. This study aims to generate new knowledge regarding pediatric medication use to establish targeted strategies to enhance pediatric medication education.
Research Question or Hypothesis: Primary Question - What are the number and types of errors that adolescents and caregivers report in using asthma controller medications? Secondary Question - Do adolescents and caregivers report more errors for specific types of control medications (HFA inhaler, DPI, tablet)?
Study Design: The study was a quantitative cross-sectional study design.
Methods: Three hundred and nineteen adolescents from four pediatric primary care practices in North Carolina met inclusion criteria. Adolescents were interviewed about their asthma controller medication use while caregivers completed a written questionnaire regarding adolescent medication use. Errors were defined by comparing reported medication use to the prescribed administration schedule on patient chart. Descriptive and bivariate statistical analysis was applied using IBM SPSS Statistics software.
Results: Fifty-eight percent of adolescents reported one or more errors, while 61% of caregivers reported one or more errors in adolescent medication use. Most frequently reported errors include not taking at all (32% adolescents, 29% caregivers), missing 3+ doses per week (15% adolescents, 14% caregivers) and not taking enough times per day (9% adolescents, 8% caregivers). Thirty-two percent of adolescents and 31% of caregivers reported medication errors while using Qvar. All other controller medications had reported errors of less than 20% by adolescents and caregivers.
Conclusion: Both adolescents and caregivers commonly report errors in adolescents using asthma controller medication. By understanding the number and types of errors that adolescents make, physicians and pharmacists can cater their medication education to increase pediatric patient outcomes.

271 | Incidence of QTc prolongation with concomitant use of methadone and atypical antipsychotics

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Introduction: Admission to the pediatric intensive care unit (PICU) frequently requires multiple sedatives and pain medications for comfort, as well as atypical antipsychotic (AAP) for treatment of pediatric delirium during the time of critical illness. Methadone is often used to prevent iatrogenic abstinence syndrome when patients are weaning off continuous opioid infusions. Both methadone and AAPs are associated with risk of corrected QT (QTc) interval prolongation. These medications are frequently being prescribed together, yet, there are limited data assessing the safety of the combined use of an AAP and methadone in PICU patients.

Research Question or Hypothesis: Does the combination of methadone and an AAP increase the incidence of QT prolongation in PICU patients?

Study Design: This was a retrospective observational study at a single-center PICU.

Methods: Patients aged 1 month to 18 years-old who received methadone and an AAP with EKG monitoring during their PICU stay were included.

Results: Prolongation of QTc occurred in 5 of the 34 included patients when an AAP was added to methadone. Patients who experienced QTc prolongation were older and weighed more, but there was no difference in gender, ethnicity, electrolyte deficiencies, number of additional QTc-prolonging medications, and number of additional drug-drug interactions identified. When comparing atypical antipsychotics, 27% of patients receiving risperidone had a prolonged QTc, versus 53% of patients receiving quetiapine (P = 0.04, Chi-square 2.5753). The net change in QTc interval after initiation of methadone was 0.19 msec (IQR 3, 15). The net change in QTc after initiation of methadone and AAP was 4 msec (IQR -16, 15).

Conclusion: This was the first study to evaluate the combination of methadone and AAP in PICU patients. Our data suggest that there are no clinically significant differences in incidence of QTc prolongation with addition of AAP to methadone.

272 | Etanercept drug level monitoring and anti-TNFα activity in juvenile arthritis

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Introduction: Under exposure to anti-TNFα biologics and development of anti-drug antibodies (ADAs) resulting in reduced anti-TNFα activity is associated with response failure in drug therapy. This work measures etanercept (ETN) levels, ADAs, and anti-TNFα activity in patients with juvenile arthritis.

Research Question or Hypothesis: We hypothesize that ETN therapy results in variable levels of ETN exposure, formation of ADAs, and variable anti-TNFα activity in children with juvenile arthritis.

Study Design: Cross-sectional study of patients (n = 29) receiving ETN at Children's Mercy Kansas City.

Methods: Plasma ETN levels and ETN ADAs were measured by ELISA (Eagle Biosciences). Plasma TNFα levels were measured by multiplex analysis (MilliporeSigma) and plasma anti-TNFα activity was measured using a gene-reporter assay (InvivoGen). Patient clinical and laboratory information was collected, including ETN dosing parameters, age, and weight. Statistical analysis included Wilcoxon rank-sum testing and Spearman's rank correlation testing.

Results: Patient median [IQR] age was 10 [8.3,14.3] years with a range of 2 to 18 years. Median [IQR] weights were 31.4 [25.4,65.8] kg with a median dose of 25 mg, that ranged from 12.5 to 50 mg with a dosing interval of 1 week for all patients sampled. ETN levels by ELISA were 2.17 [1.35,3.17] ug/mL and spanned a 22-fold range. None of the patients tested positive for ADAs (0%) by ELISA. Plasma TNFα levels were 70.4 [45.7, 100.6] pg/mL and were approximately 9-fold higher compared to juvenile arthritis patients not receiving anti-TNFα therapy (i.e. 7.6 [4.5,9.5] pg/mL, P < 0.0001). Median [IQR] anti-TNFα activity measured in ETN equivalents were 1.87 [1.00,3.34] ug/mL by gene-reporter analysis and correlated with ETN drug levels (P = 0.65, P = 0.0002).

Conclusion: ETN levels are variable under standard dosing conditions, result in the accumulation of circulating TNFα, and correspond to anti-TNFα activity. In contrast to other anti-TNF biologics, ADAs to ETN were not detected.

273 | Evaluation of clinical pharmacy services in United States pediatric ambulatory care settings

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Introduction: Efforts for pharmacy expansion in ambulatory settings have largely focused in adult practice. Children represent a vulnerable population, warranting pharmacy support to optimize care. Pharmacist integration into pediatric ambulatory practices nationwide has not been well described.

Research Question or Hypothesis: This study aimed to: 1) describe the United States (US) landscape of pediatric ambulatory pharmacy practice, and 2) evaluate pediatric ambulatory care pharmacists'

autonomy and practice scope. We hypothesized that pediatric ambulatory care pharmacists would indicate positively impacting satisfaction, safety, and outcomes.

Study Design: A cross-sectional web-based survey was broadly distributed to US-based pediatric and ambulatory care pharmacists.

Methods: Data were analyzed using descriptive statistics. Regression analyses determined predictor association with practice autonomy. A significance level of 0.05 was set a priori. Key variables needed for service expansion were assessed.

Results: A total of 191 eligible participants attempted the survey, with 68.2% in pediatric settings and 31.8% in family medicine. Geographic distribution was: West, 19.2%; Midwest, 35.2%; South, 30.8%; Northeast, 14.7%. Autonomous practice was reported by 28.3% of participants; regression analyses revealed significant predictors, such as: institution and practice type; collaborative practice agreements; board certification; billing; clinic time; direct and indirect patient care activities. Participants reported broad practice scopes and high numbers of performed activities. Many participants reported improving: medication adherence and administration (>70%); patient and provider satisfaction (>80%); safety, clinical and economic outcomes (>80%); safe medication practices and inappropriate prescribing (>90%). The top three resources needed for expansion were identified as: payment models supporting reimbursement (61.3%); buy-in from stakeholders (55.6%); additional pediatric trained pharmacists in ambulatory settings (40.1%).

Conclusion: Pediatric pharmacists have a broad practice scope, perform many patient care activities and report positively influencing satisfaction, safety and outcomes in ambulatory environments. Resources are needed to support nationwide growth. Healthcare systems are encouraged to integrate pharmacists in pediatric ambulatory care settings.

274 | Evaluate serum trough vancomycin levels in pediatric inpatients

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Introduction: Rises in vancomycin minimum inhibitory concentration against Staphylococcus spp resulted in higher doses and therapeutic ranges [10 to 20 mg/L] in adult patients. We observed subtherapeutic vancomycin trough levels in pediatric patients.

Research Question or Hypothesis: To evaluate whether our institution's vancomycin trough levels fell within the higher therapeutic ranges and determine vancomycin's efficacy, safety, and patient outcome.

Study Design: A retrospective chart review spanning nine months was approved by IRBs

Methods: Included were children one month to 18 years of age who received vancomycin and had a trough level at steady state. Excluded were patients with non-detectable levels and missed doses. Data collected: demographic, vancomycin dosing, trough level(s), laboratory data, patient outcome, and adverse effects. Patients were categorized as < or > 40 kg. We assessed initial and overall levels falling in the therapeutic ranges (TR).

Results: Forty-five children were included with 117 vancomycin trough levels. Fifteen patients had positive blood cultures for Staphylococcus spp. Overall, 40% of vancomycin levels fell in the TR. In patients <40 kg (n = 32), mean+/-SD age was 5.8+/-4.2 years. Initial doses of 59.9+/-10.4 mg/kg/day resulted in a mean level of 9.3+/-4 mg/L, with 10/32 therapeutic trough levels. Following dosage adjustments, levels were 12.7+/- 6.2 mg/L at doses of 68 +/-19.5 mg/kg/day. In patients >40 kg (n = 13), age was 14.6+/--4.6 years. Initial vancomycin doses of 2436+/-790 mg/day resulted in a level of 9+/- 3.4 mg/L, with 4/13 of trough levels in the TR. Following dosage adjustments, levels were 11.88+/-6.34 mg/L at doses of 2604+/-996.3 mg/day. There were no adverse effects and all patients survived.

Conclusion: The majority of our vancomycin trough levels were subtherapeutic. Though patient outcome was unaffected, achieving a therapeutic level early in therapy is expected to improve response to therapy. We aim to update our vancomycin dosage guidelines.

Peri-Operative Care

275 | Opioid requirements in thoracoabdominal repair with naloxone for spinal prophylaxis

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Introduction: Endovascular repair of aneurysms of the thoracoabdominal (TAAA), thoracic (TAA), and abdominal aorta (AAA) involve stent-graft placement to prevent further dilation and rupture. A rare but devastating complication is post-operative spinal cord ischemia (SCI), manifested as paralysis. The use of naloxone continuous infusion (NCI) as part of a bundled approach has been shown to decrease the incidence. However, it is unclear if NCI impairs post-operative analgesia in TAAA and TAA patients.

Research Question or Hypothesis: Does NCI inhibit post-operative analgesia

Study Design: Retrospective observational review

Methods: We evaluated postoperative opioid requirements and pain scores in patients undergoing endovascular repair of a TAAA, TAA or

AAA. Emergent or traumatic cases were excluded, as were patients with post-operative complications. Analgesic requirements and pain scores were assessed for the first 72 hours post op, or until discharge. All opioid analgesics were converted to oral morphine milligram equivalents (MME) for analysis.

Results: Forty-three patients received NCI and 52 patients composed the non-NCI cohort. During the duration of the NCI, the mean analgesic requirement was 284.8 ± 530.7 MME versus patients without CIN 49.5 ± 55.1. Adjusting for MME per hour, this was 6.93 ± 14.4 vs 1.03 ± 1.15, $P = 0.009$. Post operative pain scores were higher in the CIN group at hours 12 and 24 postoperatively (4.6 ± 13.2 vs 2.4 ± 7.1, $P = 0.001$ and 3.8 ± 12.4 vs 2.2 ± 5.2, $P = 0.008$). Pain scores were similar following discontinuation of the NCI.

Conclusion: In patients undergoing TAAA and TAA repair, the use of NCI for spinal prophylaxis is associated with increased MME compared to a group not receiving NCI. Post operative pain scores were higher in patients receiving NCI, but resembled the non-NCI group after discontinuation. At this time, the optimal analgesic regimen in patients undergoing TAAA and TAA repair is unknown.

276 | Sugammadex versus neostigmine for the reversal of neuromuscular blockade in surgical patients

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Introduction: Clinical trials comparing sugammadex to conventional neostigmine plus glycopyrrolate (NG) therapy have demonstrated that time to neuromuscular blockade (NMB) reversal and time in the operating room are significantly shorter, and patients have less residual paralysis and respiratory complications with sugammadex. While these outcomes are favorable, it is unknown if the incremental benefits are cost-effective or show meaningful clinical benefit.

Research Question or Hypothesis: What is the clinical and pharmacoeconomic value of sugammadex?

Study Design: Retrospective, cohort study.

Methods: Patients who received surgery between 1/1/16 and 10/31/17 that received rocuronium ≥0.15 mg/kg or vecuronium ≥0.015 mg/kg for NMB with either sugammadex or NG as reversal agents were eligible. Those with other non-depolarizing NMB agents, intubated prior to surgery, or emergency surgery were excluded. The primary endpoint was the composite number of respiratory events defined as reintubation, hypoxia (<90%) on oxygen, respiratory rate > 20 breaths/minute, use of BiPAP or CPAP without diagnosis of OSA, use of a nasal or oral airway, or additional reversal agent administered after the surgery. Secondary objectives were to evaluate the adverse effects of reversal agents and pharmacoeconomic implications. Pearson's chi-square or Fisher's exact tests were used to compare categorical variables. Two-sample t-tests, and Wilcoxon rank-sum tests compared continuous variables. Multiple logistic regression tested the effects of baseline characteristics on the composite endpoint.

Results: A total of 14,884 encounters met study criteria. The primary endpoint occurred significantly more in the sugammadex group vs. the NG group, 33.9% vs. 22.5%, respectively ($P < 0.0001$). Median pharmaceutical cost per patient was $186.10 in the sugammadex groups vs $137.20 in the NG group ($P < 0.001$). Total cost of care per patient was higher in the sugammadex cohort ($P < 0.001$).

Conclusion: The sugammadex group had higher rates of respiratory events and costs were higher suggesting sugammadex does not add significant value to clinical care.

Pharmacoeconomics/Outcomes

277 | Cost-effectiveness of a pharmacist led medication therapy management clinic: Hypertension management

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Introduction: In a retrospective controlled study, blood pressure was significantly lowered by a pharmacist-led medication therapy management (MTM) clinic managing patients proactively. Under Medicare Part D, MTM reimbursement is inadequate to cover comprehensive proactive services. Given the anticipated benefits of better managed hypertension on stroke and cardiovascular events, there was a need to evaluate the value provided by the model of MTM.

Research Question or Hypothesis: Is addressing primary prevention for stroke and cardiovascular events with a pharmacist-led comprehensive MTM clinic, compared with no clinic, cost-effective from a payer's perspective?

Study Design: Cost-effectiveness analysis using a semi-Markov model and 10-year time horizon.

Methods: The base-case model included six health states designed to estimate the natural progression of cardiovascular health. Model

inputs were obtained from an analysis of the MTM-program (clinical effectiveness) and the Framingham risk equation (long-term cardiovascular risk). Utility values and costs for the health states were obtained through a systematic literature review. MTM clinic costs were obtained from current reimbursement rates and visit frequency. The primary model outcomes included total costs and quality-adjusted life years (QALYs) gained, combined to generate an incremental cost-effectiveness ratio (ICER). One-way and probabilistic sensitivity analyses (PSA) were conducted to test the robustness of the conclusions.

Results: In the base-case analysis, 10-year costs and utility were $42,446 and 6.37 respectively resulting in an ICER of $44,017/QALY versus no MTM services. The model was most sensitive to the utility value for primary prevention and the cost of the MTM services. PSA suggested MTM services would be cost-effective in 89% of 10,000 iterations assuming willingness-to-pay threshold of $100,000 per QALY gained.

Conclusion: Coverage of comprehensive and proactive MTM for primary prevention of stroke and cardiovascular events improve patient outcomes and is highly likely to be cost-effective at common willingness-to-pay thresholds. Results can be used to inform discussion on the value and potential reimbursement for MTM services.

278 | Health-related quality of life by comorbidity status among hypertensive adults in the U.S.: A population-based analysis

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Introduction: Previous studies examined health-related quality of life (HRQoL) in hypertensive adults. However, little is known about HRQoL by comorbidity status among hypertensive adults who are likely to have multiple prescriptions due to comorbidities. Therefore, evidence on HRQoL in hypertensive adults with comorbidities can inform pharmacists on better coordination and collaboration with other clinicians for better care and support.

Research Question or Hypothesis: To assess the most frequent comorbidities and to determine whether comorbidities are associated with decreased HRQoL among hypertensive adults in the U.S.

Study Design: A population-based retrospective database analysis was conducted using the 2014-2015 Medical Expenditure Panel Survey.

Methods: Patients were included if they had any diagnosis codes for hypertension, answered the 12-Item Short Form Health Survey (SF-12), and were at least 18 years old (n = 12,852). The primary independent variable was comorbidity, defined modifying the Elixhauser Comorbidity Index with hypertension-related conditions. The dependent variable was HRQoL, measured by using the SF-12 physical health composite scale (PCS) and mental health composite scale (MCS). Multivariate regression models were used to estimate HRQoL by comorbidity status controlling for covariates.

Results: Among hypertensive adults, approximately 85.8% had one or more comorbid conditions (n = 10,864). Hyperlipidemia (55.4%, n = 6,927), diabetes (28.2%, n = 4,052), and mood disorder (27.1%, n = 3,214) were ranked the top three most frequent comorbidities. Having diabetes was significantly associated with decreased PCS score ($P < 0.001$), while having hyperlipidemia or mood disorder was not ($P = 0.645$ and $P = 0.453$, respectively). Hyperlipidemia or mood disorder was significantly associated with decreased MCS scores ($P = 0.015$ and $P < 0.001$, respectively), while having diabetes was not ($P = 0.917$).

Conclusion: Among the frequent comorbidities in hypertensive adults, diabetes decreased HRQoL in physical domain, while hyperlipidemia and mood disorders decreased HRQoL in mental domain. Pharmacists can use this information to coordinate and collaborate with other clinicians to optimize care in hypertensive adults with comorbidities.

279 | Cost-effectiveness of posaconazole versus fluconazole for the prevention of invasive fungal disease among acute myeloid leukemia and myelodysplastic syndrome patients in China

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Introduction: Invasive fungal disease (IFD) is among the major causes of death in immuno-compromised patients, especially in patients suffering from hematological malignancies. Although posaconazole prophylaxis has already been demonstrated to be either cost-effective or cost-saving in other countries, no pharmacoeconomics study of the use of posaconazole to prevent IFD has been conducted in China.

Research Question or Hypothesis: To estimate the cost-effectiveness of posaconazole compared with fluconazole for preventing IFD among acute myeloid leukemia (AML) or myelodysplastic syndrome (MDS) patients from the perspective of Chinese healthcare system.

Study Design: This is a cost-effectiveness analysis.

Methods: A decision-analytic model was developed based on data from a Chinese randomized trial comparing posaconazole with fluconazole therapy. The model was extrapolated to a lifetime horizon using monthly Markov cycles. The model was used to estimate total costs, IFDs avoided, life years saved (LYS), and the incremental cost-effectiveness ratio of posaconazole versus standard fluconazole therapy. Scenario analyses and probabilistic sensitivity analysis (PSA) were performed due to the uncertainty of some parameters.

Results: In the base-case model, posaconazole led to a 12.8% lower incidence of IFD (0.094 *versus* 0.222) and saved ¥412 (¥1 = 0.144 US dollar) per patient compared with fluconazole. In the lifetime model, posaconazole saved ¥412 and gained 0.115 LYS per patient relative

to fluconazole. The results remained unchanged in the scenario analyses with adjustment for the duration of treatment course, price of fluconazole, discount rate and so on. PSA showed that posaconazole was cost-effective when willingness to pay (WTP) was higher than ¥17,000. Posaconazole had a 87% probability of being cost-effective compared to fluconazole when WTP was higher than ¥193,932 based on 3 times per capita gross domestic product (GDP) of 2018 in China.

Conclusion: In China, posaconazole is a cost-saving prophylactic strategy compared with fluconazole in high-risk patients with AML or MDS.

280 | Impact of the pneumococcal conjugate vaccine in controlling antimicrobial resistance in China

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Introduction: Antimicrobial resistance (AMR) poses a serious threat to global public health. Vaccinations have the potential to hinder the progression of AMR by preventing bacterial infections and decreasing the need for antibiotic treatment. China has one of the world's highest rates of antibiotic use and low immunization coverage of the pneumococcal conjugate vaccine (PCV13).

Research Question or Hypothesis: What is the impact of PCV13 in slowing AMR accumulation for pediatric pneumococcal diseases in China?

Study Design: An agent-based DREAMR (Dynamic Representation of the Economics of AMR) model was developed to examine the impact of slowing AMR against Streptococcus pneumoniae through PCV13 childhood immunizations.

Methods: We simulated vaccinations, pneumococcal infections, antibiotic use, and AMR accumulation. Four commonly used antibiotics to treat pneumococcal diseases (penicillin, amoxicillin, 3rd generation cephalosporins, and meropenem) were modeled. Antibiotic utilization, pharmacokinetics, and pharmacodynamics were factored into predicting AMR accumulation. Three PCV13 coverage scenarios were simulated over a time-frame of five years: (1) status quo (no change in coverage), (2) accelerated (increase in coverage to 99% in five years), and (3) scaled (increase in coverage to 85% over two years, then increased to 99% coverage over three years).

Results: Our results showed that compared to status quo, over five years, AMR against penicillin, amoxicillin, and 3rd generation cephalosporins was significantly reduced by 0.31%, 7.63%, and 2.83% in the accelerated scenario and by 0.19%, 4.87%, and 1.73% in the scaled scenario. No significant change in AMR was identified for meropenem due to low incidence of pneumococcal meningitis. annual costs due to AMR, including direct costs and productivity losses, were reduced by $3.04 billion in the accelerated scenario and $1.87 billion in the scaled scenario compared to status quo.

Conclusion: Increasing PCV13 coverage in children would not only avert pneumococcal diseases but also slow the progression of AMR, prolonging antibiotic treatment effectiveness.

281 | Potentially inappropriate medication prescribing is associated with increased healthcare utilization and costs among older adults in the United States

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Introduction: Inappropriate medication use is an important public health issue especially as the U.S. population continues to age. Understanding how potentially inappropriate medications (PIMs) influence healthcare utilization is important in designing interventions to address this issue.

Research Question or Hypothesis: We hypothesize that exposure to PIMs is positively associated with healthcare utilization and expenditures.

Study Design: This is a cross-sectional analysis utilizing U.S. nationally representative data from the 2011 to 2015 Medical Expenditure Panel Survey (MEPS).

Methods: Respondents aged ≥65 years were identified within MEPS from 2011-2015. PIM exposure was operationalized using the 2019 Beers criteria. Outcomes included healthcare utilization (hospital admissions, emergency department (ED) visits, and outpatient provider visits) and related total expenditures. Negative binomial regression models were used to analyze rates of healthcare utilization and adjust for differences between groups. Survey weighted procedures were used to compare mean healthcare expenditures between groups (SAS version 9.4).

Results: PIMs were prescribed in 34.4% of our sample of ~218 million patients. Patients prescribed PIMs had significantly higher rates of healthcare utilization, including hospital admissions (33.5 vs. 19.3 per 100 patients, $P < 0.001$), ED visits (41.4 vs. 23.6, $P < 0.001$), and outpatient visits (160.4 vs 103.3, $P < 0.001$). In adjusted models, PIM prescribing was associated with a 46% increase in hospital admissions (incidence rate ratio [IRR], 1.46, 95% CI, 1.35-1.57, $P < 0.001$), 49% increase in ED visits (IRR, 1.49 95% CI, 1.39-1.59, $P < 0.001$), 41% increase in outpatient visits (IRR, 1.41 95% CI 1.37-1.46, $P < 0.001$). Adjusting to U.S. 2017 dollars, those prescribed PIMs had significantly

higher mean total expenditures for inpatient $1,769 ($P$ < 0.001), ED $140 ($P$ < 0.001), and outpatient $1,568 ($P$ < 0.001) care as well as prescribed drug costs $1,690 ($P$ < 0.001).

Conclusion: Our results suggest that patients' receipt of PIMs is associated with higher rates of healthcare utilization and increased costs across the continuum of care. Efforts to deprescribe PIMs may help reduce healthcare utilization and costs.

282 | Agreement of ICD-10 and pharmacy claims data coding of adherence among patients with diabetes or hypertension

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Introduction: ICD-10 codes exist that facilitate provider designation of patients as nonadherent to therapy; however, it is unclear whether this label accurately reflects patient behavior according to widely-accepted medication adherence metrics.

Research Question or Hypothesis: To what extent are patients both accurately coded for and have calculated rates of nonadherence using ICD-10 codes and claims, respectively?

Study Design: Retrospective cohort study

Methods: Patients were identified using 2015-2016 IBM MarketScan Commercial Claims and Medicare Advantage data. To be included, patients must have been coded nonadherent according to ICD-10 codes in outpatient encounter data (Z53.2, Z53.20, Z53.29, Z91.11-Z91.14) and have a primary diagnosis for either diabetes and/or hypertension, at least one oral antidiabetic or antihypertensive medication fill, and continuous enrollment 6 months before and after the initial nonadherence code. Tests of proportion, Chi-squared tests, generalized linear models, and logistic regression examined characteristics related to diagnosis concordance and changes in adherence (by proportion of days covered [PDC]) before and after the initial non-adherence code, respectively.

Results: A total of 2,387 patients coded nonadherent were identified, the majority of which were at least 45 years of age (81.5%), female (52.5%), resided in the South (56.2%), and lived in an urban area (85.1%). Among those coded nonadherent, 51.4% (diabetes) and 55.1% (hypertensive) had PDCs prior to the nonadherence code that would deem them adherent. The odds of being correctly labeled non-adherent when claims also indicated nonadherence decreased with age for diabetes (OR: 0.81 95% CI: 0.760-0.862) and hypertension (OR: 0.96; 95% CI: 0.951-0.966); consistent misclassifications were observed among those 55 years of age and older. PDCs and the proportion adherent increased significantly among both conditions following the nonadherent code (all P < 0.05).

Conclusion: Providers may be misclassifying patients as nonadherent using ICD-10 codes, but changes in adherence following the initial code indicate efforts to improve medication use may be put in place following such an encounter.

283 | Accuracy of estimated control group binomial event rates for medication related randomized controlled trials

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Introduction: Accurate estimates for sample size calculations can be difficult. For clinical trials with dichotomous outcomes the estimated event rate (ER) in the control group is necessary for sample size calculation. Investigators often estimate this ER based on published reports, despite differences in trial location, eligibility criteria, and endpoints. Significantly underestimating the ER could contribute to underpowered studies.

Research Question or Hypothesis: To evaluate the accuracy of the predicted control group ER (for the primary outcome) compared to the observed rate in randomized controlled trials (RCTs) involving medications or medication devices.

Study Design: Secondary analysis of published RCTs.

Methods: A literature review and data extraction were performed for RCTs involving a medication or medicated device from the journals New England Journal of Medicine, JAMA, and Lancet from 2015-2017, inclusive. Additional study inclusion criteria included: human subjects, anticipated control ER articulated in study methods, primary outcome of dichotomous event or composite of dichotomous events, and a lower rate of the primary outcome reflected greater drug effectiveness.

Results: There were 1685 studies reviewed. Sixty-seven studies met criteria for inclusion (NEJM 35, JAMA 13, Lancet 19). There were 29 studies (43.3%) with actual control ERs below predicted vs. 38 studies (56.7%) with rates above predicted. Range for the relative difference (actual - predicted / actual) in control ERs was -3.348 to 0.879. Only 21 studies (31.3%) achieved a control ER which was within 20% of the predicted rate, relatively. Study characteristics associated with improved accuracy were studies with larger enrollment and inclusion of mortality among outcome events (P < 0.05 for each).

Conclusion: Significant variation exists regarding accuracy of control group ER predictions. Such variation may lead to underpowered studies which may contribute to type 2 error. Larger study enrollment and inclusion of mortality were each associated with improved accuracy.

Pharmacoepidemiology

284 | Prevalence and predictors of potentially inappropriate medication prescribing among older adults in the United States: A population-based study

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Introduction: Potentially inappropriate medications (PIMs) have been shown to be associated with adverse clinical outcomes. Updated information on PIM exposure in the elderly as well as attributes associated with PIM prescribing is needed to implement focused interventions.

Research Question or Hypothesis: We hypothesize that PIM exposure is associated with socio-demographic and clinical risk factors.

Study Design: Cross-sectional study using U.S. nationally representative data from the 2011-2015 Medical Expenditure Panel Survey.

Methods: We defined our exposure to PIMs based on the 2019 Beers Criteria and applied it to adults age ≥ 65 from 2011-2015. Exposure to PIMs was first defined as any PIM use during the time period. Next, we examined exposure to multiple PIMs which was defined as receipt of ≥2 therapeutic PIM categories. The change in PIM prevalence was assessed using the Cochran-Armitage test for trend. A multinomial logistic regression model was used to identify patient-level predictors associated with PIM prescribing (SAS version 9.4).

Results: PIM use decreased from 35.3% in 2011 to 32.5% in 2015 (P = 0.04). Patients on multiple PIMs also decreased from 12.3% to 10.3% during this time period ($P \leq 0.01$). The three most common PIM classes were benzodiazepines (9.0%), sulfonylureas (4.4%), and first generation antihistamines (4.1%). Therapeutic classes with the most significant change included: digoxin (-62.3%, $P < 0.001$), non-benzodiazepine hypnotics (-36.7%, $P = 0.01$) and antidepressants (-34.7%, $P < 0.01$). Our results suggest that poor general and mental health status were significantly associated with higher PIM use, while male sex, race/ethnicity, and residence in the northeast were significantly associated with lower PIM use ($P < 0.05$). Results were similar for patients exposed to multiple PIM categories.

Conclusion: Although PIM use remains high among older adults, our results suggest that PIM prescribing is declining. Understanding how patient characteristics are related to PIM exposure will be needed to improve patient safety through prescriber education and patient-centered interventions.

285 | Impact of lowering age limits of pharmacist-administered flu vaccination on immunization rate

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Introduction: Although many states have expanded pharmacists immunizing authority over the past two decades, some states including Connecticut, Florida and Vermont, still preclude pharmacists from providing influenza vaccines to patients under 18 years.

Research Question or Hypothesis: Does lowering the age limit for pharmacist-administered immunization affect the likelihood of flu vaccination among teens?

Study Design: Using the National Immunization Survey - Teen data, we conducted a case study of Pennsylvania, which lowered the patient age limit of pharmacist-administered influenza vaccines from 18 to 9 in 2015. The comparator state, Wisconsin, was chosen given its comparable teen flu vaccine rates in 2014, the year prior to age-limit change in Pennsylvania.

Methods: We used a difference-in-differences approach to compare the odds of teens aged 13-17 years in Pennsylvania receiving flu vaccine in 2016 to those in Wisconsin. The analysis was adjusted for available patient socio-demographic and health utilization characteristics.

Results: By design, the odds of a teenager receiving flu vaccination in Pennsylvania and Wisconsin in 2014 was comparable (P value = 0.98), with a weighted vaccination rate of 14.7%. Notably, several of characteristics that predict healthcare utilization in the US, such as age, sex, race and ethnicity and relative poverty status were not associated with the likelihood of vaccination both in 2014 and 2016 (P values >0.05). The rate of teen flu vaccination in Pennsylvania increased from 12.7% to 17.1%, while the rate in Wisconsin increased from 12.6% to 14.3%. However, this difference-in-differences was not statistically significant (P = 0.86).

Conclusion: Lowering the age limit for pharmacist-administered influenza vaccination was not associated with statistically significant increases in teen vaccination rates. Additional research is required the address barriers of the pharmacist-administered vaccinations among children.

Pharmacogenomics/Pharmacogenetics

286 | Differences in predicted warfarin dosing requirements for Hmong versus East Asians using a genotype-based dosing algorithm

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Introduction: Warfarin's narrow therapeutic index and high variability in dosage requirements make dosage selection critical. Genetic factors are known to impact warfarin dosage selection. The Hmong are a unique Asian population numbering over 73,000 in Minnesota whose participation in genetic-based research is virtually non-existent.

Research Question or Hypothesis: Do predicted warfarin starting doses differ between Hmong and East Asians, solely based on allele frequency differences within warfarin pharmacogenes?

Study Design: Quantitative cohort study.

Methods: Two independent cohorts (N = 219 and N = 187) of self-identified Hmong adults were genotyped for *CYP2C9**2, *3, *VKORC1* (G-1639A) and *CYP4F2**3. Allele frequencies of the combined Hmong population (N = 406) and an East Asian population (N = 1200) from the dbSNP were compared using a Chi-squared test. Non-genetic variables for East Asians were simulated using a bootstrap method based on Hmong data. The Gage (2017) algorithm was used to calculate warfarin starting doses. Mean warfarin starting dose and the percentage of individuals requiring extreme starting doses, were compared using a t-test and chi-squared test, respectively. ($P < 0.05$ for significance). Extreme starting doses were defined as the absolute difference between genetic and clinical dose ≥1 mg/day.

Results: Allele frequencies of *CYP2C9**3 and *CYP4F2**3 in Hmong were significantly different from those in East Asians (19.1% vs 3.4%, $P < 0.00001$ and 9.8% vs 22.1%, $P < 0.0001$, respectively). No differences in other SNPs were noted. The mean predicted starting dose (2.7 vs 3 mg/day, $P < 0.001$) and prevalence of extreme starting dose (65% vs 51%, $P < 0.001$) differed between Hmong and East Asians.

Conclusion: Allele frequency differences between Hmong and East Asians for *CYP2C9**3 and *CYP4F2**3 are predicted to have a consequential impact on warfarin starting doses and extreme dose requirements. Our findings suggest a clinically important risk exists to simply generalizing warfarin doses based on race/ethnicity classifications and illustrate the importance of individualizing dose requirements for drugs such as warfarin.

287 | Evaluation of CPIC level A drug prescribing in IGNITE-affiliated health systems: Opportunity for pharmacogenomics implementation among adult patients

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Introduction: The value of utilizing a pharmacogenomics panel to tailor pharmacotherapy is contingent on the prevalence of prescribed medications with an actionable pharmacogenomic association. The Clinical Pharmacogenetics Implementation Consortium (CPIC) has categorized over 35 gene-drug pairs as CPIC Level A, defined as having sufficiently strong evidence to recommend that genetic information should be used to guide drug prescribing.

Research Question or Hypothesis: Determine the exposure rate to CPIC Level A drugs among Implementing GeNomics In pracTicE (IGNITE) Network-affiliated health systems.

Study Design: Inpatient and outpatient electronic-prescribing data for CPIC Level A drugs and demographics for adult patients ≥18 years of age were collected at 11 IGNITE-affiliated health systems across the U.S.

Methods: Aggregate data by year between 1/1/2010-12/31/2017 were provided by each site. The exposure rate to CPIC Level A drugs was determined using a binomial regression model.

Results: Approximately 7.5 million adult patients were eligible for drug prescribing within a typical calendar year among the eleven health systems. The median exposure percentage in a typical year to at least one CPIC Level A drug was 19.9% (interquartile range 19.8-19.9%). Ondansetron (8.8% exposure), oxycodone (6.8% exposure), tramadol (3% exposure), and simvastatin (2.6% exposure) were most commonly prescribed; high ondansetron prescribing rates may be representative of short term or as needed use. Excluding ondansetron, opioids (9.2% exposure), antidepressants (2.8% exposure), and statins (2.6% exposure) were the most commonly prescribed drug classes. Medications influenced by *CYP2D6*, *CYP2C19*, and *SLCO1B1* were prescribed to a greater extent than other gene-drug pairs. Among all CPIC Level A drugs, exposure rates were similar across age groups.

Conclusion: A significant portion of adults treated at medical institutions across the U.S. are exposed to medications for which genetic information, if available, should be used to guide prescribing. These findings demonstrate the opportunity of implementing a

pharmacogenomics panel to tailor pharmacotherapy at a wide spectrum of health systems.

288 | Discrepancies in clinical guidance to manage drug-gene interactions: Analysis of recommendations from prominent U.S. guidance sources

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Introduction: Advances in pharmacogenetics (PGx) knowledge have enhanced understanding of patient-specific factors that affect drug action, including drug disposition, therapeutic efficacy, and toxicity. Effective implementation of PGx principles to inform personalized medicine has remained slow, however, in part due to inconsistent PGx-related guidance to clinicians.

Research Question or Hypothesis: How prevalent are discrepancies (i.e. contradictory guidance) in drug-gene interaction recommendations from prominent U.S. guidance sources?

Study Design: We surveyed drug-gene recommendations from current versions of Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines, U.S. Food and Drug Administration (FDA) drug labels, and U.S. professional organization clinical practice guidelines (CPGs) through 05/24/19.

Methods: Collected data included drug-gene recommendations, therapeutic areas of the drugs involved, genetic biomarkers involved, and whether routine genetic screening was recommended. Actionable recommendations were categorized as those directing a specific clinical management strategy (e.g. dose adjustment). Data were analyzed using descriptive statistics (counts and percentages) in JMP v.13.0.0 (SAS Institute).

Results: We identified 520 drug-gene recommendations that contained 241 unique FDA-approved medications, 365 unique drug-gene pairs, and 79 unique genes. Oncology (22.4% of drug-gene pairs) and psychiatry (13.3%) were the therapeutic areas with the most drug-gene recommendations. CPIC guidelines, FDA drug labels, and professional CPGs contained 64, 315, and 141 drug-gene recommendations, respectively, that were actionable in 93.8%, 54.0%, and 70.9% of cases. For the 121 drug-gene pairs with recommendations from ≥2 sources, discrepancies in the recommendation occurred in 38.0% of cases. Recommendation discrepancies were most prevalent with psychiatry medications (86.7%) and antivirals (63.6%) and least common with hematology (23.5%) and oncology (20.3%) agents. Discrepancies also occurred based on the gene within the drug-gene pair (46.2% of cases) and whether routine screening was recommended (22.4%).

Conclusion: Vast discrepancies exist among drug-gene interaction recommendations within CPIC guidelines, FDA drug labels, and professional CPGs. These discrepancies may contribute to ineffective clinical PGx implementation.

289 | Pharmacists attitudes and knowledge of pharmacogenetics in a large, multi-state, healthcare system

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Introduction: Pharmacists are well suited to implement pharmacogenetic testing in healthcare systems; however, their comfort level and willingness to do so is poorly understood.

Research Question or Hypothesis: The primary objective of this survey was to assess the knowledge and attitudes of pharmacogenetic testing of pharmacists employed by a large, multi-state healthcare system.

Study Design: A thirteen question survey was developed to assess current knowledge and attitudes pharmacists have on pharmacogenetic testing and how prepared and willing they are to implement pharmacogenetic testing.

Methods: Survey questions were developed by the study team, and responses were collected electronically using REDCap. The electronic survey was sent to 161 pharmacists by email. Questions were analyzed using JMP Software from SAS and stratified based on demographics. Statistical significance was determined using chi-squared testing with statistical significance defined as a *P*-value <0.05.

Results: The survey response rate was 47%. The majority of respondents were female (60%), had graduated in or after 2010 (43%), worked in acute care settings (57%), were full-time employees (80%), and worked in an urban area (85%). For post-graduate education, 36% of respondents completed a Post-Graduate Year 1 residency and 27% had a board certification. Seventy-five percent of respondents had not received any formal training and/or education on pharmacogenetics. Fifty-nine percent of pharmacists surveyed felt uncomfortable providing recommendations to a provider or patient based on pharmacogenetic test results. The vast majority (97%) of respondents supported offering pharmacogenetic testing and interpretation through pharmacy services in the health system. The most common barriers to implementation respondents reported were education and lack of resources. Fifty-eight percent of pharmacists surveyed felt that pharmacists are the best suited clinicians to implement pharmacogenetic testing.

Conclusion: Although the pharmacists surveyed strongly supported pharmacy ownership of pharmacogenetic testing, a lack of education remains a significant barrier that must be addressed prior to implementation.

290 | Providers' experiences and perspectives with psychiatric pharmacogenomic testing

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Introduction: Psychiatric pharmacogenomics (PGx) testing seeks to avoid trial-and-error prescribing by tailoring drug and dose selection to an individual's genetic profile. The role of psychiatric PGx testing is currently unclear due to conflicting evidence regarding its clinical application. Despite this, some providers have adopted it into clinical practice. There is a need to better understand providers' experiences and perspectives with using psychiatric PGx testing to assess its clinical utility.
Research Question or Hypothesis: Providers' views regarding the utility of psychiatric PGx testing are influenced by factors such as strength of evidence, knowledge, and experience with the test.
Study Design: A qualitative study was conducted among psychiatrists who utilized psychiatric PGx testing at the University of Colorado Depression Center using individual semi-structured interviews.
Methods: Interviews were audio-recorded, transcribed verbatim with transcripts coded and analyzed using deductive and inductive approaches to identify salient themes.
Results: A total of seven psychiatrists (71.4% female, 85.7 % Caucasian, mean age 53.0 ± 11.0 years, mean years of practice 22.4 ± 12.4) were interviewed, with psychiatric PGx test experience ranging 2 to 5 years. Themes that emerged included a lack of consensus on the clinical utility of psychiatric PGx testing, with some providers being skeptical about its role, while others saw it as a good clinical decision tool. Providers' post-test attitudes ranged from skepticism to disappointment to hopefulness. Some concerns included: difficulties interpreting and applying the results, challenges associated with managing patients' expectations, and inconsistent insurance coverage. Overall, providers wanted clearer guidance on who and when to test, stronger evidence of clinical utility; and transparency behind algorithms used by commercial companies to interpret the PGx results.
Conclusion: There was no consensus among providers' regarding the clinical utility of psychiatric PGx testing. Based on their post-test perspectives and experiences, more robust research is needed to support the test with clearer guidance on employing its use.

291 | Patient's perspectives about psychiatric pharmacogenetic testing

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Introduction: Pharmacogenetics has the potential to reduce trial-and-error treatment approaches in the field of psychiatry medicine. Currently, there are mixed views among providers about the clinical utility of psychiatric pharmacogenetic testing. However, there is a growing interest in psychiatric pharmacogenetic testing among patients with mental health conditions. As such, there is a critical need to assess patients â€˜perspectives and experiences with psychiatric pharmacogenetic testing.
Research Question or Hypothesis: What are the perspectives and experiences of patients who have undergone psychiatric pharmacogenetic testing?
Study Design: Qualitative study.
Methods: Individual semi-structured interviews were conducted among patients with a diagnosis of major depressive disorder, who had undergone genotyping using a single commercial psychiatric pharmacogenetic test. Interviews were audio-recorded and transcribed verbatim. Transcripts were analyzed for salient themes using deductive and inductive approaches.
Results: A total of twenty patients (100% Caucasian, 60% female, mean age 39 ± 18 years) were interviewed, with the majority (90%) of the psychiatric pharmacogenetic tests initiated by providers for the primary reasons of patients' history of medication intolerances or failed psycho-pharmacotherapies. Patients' perspectives were impacted by the perceived utility of their test results and the insurance coverage of the test. Some patients found testing beneficial even if the results were not used to alter their psycho-pharmacotherapy, because the results helped explain their lack of drug response or side effects previously experienced. Some patients were skeptical about the results as some of the medication recommendations from the test company conflicted with their prior experience with those medications. Some patients found the cost of the test prohibitive. A few patients wished the pharmacogenetic test was performed earlier to guide drug selection for their mental health condition.
Conclusion: Patients' perspectives and experiences with psychiatric pharmacogenetic testing varied, with the perceived value of the test dependent on their results and insurance coverage of the test.

292 | The impact of pharmacogenomics transitions of care: Downstream prescribing after inpatient pharmacogenomics service consultation

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Introduction: Several institutions nationwide have implemented inpatient CYP2C19 genotyping to tailor antiplatelet therapy in patients undergoing percutaneous coronary intervention (PCI). Given the potential life-long value of these data and the fragmented nature of the US health system, it is vital to understand whether focused inpatient services can direct downstream prescribing.

Research Question or Hypothesis: Our objective was to determine whether antiplatelet prescribing maintains concordance with genotype results through all transitions of care.

Study Design: Retrospective cohort.

Methods: In an IRB-approved study, eligible patients underwent PCI and CYP2C19 genotyping between 12/2015 and 12/2016. Predicted phenotype was assigned based upon standardized methods/terminology - patients were classified as ultrarapid, rapid, normal, intermediate, or poor metabolizers (UM, RM, NM, IM, or PM, respectively). Genotype-concordant therapy was defined as the use of ticagrelor or prasugrel in IM/PMs. Chi-square and unpaired t-tests were used to evaluate nominal and continuous data, respectively. Patient data was censored after loss-to-follow-up.

Results: 567 patients were included. 120 (21.2%) patients experienced at least one switch from one antiplatelet to another. Among IM/PMs who switched from clopidogrel to prasugrel or ticagrelor, this switch occurred at a median of 7 days after PCI, but the range was wide (2 to 295 days). Prasugrel and ticagrelor use was higher in IM/PMs than UM/RM/NMs at discharge (31.8% vs 22.3%, $P = 0.033$), at 30 days (42.1% vs 19.6%, $P < 0.001$), and at 1 year (41.2% vs. 15.7%, $P < 0.001$) post-PCI. PMs were uncommon (3.2% of our population), but had a numerically higher use of genotype concordant therapy after one year compared to IMs (72.7% vs. 61.7%, $P = 0.68$).

Conclusion: Genotyped post-PCI patients experience changes in antiplatelet therapy in the outpatient setting. Downstream provider education and decision support are important elements of appropriate antiplatelet prescribing for genotyped post-PCI patients throughout the care continuum.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

293 | Clinical population pharmacokinetics of ampicillin-sulbactam in plasma and prostate

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Introduction: Ampicillin-sulbactam (ABPC-SBT) has been used for urinary infections including prostatitis. However, the clinical pharmacokinetics of ABPC-SBT at the site of action has been unclear. This study investigated a population pharmacokinetics by simultaneously analyzing ABPC-SBT concentrations in plasma and prostate tissue.

Research Question or Hypothesis: To develop a population pharmacokinetic model of ABPC-SBT in plasma and prostate.

Study Design: A multicenter, open label, non-comparative and prospective study.

Methods: Subjects were prostatic hyperplasia patients prophylactically receiving a 0.5-h infusion of ABPC-SBT (1.0-0.5 g or 2.0-1.0 g) before transurethral resection of the prostate. Blood samples were collected at 0.5, 1, 1.5, 3 and 5 h after the start of infusion. Prostate tissue samples were collected at 0.5, 1 and 1.5 h after the start of infusion. ABPC and SBT concentrations were measured by high performance liquid chromatography. Population pharmacokinetic modeling was performed by using NONMEM 7.3. The adequacy of the developed model was assessed by goodness-of-fit plots.

Results: All concentration-time data (219 samples for plasma and 109 samples for prostate tissue) from 44 patients were adequately described by a three-compartment model. For ABPC, the parameter estimates for volumes of distribution of central (V_1), peripheral (V_2) and prostate (V_3) compartments, clearance (CL) from central compartment, intercompartmental clearances (Q_2 and Q_3) were 6.31 L (inter-individual variability = 49.7%), 5.67 L (31.9%), 0.32 kg (29.7%), 11.1 L/h (40.1%), 13.7 L/h (36.2%) and 5.84 L/h (95.1%), respectively. Goodness-of-fit plots confirmed the relatively good stability and prediction capability of the model. As the area under the drug concentration-time curve, the mean prostate tissue/plasma ratio of ABPC was estimated to be 0.37, and the mean ABPC/SBT ratio in prostate tissue was predicted to be 2.07.

Conclusion: The developed population model helps to define the clinical pharmacokinetics of ABPC-SBT in plasma and prostate, while also helping to consider the dosing regimens for prostatitis based on site-specific pharmacodynamics.

294 | Evaluation of vancomycin pharmacokinetics in end stage liver disease

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Introduction: There are limited studies evaluating the effects of liver dysfunction on intravenous vancomycin pharmacokinetics (PK). A MAP-Bayesian derived clinical decision support platform for therapeutic drug monitoring has the potential to model vancomycin PK in

end stage liver disease (ESLD) patients. This knowledge can provide clinicians with vital decision support to optimize vancomycin dosing in ESLD patients.

Research Question or Hypothesis: Do the vancomycin PK of ESLD patients fit existing population pharmacokinetic models (PPKM)?

Study Design: Retrospective descriptive cohort study.

Methods: Adult patients were included if they had received vancomycin from 6/1/16 to 12/31/17, diagnosis of cirrhosis (Child-Pugh Class B and C), and > 1 vancomycin trough. Patients were excluded if they were on hemodialysis or continuous renal replacement therapy, received any type of organ transplantation, or received vancomycin at an outside hospital prior to admission. Patients were analyzed through CDS software using each of three existing vancomycin PK models (Buelga, Goti, and Thomson), where individual calculated and predicted (population) PK parameters were collected. We assessed deviations of individual volume of distribution (Vd) and clearance (Cl) values from their respective population PK model, expressed as a log ratio

Results: 141 patients were identified with an average age of 55.5 years, weight of 78.1 kg, Child-Pugh Score of 8, CrCl of 100 mL/min and 4 days of vancomycin therapy. The prediction accuracy log ratios are as follow: For Vc - Buelga (0.058/0.018), Goti (0.110/0.025), Thomson (0.067/0.020); For Cl - Buelga (0.513/0.033), Goti (0.167/0.026), Thomson (0.494/0.055). Based on ANOVA analysis, there were significant differences in Vc [F (2,140) =3.92, P = 0.00] and Cl [F (2,140) =3.75, P = 0.00] predictor accuracy between vancomycin PPKM. The prediction accuracy for Vc is Buelga > Thomson > Got and for Cl is Goti > Thomson > Buelga.

Conclusion: The Thomson model provided the most consistent accuracy in predictions of Vc and Cl overall.

295 | Initial characterization of nicotinamide metabolism in pregnancy: a novel treatment for preeclampsia

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Introduction: Nicotinamide (NAM), vitamin B3-amide, has entered clinical trials for preeclampsia due to protective effects in preclinical models. NAM is metabolized by nicotinamide N-methyltransferase (NNMT) in liver to methyl-nicotinamide (MNAM) and methyl-2-pyridone-5-carboxamide (2PY). After a 1-gram dose, NAM half-life is 1.5-3.5 hours in non-pregnant patients. However, NAM pharmacokinetics and metabolism have never been studied in pregnancy.

Research Question or Hypothesis: What is the exposure of NAM and its metabolites in pregnancy?

Study Design: Single-dose pharmacokinetic study with parallel human hepatocyte *in vitro* experiments.

Plasma concentrations (ng/mL)	Baseline	2-hours	8-hours
NAM	20 ± 5	6595 ± 2559	363 ± 654
MNAM	18 ± 10	658 ± 322	584 ± 186
2PY	240 ± 145	3419 ± 858	5590 ± 1792

Methods: Plasma was collected at baseline, 2-hours (peak), and 8-hours (trough) after oral NAM administration (1-gram) in 6 early-onset preeclampsia patients enrolled in a clinical trial (NCT03419364). NAM, MNAM and 2PY were quantified by LC-MS/MS. Sandwich-cultured human hepatocytes (SCHH) from a female donor were exposed to a cocktail of pregnancy-related hormones (1 μM, 10 μM, or vehicle control) for 72-hours to evaluate effects on NNMT expression (immunoblot) and NAM metabolism. Data were analyzed using descriptive statistics (mean ± SD).

Results: Plasma NAM (404 ± 238-fold), MNAM (39.8 ± 13.3-fold), and 2PY (15.0 ± 5.7-fold) concentrations increased substantially 2-hours after dosing (Table). NAM concentrations rapidly decreased (elimination half-life: 1.11 ± 0.65 hours), while MNAM and 2PY concentrations remained elevated at 8-hours. In SCHH, pregnancy hormones did not alter NNMT expression (1uM: 1.04 ± 0.2-fold, 10uM: 0.96 ± 0.3-fold) or total metabolite (MNAM+2PY) formation (1uM: 0.96 ± 0.04-fold, 10uM: 1.08 ± 0.06-fold) relative to vehicle control.

Conclusion: These data provide initial evidence of NAM pharmacokinetics and metabolism in pregnancy. NAM elimination half-life is similar to prior reports in non-pregnant patients. The lack of change in hepatic NNMT expression and function *in vitro* is consistent with the *in vivo* results. Although limited by lack of non-pregnant patients for comparison, these data suggest that major differences in NAM metabolism and clearance during pregnancy are unlikely. Additional studies are needed.

296 | Levetiracetam pharmacokinetics in critically ill patients undergoing renal replacement therapy

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Introduction: Levetiracetam is used frequently in the critically ill; however, there is limited information regarding its disposition in patients

requiring continuous renal replacement therapy (CRRT) or sustained low efficiency dialysis (SLED). There is a critical need to determine how these modalities affect levetiracetam removal to optimize dosing regimens.

Research Question or Hypothesis: How do CRRT and SLED affect levetiracetam clearance?

Study Design: Prospective, single-center, pharmacokinetic study

Methods: Adult patients admitted to Methodist University Hospital with acute kidney injury (AKI) or end stage renal disease requiring either CRRT or SLED and levetiracetam were included. Levetiracetam dosing and CRRT settings were at the prescriber's discretion. Blood and dialysate flow rates during SLED were maintained at 250 and 100 mL/min, respectively. Simultaneous arterial, venous, and effluent samples for analysis of levetiracetam concentrations were collected every two hours for up to 6 hours during CRRT. Simultaneous arterial and venous blood samples were collected hourly for up to 8 hours during SLED. Levetiracetam clearance (CL) and half-life ($t_{1/2}$) were calculated for each modality.

Results: Four SLED patients and eight CRRT patients completed the study: 67% male, mean age 52 ± 13 years, and 83% had AKI. Seven CRRT patients received continuous venovenous hemodiafiltration (CVVHDF) and one patient received continuous venovenous hemofiltration (CVVH). The mean effluent dose ranged from 19-31 mL/kg/hr. The mean levetiracetam CL during CVVHDF was 33.7 ± 8.8 mL/min and mean $t_{1/2}$ was 10.4 ± 2.2 hr. For the patient requiring CVVH, clearance and $t_{1/2}$ were 28.7 mL/min and 9.5 hr, respectively. Mean levetiracetam CL during SLED was 74.0 ± 25.3 mL/min and $t_{1/2}$ 4.8 ± 2.3 hr.

Conclusion: Considering the levetiracetam $t_{1/2}$ in individuals with normal kidney function is ~6-8 hours, levetiracetam clearance was substantial with both modalities. There is the potential for subtherapeutic concentrations with current recommended dosing strategies that account only for kidney function and not these extracorporeal routes of elimination.

297 | Polymeric nanoformulation of an antidiabetic drug, canagliflozin

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Introduction: With the rising incidence of diabetes, interest in pharmacological intervention for type II diabetes has increased. Sodium-glucose co-transporter-2 (SGLT2) inhibitors, such as canagliflozin, may confer an increased risk of renal adverse events. As nanoformulation may decrease some side effects, the technique may provide risk reduction for canagliflozin-associated acute renal failure.

Research Question or Hypothesis: In this study, we aimed to formulate canagliflozin-loaded poly(lactide-*co*-glycolide) nanoparticles (NPs).

Study Design: *In vitro* experiments.

Methods: Formulations were based on an emulsion-diffusion-evaporation method. Canagliflozin amounts were varied (5, 10, or 15 mg); while the stabilizer, didodecyldimethylammonium bromide (DMAB), concentration was either 0.25% or 0.50% w/v. NPs were evaluated for particle size, zeta potential, and polydispersity index (PDI). Preliminary entrapment efficiencies (EE) was calculated. ANOVA and Student's t-tests were utilized as appropriate with significance at $P < 0.05$.

Results: The 0.25% DMAB grouping yielded no significant differences. Although the 15 mg formulation was not monodispersed, significant particle size difference ($P = 0.002$) was found between the 5 mg (108.53 ± 3.19 nm) and the 10 mg (95.23 ± 1.00 nm) groups with 0.50% DMAB. For zeta potential in 0.25% DMAB, 15 mg (51.42 ± 2.35 mV) of canagliflozin was significantly higher than both 5 mg (43.28 ± 3.44 mV; $P = 0.016$) and 10 mg (39.85 ± 1.07 mV; $P = 0.003$). Concerning 0.50% DMAB, the zeta potential of 10 mg (33.57 ± 4.88 mV) was statistically significant ($P = 0.033$ and $P = 0.002$, respectively) compared to 5 mg (48.80 ± 7.84 mV) and 15 mg (49.83 ± 2.21 mV). No statistical differences were found concerning PDIs. EE was low with the highest being around 10%.

Conclusion: The 0.25% DMAB with 15 mg canagliflozin yielded the most stable particle with regard to zeta potential. Drug loading amount did not affect PDI in this study. Further optimization is needed to improve entrapment efficiency.

298 | Prediction of human pharmacokinetics of duloxetine after co-administration with propolis

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Introduction: Duloxetine (DLX), a potent treatment of depression and urinary incontinence, undergoes extensive liver metabolism by the CYP1A2. Meanwhile, propolis (PPL) is one of the most popular functional foods that has been known to have inhibitory effects on human cytochrome P450 activities including CYP1A2.

Research Question or Hypothesis: Due to the high possibility of using medical drugs and functional foods simultaneously, the present study was designed to investigate the potent effect of propolis on the pharmacokinetics (PK) of DLX after co-administration.

Study Design: The PK study was conducted in 18 rats SD rats divided into 3 groups (G1, G2, and G3; n = 6 rats/group). Each was orally administered a same DLX dose (40 mg/kg) and a different PPL dose (G1, 0 mg/kg; G2, 100 mg/kg; and G3, 300 mg/kg).

Methods: Plasma concentration of DLX and its major metabolite were determined. A population PK model was developed to simultaneously describe the PK of DLX and its metabolite in the absence and presence of PPL co-administered. These results were then extrapolated to predict potential effects of PPL to PKs of DLX in healthy humans using the allometric scaling method.

Results: When co-administration with 500 and 1500 mg/kg PPL, the pre-systemic metabolizing activity of CYP1A2 reduced by 24.9% and 36.4%, respectively, and the systemic elimination of DLX reduced 15.9% and 26.9%, respectively. In humans, the estimated PK of DLX at a dose of 60 mg, once daily, and co-administered with DLX at a dose of 5000 or 10000 mg, once daily, for 7 days was simulated. The mean AUC of DLX in co-administration with PPL was increased by 10.4% and 19.6%, respectively, compared to those in DLX administration only.

Conclusion: This is the first study to evaluate the effects of PPL on DLX PK. The possibility of interaction between PPL and DLX should be noticed.

Psychiatry

299 | Outcomes comparison between risperdal consta and invega sustenna in veterans

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Introduction: Long-acting injectable antipsychotics (LAI-APs) have been integral in the management of schizophrenia and other psychiatric illnesses, such as bipolar disorder, in veterans. However, there are limited studies within LAI-APs, including Risperdal Consta (RC) and Invega Sustenna (IS). RC requires a 3-week oral overlap and is administered every 2 weeks, while IS does not require an oral overlap and is administered every 4 weeks.

Research Question or Hypothesis: Are there differences in psychiatric hospitalizations, medication nonadherence, and medication discontinuation between RC and IS?

Study Design: Retrospective chart review.

Methods: Veterans who have received at least 2 injections of either RC or IS between 01/01/2016 and 12/31/2018 at VA Loma Linda Healthcare System were included. Demographics and diagnoses were analyzed descriptively. Nonadherence was defined as missing an injection for a specified duration (>3 days for RC and > 7 days for IS). Pre-LAI-AP and post-LAI-AP hospitalizations were assessed using a pre-post design with equivalent time periods. Chi-Square, Fisher's Exact, and Mann-Whitney U tests were used for statistical analysis and *P*-value was set at <0.05 for statistical significance.

Results: Ninety-seven subjects were included in this study (44 on RC and 53 on IS). Subjects had a mean age of 46 ± 13.8 years, 92% were male, and 94% were diagnosed with schizophrenia or schizoaffective disorder. Subjects on RC were less likely to be rehospitalized (22.7% vs 47.2%, $P = 0.013$) and had less post-LAI-AP hospitalizations (0.4 ± 1.0 vs 0.9 ± 1.5, $P = 0.015$) compared to IS. However, subjects on RC had a shorter treatment duration (41.6 ± 40.2 vs 58.2 ± 45.7 weeks, $P = 0.043$) compared to IS. No differences were detected in nonadherence rates (25% vs 28.3%, $P = 0.715$) and discontinuation rates (68.2% vs 62.3%, $P = 0.543$) between RC and IS.

Conclusion: Veterans on RC were less likely to be rehospitalized and had less post-treatment psychiatric hospitalizations. Medication nonadherence and discontinuation rates were comparable between RC and IS. Future studies that include all VA institutions are warranted.

Pulmonary

300 | Clinical impact of a chronic obstructive pulmonary disease exacerbation care-path at an academic institution

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Introduction: Care-paths are used for disease states to improve patient care and reduce hospital admissions. There is conflicting data regarding impact of a chronic obstructive pulmonary disease (COPD) care-path on process indicators and clinical outcomes. A care-path with multidisciplinary interventions for management of COPD exacerbations was implemented at Cleveland Clinic in January 2017.

Research Question or Hypothesis: Determine the effectiveness of a care-path in improving COPD exacerbation process indicators and clinical outcomes

Study Design: Single-center, retrospective cohort study

Methods: Patients 40 years of age or older with a hospital admission between March 2017-March 2018 for COPD exacerbation were included. Exclusion criteria included: direct admission to an intensive care unit, heart failure exacerbation, underlying malignancy, interstitial lung disease, acute pulmonary embolus, pulmonary hypertension, or planned/completed lung transplant. The primary objective was composite of COPD exacerbation process indicators (scheduled short-acting bronchodilator, systemic corticosteroid, and prescription for a long-acting bronchodilator at discharge) in patients treated with the COPD care-path versus usual care. Secondary objectives included: composite of any scheduled bronchodilator, corticosteroid, and discharge long-acting bronchodilator; antibiotic therapy; all-cause/COPD-related 30-day readmission rates; and hospital length of stay.

Comparisons were made using inferential statistics (Stata, $P < 0.05$ significant).

Results: One-hundred fourteen patients were included (n = 66 in care-path group; n = 48 in usual care group). The primary composite endpoint was met by 81.8% of care-path patients versus 66.7% of usual care patients ($P = 0.06$). The secondary composite endpoint was met by 86.4% of care-path patients versus 70.8% of usual care patients ($P = 0.04$). Administration of any antibiotic was similar between groups, however, significantly more patients in the care-path group received oral antibiotic(s) (60.6% versus 33.3%, $P = 0.01$). There were no differences in other secondary objectives.

Conclusion: Utilization of a COPD care-path resulted in a clinically significant improvement in a composite of COPD exacerbation process indicators and increased use of oral antibiotic(s).

301 | Impact of a COPD care bundle on hospital readmission rates

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Introduction: Chronic obstructive pulmonary disease (COPD) is currently the third leading cause of hospital readmissions in the United States. In October 2014, the Centers for Medicare and Medicaid Services introduced penalties for hospitals with excess 30-day readmission rates following hospitalizations due to an acute exacerbation of COPD (AECOPD).

Research Question or Hypothesis: To evaluate whether a COPD care bundle (CCB) would reduce hospital readmission rates and improve patient outcomes in patients hospitalized with an AECOPD.

Study Design: Retrospective, pre-post intervention study

Methods: Inclusion criteria consisted of a hospitalization for AECOPD and age greater than 18 years. Patients who left against medical advice or refused the CCB were excluded. Interventions included disease state management, optimization of pharmacotherapy, outpatient follow up appointment arrangement, outpatient care coordination, and improved access to medications. Outcomes evaluated included 30-, 60- and 90-day all cause readmission rates, escalation of pharmacotherapy, and pharmacy interventions.

Results: A total of 189 patients were included in the control arm and 127 patients in the CCB arm. There was a reduction in 30-day readmissions between the control arm and CCB arm (21.7% vs. 11.8%, $P = 0.017$). There was also a reduction in 60-day (18% vs. 8.7%, $P = 0.013$) and 90-day readmissions (19.6% vs. 4.7%, $P < 0.001$). Transitions of care clinical pharmacists consulted with 68.5% of patients with an average time spent of 67.1 minutes per patient and identified an average of 2.8 medication errors per patient. An escalation in COPD maintenance therapy occurred more often in the CCB arm, (44.9% vs. 22.2%, $P < 0.001$). A follow up appointment was arranged for 82.7% of patients in the CCB arm. Screening for depression, anxiety, GERD, and sleep apnea was performed in more than 90% of patients in the CCB arm.

Conclusion: A COPD care bundle resulted in a significant reduction in 30- 60- and 90-day all cause hospital readmissions.

Substance Abuse/Toxicology

302 | Naloxone and opioid co-prescribing strategies in a family medicine residency program

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Introduction: Naloxone co-prescribing is now encouraged as a risk mitigation strategy to reduce opioid-related deaths. The CDC guideline recognizes patients at high risk of overdose as patients with an overdose or substance use history, high opioid dosages or concurrent benzodiazepine. The RIOSORD is a validated tool stratifying a patient's probability of experiencing opioid-induced respiratory depression across seven risk classes (risk class 1 [lowest risk] to 7 [high risk]). Within our family medicine clinic (FMC), naloxone is rarely written, suggesting naloxone co-prescribing is underutilized.

Research Question or Hypothesis: We hypothesize there are opportunities to promote harm reduction strategies by co-prescribing naloxone with opioids to high-risk patients.

Study Design: Retrospective, cross-sectional study

Methods: Prescriptions were included if they were for patients ≥18 years, seen in the FMC, and received an opioid prescription between January 1 and June 30, 2017. Prescriptions containing butalbital, tramadol and codeine-containing liquids as well as pregnant patients were excluded. The primary outcome was the prevalence of high-risk opioid prescriptions based on CDC recommendations or RIOSORD risk class 6 or higher. Secondary outcomes included individual risk factors and opioid-related patient outcomes.

Results: Across 439 unique patients and 988 prescriptions found 48% (n = 368) prescriptions were high risk based on the CDC recommendations and 7.7% (n = 76) based on the RIOSORD risk class. Individual risk factors from the CDC recommendations showed 26% (n = 252) prescriptions totaled >50 mg morphine equivalents/day, 2% (n = 28) of patients had a substance use disorder and 20% (n = 88) of patients were concurrently prescribed a benzodiazepine. The most common opioid prescribed was hydrocodone/acetaminophen (n = 730, 73.9%) for a mean duration of 19 ± 13 days with a median dose of 44 ± 41 mg morphine equivalents/day.

Conclusion: Many patients prescribed opioids from the family medicine clinic are considered high risk for overdose. There are opportunities for primary care providers to co-prescribe naloxone.

303 | Translational approaches to drug repurposing for the treatment of alcohol use disorder (AUD) using fenofibrate

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Introduction: Excessive alcohol consumption is estimated to cost $250 billion per year in the US. The current FDA approved medications for Alcohol Use Disorder (AUD) mechanisms of action are either to decrease the reward sensation or are not fully understood. Fenofibrate, a PPAR-α agonist, decreased voluntary alcohol drinking in animal models of AUD.
Research Question or Hypothesis: We seek to explore the effects of fenofibrate on human brain cells exposed to ethanol. We hypothesize fenofibrate will reduce inflammatory marker MCP-1 and IL-6 in brain cells that are treated with ethanol.
Study Design: Cell culture.
Methods: Normal human astrocytes were seeded at 5,000 cells/cm^2 and treated with clinically relevant concentrations of EtOH 0.08% and fenofibrate (10 mM) in triplicate. Relative gene expression of MCP-1 was analyzed using RT-PCR. MCP-1 and IL-6 protein production were quantified by ELISA. Results were compared using one-way ANOVA.
Results: The IL-6 production was not significantly lowered by fenofibrate. However, MCP-1 protein production (pg/mg of total protein) was lowered by fenofibrate even in the presence of EtOH (control 5129 ± 237 vs 2524 ± 191 fenofibrate or 2668 ± 285 EtOH + fenofibrate). Gene expression of MCP-1 was also statistically significant lowered by fenofibrate even in the presence of EtOH (46% fenofibrate alone and 48% in EtOH + fenofibrate).
Conclusion: Fenofibrate significantly reduced the inflammatory protein production and gene expression of MCP-1 in brain cells treated with EtOH. Further evaluation of fenofibrate's effects in various brain cells and additional concentrations of EtOH are warranted.

Transplant/Immunology

304 | Feasibility and potential of mobile health for pain management and education in kidney transplants

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Introduction: Over 10% of kidney transplant recipients (KTR) use opioids chronically after transplant. Opioid use before and after transplant has been associated with significant morbidity and mortality. The purpose of this study was to assess the utility of mHealth in educating KTR on pain management post-transplant.
Research Question or Hypothesis: What proportion of KTR perceive mobile health technology as helpful for pain management and are willing to adopt technology for reporting, education, and communication?
Study Design: A prospective, single-center, key informant interview (KII) qualitative analysis in KTR.
Methods: KIIs were conducted with KTR in the MUSC transplant clinic between August 2018- February 2019. Investigators gathered patient perspectives on pain, and used qualitative methodology to evaluate pain expectations, pain management, utility of technology for care team communication, and participant willingness to use mHealth for pain management.
Results: 50 KIIs were completed (42 kidney, 7 kidney/pancreas, and 1 kidney/liver) and analyzed. The majority (82%) had smartphones. A total of 22% (n = 11) experienced pain at least weekly. We asked how useful a smart phone would be in relaying information to care teams regarding pain perception and medication use. 70% (n = 35) reported a maximum effectiveness score of 5, 14% (n = 7) reported 4, 6% (n = 3) reported 3, 0 reported 2, and 12% (n = 6) reported 1. Only 4 (n = 2) had concerns about their doctor knowing the medications and methods they used to manage pain.
Conclusion: Pain is a common acute and chronic symptom experienced among KTR, occurring in 19% of recipients. Most participants had a smartphone and reported that they believed technology would be useful in reporting pain perception and medication utilization. Implementing mHealth technology may improve KTR pain management and medication use, potentially reducing downstream deleterious clinical outcomes.

305 | Desensitization strategies in heart transplant candidates: A survey of transplant pharmacists

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Introduction: Significant equipoise exists within the heart transplant (HT) community surrounding desensitization therapy.
Research Question or Hypothesis: The purpose of this project is to characterize the variance in desensitization practice patterns in sensitized patients listed for HT through survey of transplant pharmacists.
Study Design: Cross-sectional survey
Methods: A 20 item survey was created and distributed via an email listserv to transplant pharmacists in June through August 2018. Questions assessed the standard center practice for desensitization therapy as well as use of induction immunosuppression at the time of transplant. Responses were aggregated by center and analyzed utilizing Qualtrics survey software. Exempt IRB approval was obtained from Columbia University.
Results: The overall response rate was 38% (36/95). The majority of centers (21) do not routinely desensitize HT candidates, citing limited evidence for efficacy (42%) and concerns for drug toxicity (21%) as the most common reasons. For centers who desensitize, 100% reported a panel reactive antibody of greater than 50% was the threshold to consider therapy. The most common initial regimens were intravenous immunoglobulin (IVIg) combined with either plasmapheresis (37%) or with rituximab (37%). The most common second line regimen was bortezomib with plasmapheresis (50%). The most common measure of treatment success reported was a negative crossmatch and successful HT (50%). The decision to desensitize was not impacted by the presence of a left-ventricular assist device or antibody type (i.e. Class I versus Class II predominance). For sensitized patients without donor specific antibodies (DSA), the most common induction regimen was thymoglobulin alone (33%), followed by a corticosteroid alone (23%). For sensitized patients with DSA, the most common induction regimen was thymoglobulin alone (38%).
Conclusion: The majority of programs who responded to our survey do not routinely desensitize patients listed for HT. While some regimens were more common than others, significant variability in the approach to desensitization and induction were noted.

306 | Impact of protease inhibitor-based antiretroviral therapy on tacrolimus intrapatient variability in HIV+ kidney transplant recipients

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Introduction: HIV+ kidney transplant recipients (KTRs) experience higher rates of acute rejection, possibly due to interactions between protease-inhibitor (PI)-based highly active anti-retroviral therapy (HAART) and immunosuppression. Moreover, high tacrolimus (FK) intra-patient variability (IPV) has been associated with inferior outcomes in KTRs. While the effect of PI-based HAART on FK levels is well-recognized, pharmacists should consider whether these interactions result in high FK IPV, thereby affecting immune outcomes.
Research Question or Hypothesis: To evaluate the impact of PI-based HAART on FK IPV and immune outcomes
Study Design: Retrospective, single center observational study from 2007 to 2017 at Houston Methodist Hospital (Houston, Tx)
Methods: All adult HIV+ KTRs were included. FK levels between months 1 and 12 post-transplant were collected. Patients were classified into high or low IPV cohorts based on population median percent coefficient of variation [%CV = (σ/μ) x 100; σ, median; μ, mean]. Primary endpoint was FK IPV at 6 months in PI-based versus non-PI-based KTRs. Secondary endpoints included FK IPV at 12 months, biopsy-proven acute rejection, *de novo* donor specific antibodies, graft survival, and patient survival.
Results: Twenty-three HIV+ KTRs were included, of which 10 were receiving PI-based HAART. At 6 and 12 months, population median % CV were 35.8% and 41%, respectively. At 6 months, high IPV was experienced in 6/10 (60%) PI-based and 5/13 (38%) non-PI-based KTRs. At 12 months, high IPV was experienced in 7/10 (70%) PI-based and 4/13 (31%) non-PI-based KTRs. Median IPV was higher at 6 months (37.3% vs 26.8%, $P = 0.11$) and significantly higher at 12 months (57.8% vs. 30.9%, $P = 0.01$) in PI-based KTRs. No differences in immune outcomes were observed.
Conclusion: This data suggests higher FK IPV for HIV+ KTRs receiving PI-based HAART. While there were no differences in immune outcomes, the sample size was small. Larger studies are warranted to determine the impact of high IPV on immune outcomes in HIV+ KTRs.

307 | Effect of induction therapy on absolute CD4 count and CD4 percentage in HIV positive kidney transplant recipients

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Introduction: Anti-thymocyte globulin (ATG) induction causes profound and long-lasting lymphocyte depletion, with CD4 subset reconstitution lagging behind other subsets. While absolute CD4 count is the preferred monitoring parameter for disease progression and immune function in HIV+ patients, lymphocyte-depleting induction may render it unreliable. An alternative immune monitoring parameter

in HIV+ patients is CD4 percentage (%CD4). Since pharmacists assist in selection and duration of antimicrobial prophylaxis post-transplant, it is important to understand CD4 and %CD4 recovery in HIV+ kidney transplant recipients (KTRs).

Research Question or Hypothesis: To evaluate CD4 and %CD4 recovery following ATG in HIV+ KTRs

Study Design: Retrospective, single center observational study from 2007 to 2017 at Houston Methodist Hospital (Houston, TX).

Methods: Adult HIV+ KTRs receiving ATG were included if lymphocyte subset data was available. Recovery at 1 year post-transplant was defined according to CDC definitions for AIDS: absolute CD4 count ≥200 cells/μL or CD4 percentage ≥ 14%.

Results: Twenty-five HIV+ KTRs were identified and nine patients were included. Patients received standard maintenance immunosuppression per institutional protocol. At 1 year, 8 (89%) had absolute CD4 count ≥200 cells/μL and 8 (89%) had %CD4 ≥ 14%. Absolute CD4 count and %CD4 recovery were discordant in 2 cases. Median times to recovery of absolute CD4 count and %CD4 were 168 (IQR 56-177) and 53 (IQR 18-110) days, respectively. No breakthrough HIV viremia occurred. One patient experienced opportunistic infection. At 1 year, there were no graft losses or patient deaths.

Conclusion: This study suggests that although adequate recovery of both absolute CD4 count and %CD4 were observed following ATG, discordance between the values may exist. Furthermore, %CD4 may recover earlier than absolute CD4 count. To our knowledge, this is the first study assessing %CD4 monitoring in HIV+ transplant recipients. Understanding lymphocyte reconstitution and utility of %CD4 monitoring requires further investigation.

308 | Safety and efficacy of direct oral anticoagulants in abdominal transplant recipients

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Introduction: Direct oral anticoagulants (DOACs) are an attractive option for anticoagulation due to their standardized dosing and predictable pharmacokinetics, however their role in abdominal transplant recipients remains unclear.

Research Question or Hypothesis: We sought to identify prescribing patterns and outcomes in abdominal transplant recipients who were prescribed a DOAC within 6 months after transplantation.

Study Design: This was a health system-wide single arm retrospective chart review.

Methods: Patients were included if they received a kidney, liver, and/or pancreas transplant between October 2010 and May 2018 and received a DOAC for atrial fibrillation (AF) or venous thromboembolism (VTE) within 6 months of transplantation. Patient demographics, laboratory values, transplant information, DOAC dosing information, and interacting medications were collected. Patient outcomes were followed for 6 months to assess for incidence of bleeding and thrombotic events.

Results: 35 patients met inclusion criteria, with a median age of 58 years. The most commonly transplanted organ was kidney (69%) and most commonly prescribed DOAC was apixaban (91%). Indications for anticoagulation included AF (40%) and VTE (60%). The median time from transplant until DOAC start was 18 days. The DOAC was dosed correctly, according to the manufacturer's labeling, in 69% of patients. Two patients (6%) experienced breakthrough thrombotic events, and 8 patients (23%) experienced bleeding events, of which 4 (50%) were major bleeds. There were no differences between patients who experienced bleeding versus those who did not with regard to age, sex, renal function, transplanted organ, DOAC medication, dose, interacting medications, or concomitant aspirin use.

Conclusion: While DOACs are an alternative to traditional anticoagulation medications, such as vitamin K antagonists, in abdominal transplant recipients, patients taking DOACs must be counseled on and closely monitored for signs and symptoms of bleeding. Further research is needed to determine their safety and definitive place in anticoagulation therapy in this unique patient population.

309 | Clinical outcomes and risk factors for delayed or slow graft function in an adult, urban renal transplant population

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Introduction: Delayed graft function (DGF) and slow graft function (SGF) are associated with higher risk of rejection and suboptimal allograft function. DGF is an independent risk factor for the development of acute rejection. However, the clinical implications of SGF after renal transplant (RTx) are less defined.

Research Question or Hypothesis: Is there a difference in clinical outcomes and risk factors associated with patients who experience DGF or SGF?

Study Design: Retrospective chart review of adult RTx from 1/2015 to 10/2017

Methods: DGF was defined as need for dialysis before post-operative day (POD) 7. SGF was defined by <50% decrease in serum creatinine (SCr) from pre-RTx SCr or SCr ≥3.00 mg/dL by POD7. Primary outcome was incidence of patients with an eGFR ≥45 mL/min/1.73m^2 at 3 months post-RTx. Univariate and multivariate logistic regression

was performed to identify risk factors for acute-tubular necrosis (ATN) post-RTx.

Results: Total of 269 patients were analyzed. Patients were mostly African American (48.0%), male (63.9%), and received deceased donor RTxs (51.3%). Patients with ATN had significantly longer length of stay (LOS) ($P < 0.001$). Mean eGFR and incidence of eGFR ≥45 mL/min/1.73m^2 was highest in IGF patients at 3 months ($P = 0.003$); however, mean eGFR was similar at 12 months ($P = 0.175$). Incidence of biopsy-proven rejection (BPAR) was not significant ($P = 0.98$). Incidence of empirically treated rejection was significantly different (DGF 31.3% vs SGF 21.7% vs IGF 12.1%, $P = 0.012$). Graft loss at 12 months was similar ($P = 0.252$). In multivariate analysis, deceased donor RTx (DDRT) (OR = 7.23, $P = 0.001$), body mass index BMI (OR = 1.05, $P = 0.009$) and donor age (OR = 2.43, $P = 0.021$) significantly increased the risk for immediate post-RTx ATN. African American race did not impact ATN risk.

Conclusion: Immediate post-RTx ATN was associated with longer LOS and poorer acute allograft function. However, at 12 months, BPAR, allograft function, and graft survival were similar. BMI, DDRT, and donor age increased risk for ATN development.

310 | Evaluation of different transverse abdominis plane (TAP) blocks on opioid use following laparoscopic living donor nephrectomy

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Introduction: Opioids are often used to treat acute pain after surgery, but are associated with side effects such as respiratory depression, nausea, and constipation. Enhanced Recovery After Surgery (ERAS) protocols use a multimodal approach to facilitate recovery. This abstract describes the effects of three approaches to pain management following living donor nephrectomy.

Research Question or Hypothesis: Liposomal bupivacaine decreases opioid utilization following living donor nephrectomy

Study Design: Single center retrospective cohort study

Methods: Opioid requirements expressed as oral morphine equivalents (OME) and outcomes in consecutive live kidney donors were evaluated. In the Pre-ERAS (control) group, pain was managed with patient controlled analgesia (PCA). A bupivacaine transverse abdominis plane (TAP) block was used in the TAP group, whereas a liposomal bupivacaine (LB) TAP block was used in the third group.

Results: Data was available for 50 donors pre-ERAS, 96 in the TAP, and 31 in the LB groups. The utilization of PCA was 100%, 2.1% and 0% respectively. On post-operative day (POD) 0, the OME was lower in the LB and TAP groups compared to pre-ERAS (4.4, 9.6, and 25.4 mg, respectively, $P < 0.05$) as well as on POD 1 (15.7, 38.3, and 94.1 mg respectively, $P < 0.05$). OME was lower with LB compared to TAP (9.8 vs 22 mg, $P < 0.05$) on POD 2 but not on POD 3 (2.1 vs 8.2 mg, P=NS). The amount of opioids (in OME) prescribed at time of discharge was lower in the LB group (135.4 mg) compared to pre-ERAS (189.9 mg) and TAP (158.9 mg). The time spent in the post anesthesia care unit and length of stay were similar.

Conclusion: An ERAS protocol that employs bupivacaine or liposomal bupivacaine TAP block decreases the utilization of PCA and other opioids after living donor nephrectomy. A liposomal bupivacaine TAP block provides longer analgesia and further reduces the amount of opioids used and prescribed at discharge.

311 | Clinical implications of belatacept conversion a high risk urban renal transplant population

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Introduction: Conversion to belatacept as a component of maintenance immunosuppression has gained traction to prevent calcineurin inhibitor (CNI) induced toxicities in renal transplant (RTx) recipients. However, limited knowledge exists regarding the clinical impact of this strategy on high-risk, obese, and racially diverse patients.

Research Question or Hypothesis: Belatacept conversion in high risk, racially diverse kidney transplant recipients improves renal, cardiovascular, and metabolic health outcomes.

Study Design: This was a retrospective, observational, pre-post cohort study of high-risk patients who underwent RTx from 01/01/2012 to 12/31/2017 and were converted to belatacept. High risk RTx was defined as: African American race, panel reactive antibody >10%, re-transplant, or positive flow-crossmatch.

Methods: The primary outcome was to compare estimated glomerular filtration rate (eGFR) at time of belatacept conversion to 6 months post-conversion. Secondary outcomes included 1-year incidence of biopsy proven acute rejection (BPAR) post-conversion and comparisons of cardiovascular, metabolic, and infectious outcomes. Data were compared with McNemar's test, paired t-test, and Wilcoxon signed rank test.

Results: There were 32 RTx recipients that were analyzed. Majority of patients were male (71.9%), African American (71.9%), and obese (53.1%) undergoing belatacept conversion with a starting dose of 10 mg/kg (87.5%) at a median of 47.5 days post-RTx. The mean body mass index ± SD was 33.6 ± 10.4 kg/m2. CNI nephrotoxicity (65.6%)

was the major conversion indication. Estimated GFR improved significantly after converting to belatacept (pre-conversion 29.3 mL/min/1.73 m^2 vs. 6 months post-conversion 48.4 mL/min/1.73m^2, P = 0.003). Six patients (18.8%) experienced BPAR at a median of 123 (IQR 19-225) days post- conversion. There were no differences in the use of anti-hypertensive agents, low density lipoprotein, and glycosylated hemoglobin profiles pre and post-conversion (P > 0.05 for all).

Conclusion: Belatacept conversion can be accomplished in a high risk population. Despite increased incidence of BPAR after conversion, allograft function continued to improve throughout study period.

312 | Analysis of clinical outcomes associated with generic-to-generic interchange of tacrolimus in renal transplantation

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Introduction: Generic interchange is generally discouraged for narrow therapeutic index medications. Current literature on generic-to-generic interchangeability among immunosuppressants is sparse. Tacrolimus is a first-line agent in many renal transplantation protocols, but available studies have only investigated differences in brand-to-generic interchange.

Research Question or Hypothesis: To evaluate the effect on dosing and clinical outcomes with generic-to-generic interchange of tacrolimus.

Study Design: Retrospective cohort study of renal transplant patients followed by an outpatient transplant team at a large academic medical center.

Methods: Subjects were adult patients on stable doses of tacrolimus who switched from Sandoz® to Accord® manufacturer after August 2018. We excluded subjects for non-adherence, changes in trough goal, or initiating interacting or nephrotoxic medications during conversion. We screened 92 patients and included 64. The primary outcome was mean change in tacrolimus dose before and after conversion. The secondary outcome was mean change in tacrolimus trough level. The primary safety outcome was an increase in serum creatinine of greater than 0.5 mg/dL. Data were analyzed using SAS version 9.4.

Results: The mean change in dose was 0.172 mg (P = 0.011). One patient had a decrease in dose of 2 mg, eleven patients had a decrease of 1 mg, and two patients had an increase of 1 mg. Fifty patients had no change in dose. The mean change in trough level was a decrease of 0.084 ng/mL. The difference in trough level was not statistically significant (P = 0.777). One patient had an increase in serum creatinine of 0.66 mg/dL. The remaining patients did not have an increase in serum creatinine of greater than 0.5 mg/dL. The difference in serum creatinine was not statistically significant (P = 0.489).

Conclusion: Although the mean change in tacrolimus dose before and after generic interchange was statistically significantly different from zero, most patients did not require a change in dose.

313 | Utilization of direct acting oral anticoagulation in solid organ transplant patients: A national survey of institutional practices

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Introduction: High clinical practice variability exists regarding direct oral anticoagulant (DOAC) utilization and urgent reversal strategies in both the pre- and post-transplant stages. As DOACs approach the forefront of anticoagulation modalities, centers are faced with the need to reflect on their approach to this medication class. Limited data regarding DOACs and their reversal exists in transplant patients, introducing variable clinical practices.

Research Question or Hypothesis: What is the clinical landscape of DOAC utilization and reversal management pre- and post-transplantation?

Study Design: National survey

Methods: Survey of pharmacists was conducted to assess DOAC and urgent reversal practices among adult transplant programs in the United States. A 27-question online survey was distributed to members of transplant pharmacy organization listservs between 5/28/19-6/14/19.

Results: A total of 103 responses were received representing individual transplant organ programs (10.7% partial responses). Kidney (43.7%), heart (19.4%), and lung (19.4%) transplant programs were predominant responders. DOAC use was prohibited in 41.8% of programs in pre-transplant candidates. Of those that use DOACs, apixaban (57.5%) was the most popular, but many programs (27.5%) did not have a preference. At transplant surgery, reversal of DOAC was performed "as needed" (46.8%) or was not routine (38.3%). If reversal occurred, 4-factor prothrombin complex concentrate (factor Xa inhibitors, 82.4%) or idarucizumab (dabigatran, 75%) were preferred. DOAC use post-transplant was common (94.9%). A majority of centers follow FDA recommended dosing in the setting of drug-drug interactions (51.7%). Factors influencing DOAC prescribing include: renal function (23.8%), drug-drug interactions (23.1%), and insurance (19.9%). Limited data of DOAC use (64.1%) was the largest perceived risk in a transplant-specific population.

Conclusion: Clinical heterogeneity exists pre- and post-transplantation regarding DOAC utilization. More research is needed to refine the landscape of DOAC utilization in this specialty population.

314 | Clinical and metabolic implications of early corticosteroid withdrawal in pancreas and simultaneous pancreas-kidney transplant recipients: Long-term outcomes from a single center retrospective cohort

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Introduction: Tacrolimus, mycophenolate mofetil, and chronic corticosteroids (CCS) are the most popular immunosuppression regimen after pancreas transplantation. However, early corticosteroid withdrawal (ECSWD) is an increasingly popular immunosuppression modality. There is limited evidence regarding the long-term clinical efficacy and safety between ECSWD and CCS immunosuppression regimens after pancreas transplantation.
Research Question or Hypothesis: Pancreas transplant recipients maintained on ECSWD immunosuppression will have similar death-censored allograft survival compared to patients maintained on CCS.
Study Design: Single-center retrospective cohort study.
Methods: Adult pancreas transplant or simultaneous pancreas-kidney transplant (SPK) from 1/1/1997 to 10/1/2010 were included. Patients were excluded if there was <6-months follow-up or had graft failure <30 days post-transplant. The primary endpoint was to compare death-censored allograft survival 5 years post-transplant between CCS and ECSWD transplant recipients. Secondary efficacy endpoints compared rejection, allograft failure, and patient death at 5 and 10 years post-transplant. Metabolic and infectious outcomes will also be compared at 5 and 10 years post-transplant.
Results: Total of 79 patients were analyzed (ECSWD n = 47; CCS n = 32). The 5-year death-censored allograft survival was similar between groups (log-rank *P*-value = 0.15). Patient survival (logrank *P*-value = 0.77) and incidence of rejection (*P* = 0.24) were also similar at 5 post-transplantation. Hemoglobin A1C was significantly lower in ECSWD patients at 5-years (CCS 6.8 vs. ECSWD 5.5%, *P* = 0.008) and 10-years (CCS 6.7 vs ECSWD 5.5%, *P* = 0.008) post-transplant. Mean total cholesterol was lower in ECSWD patients at 5-years post-transplant (CCS 173.3 mg/dL vs ECSWD 146.2 mg/dl, *P* < 0.001). A lower incidence of ECSWD patients were hospitalized secondary to infection 10-years post-transplant (CCS 55% vs ECSWD 16.7%, *P* = 0.006).
Conclusion: ECSWD immunosuppression strategy yields similar long-term allograft survival and rejection outcomes post-pancreas transplant, but may provide improved metabolic and infectious profiles. Further research is warranted into the long-term implications of this immunosuppression modality.

Women's Health

315 | Assessment of long-acting reversible contraception use and knowledge among female doctor of pharmacy students

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Introduction: Despite being recommended first-line by the American College of Obstetricians and Gynecologists, long-acting reversible contraception (LARC) is underutilized in females of reproductive age.
Research Question or Hypothesis: To determine whether education received in the Pharm.D. curriculum impacts a student's likelihood and ability to recommend LARC in appropriate patients.
Study Design: Cross-sectional survey.
Methods: Female Pharm.D. Candidates were invited to complete an online survey which assessed personal contraceptive use and clinical knowledge of LARC. Clinical knowledge was assessed through 11 true/false questions and 7 patient case scenarios. The primary endpoints were the mean difference in knowledge scores and appropriate recommendations between those who received education prior (P3/P4 students) and those who did not (P1/P2 students). Chi-squared and t-tests were used to analyze categorical and continuous data, respectively.
Results: A total of 152 surveys were completed (68 P1/P2 and 83 P3/P4). Baseline demographics were similar between groups. Current hormonal contraception use was reported by 71.5%, of which 21.3% reported LARC use. Of those students not utilizing LARC, significantly less in the P3/P4 cohort identified lack of knowledge of LARC as a barrier to use (5.3% vs 28.6%, *P* = 0.003). Overall, concern for pain with insertion was the most commonly identified barrier to LARC use (53.5%). Compared to the P1/P2 cohort, the P3/P4 cohort achieved a higher mean score on the 11 question knowledge assessment (6.84 vs 4.62, *P* < 0.0001) and correctly identified patients for whom progestin-only contraception was indicated more frequently (75.6% vs 62.2%, *P* = 0.004). More P3/P4 students recommended LARC as the preferred contraceptive method for a healthy female of reproductive age, but the difference was not statistically significant (47.9% vs 33.3%, *P* = 0.11).
Conclusion: LARC education in the Pharm.D. curriculum significantly increased knowledge and impacted clinical recommendations, but further education on barriers to use is warranted to increase future pharmacists' comfort utilizing and recommending LARC.

316 | Adolescents' perceptions of contraception ACCeSS through pharmacies

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Introduction: Young people have the highest rates of unintended pregnancy, and state pharmacist contraceptive prescribing laws have been passed to improve access; however, pharmacist prescribing is markedly underutilized. To expand implementation, it is essential to understand patient perspectives on pharmacist prescribing, especially amongst young people.
Research Question or Hypothesis: How do adolescents perceive pharmacist prescribing as a method for obtaining contraception?
Study Design: Qualitative
Methods: As part of a larger pharmacy access study, we recruited 60 females, ages 14-21, from primary care and pediatric subspecialty clinics to complete simulated pharmacist contraception prescribing and a semi-structured qualitative interview. Participants were asked their perspectives on pharmacist prescribing, with up to 8 probing questions gathering additional information, such as "What would make you more comfortable getting your birth control directly from a pharmacist?" Interview transcripts were deductively analyzed to identify themes and subthemes. We compared responses between younger and older adolescents, and general and subspeciality clinics.
Results: Average age of participants was 17.0 years (STD 1.7 years), with 50% from both primary care and pediatric subspecialty clinics. Participants ≥18 years reported more sexual experience (67% vs. 31%, $P = 0.02$) and birth control use (71% vs 31%, $P = 0.01$). Overarching themes focused on accessibility, quality of care and knowledge, and comfort with pharmacist. Subthemes highlighted the need for improved confidential access, a desire for additional pharmacist training, and interactions with a pharmacist that can relate to the young person. Participants <18 years more commonly expressed the desire to use this service to increase contraception accessibility, while voicing concerns related to confidentiality and privacy. Subspecialty patients expressed support for pharmacist prescribing as a method to increase accessibility. Remaining themes were consistently identified across subgroups.
Conclusion: Consistent with reports from women of other ages, young people desire access to contraception that is safe, confidential, and easy. Pharmacy access to contraception should be expanded to include women <18 years.

317 | Emergency contraception counseling in community pharmacies: A comparison between states with pharmacist contraceptive prescribing versus without pharmacist prescribing

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Introduction: Pharmacists are often the sole source of emergency contraception (EC) information and counseling for patients, particularly since EC became available over the counter. California pharmacists have been able to prescribe oral EC for over 10 years upon completion of an EC training program.
Research Question or Hypothesis: Are there differences in patient EC counseling between pharmacists located in a state allowing pharmacist prescribing of emergency contraception versus a state without this expanded scope?
Study Design: Prospective, randomized, telephone-based survey
Methods: In 2017, telephone calls were placed to all community pharmacies within three large cities: San Diego and San Francisco in California represented expanded pharmacist scope, Atlanta, Georgia represented traditional scope. Researchers called posing as young adult females inquiring about EC via a structured script. Data collection utilized a standardized tool, including EC availability, patient age inquiry, and EC counseling points. Statistical analyses completed with SPSS.
Results: Researchers reached 393 pharmacists (CA 61%, GA 39%). Those indicating the pharmacy "[had] something that could be used after sex to not get pregnant" were included [87% (343); CA 92% (220) vs GA 80% (123); $P < 0.01$]. California pharmacists more frequently discussed ulipristal [CA 23% (50) vs GA 4% (5), $P < 0.01$], inquired when unprotected intercourse occurred (CA 21% vs 11%, $P = 0.02$), and indicated levonorgestrel "will work" or "will work but may be less effective" after 4 days (CA 67% vs GA 16%, $P < 0.01$). There were no differences in counseling frequency regarding efficacy window (CA 96% vs GA 92%, $P = 0.26$), weight (CA 1% vs GA 0%, $P = 0.31$), ongoing contraception (CA 2% vs GA 0%, $P = 0.33$), STD prevention and screening (0%), or unnecessary age inquiries (CA 2% vs GA 6%, $P = 0.18$).
Conclusion: Pharmacists practicing in states which offer expanded scope for pharmacist prescribed emergency contraceptives may be associated with providing improved access to oral EC and more accurate patient counseling.

318 | Hypothyroidism and the use of assisted reproductive technology: A case-control study among a population of insured women in the US

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Introduction: Correlations exist between hypothyroidism and pregnancy outcomes, however the association between hypothyroidism and using assisted reproductive technology (ART) is less understood.

Research Question or Hypothesis: Is there an association between hypothyroidism and the need for ART among a cohort of insured women in the US?

Study Design: Case-control study.

Methods: This study leverages nearly nine years of medical and pharmacy claims data (1/2007-9/2015) from the PHARMetrics Health Plan Claims Database. Cases were defined as women who used In-Vitro Fertilization (IVF) or Intrauterine Insemination (IUI), identified using ICD-9 code V23.85 or a procedure code used to bill for ART procedures (CPT codes 58322, 58970, 58974, 58976, 89280, and S4042). Controls were women with a normal pregnancy (ICD-9 code V22.0) with no prior indication of IVF/IUI. Women were excluded from being a control if they filled any medication used to treat infertility. Claims during the 12 months prior to the earliest ART or normal pregnancy event were used to identify hypothyroidism diagnoses (ICD-9 codes 243, 244). Cases and controls were matched on age and month of event. Multivariable logistic regression was used to estimate the association between hypothyroidism and ART while controlling for region, insurance type, and comorbidities via the Charlson Comorbidity Index (CCI).

Results: We identified 2,155 cases and 8,581 matched controls with an average age of 32 years. Twice as many cases had a prior hypothyroidism diagnosis than controls (8.54% versus 4.61% respectively; $\chi^2 = 42.47$, $P < 0.0001$). Odds of hypothyroidism were 81% higher in cases than controls (OR = 1.81, $P < 0.0001$) after adjusting for region, insurance type, and CCI.

Conclusion: Results indicate that women who use ART are more likely to have a hypothyroidism diagnosis. ART is associated with a higher risk of psychological, financial, and physical complications. Knowing about this association in advance can allow women with hypothyroidism to plan appropriately and shorten the time it takes to start a family.

LATE BREAKING ORIGINAL RESEARCH

ADR/Drug Interactions

319 | A review of the food and drug administration adverse event reporting system for tramadol related hypoglycemia

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Introduction: Tramadol is a central analgesic used for moderate to severe, acute and chronic pain. Hypoglycemia is a rare tramadol adverse effect that is described in the medical literature and package insert.

Research Question or Hypothesis: The purpose of this study was to review reports of tramadol and hypoglycemia in the Food and Drug Administration Adverse Event Reporting System (FAERS) database to determine a potential association.

Study Design: Retrospective case review

Methods: Disproportionality analysis with Bayesian correction was used to compare tramadol and hypoglycemia with other medications in FAERS using Empirica Signal Software. Empirical Bayesian geometric mean (EBGM) is a Bayesian correction of the relative reporting ratio (RR) based on the prior distribution of all RR values in the database. The results were considered significant if the fifth percentile of the EBGM distribution (EB05) > 2. Logistic regression odd-ratios (LROR) was used to determine if age, diabetes medications, and renal insufficiency masked the disproportionality of hypoglycemia with LR05 > 2 indicating a potential signal. The Interaction Signal Score (INTSS) was computed to determine the influence of predisposing risk factors' on the signal.

Results: Six hundred and five cases of tramadol associated hypoglycemia were reported in the FAERS database. Our disproportionality analysis results were not significant (EB05: 1.590) despite the increasing number of tramadol associated hypoglycemia cases over time. Tramadol associated hypoglycemia was significant in patients who did not take diabetes medications (EB05: 2.256; LR05: 2.2104), but not in patients receiving concomitant antidiabetic agents (EB05: 0.856; LR05: 1.5631). Renal insufficiency was not found to increase the risk of tramadol associated hypoglycemia (INTSS: 0.865). There was a significant signal for tramadol associated hypoglycemia in patients aged 0-1 years (LR05: 3.0240) and 2-4 years (LR05: 2.6853).

Conclusion: The results of our disproportionality analysis suggests a potential association between hypoglycemia and tramadol in patients not taking diabetes medications and patients <4 years.

Adult Medicine

320 | Carvedilol versus metoprolol succinate for heart failure with reduced ejection fraction and concomitant cocaine use

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Introduction: Concern for unopposed alpha-stimulation may influence the decision to prescribe beta-blockers in patients with heart failure with reduced ejection fraction (HFrEF) and concomitant cocaine use. In this population, it remains unclear if the alpha-antagonist property of carvedilol provides additional benefit over the selective beta-antagonism of metoprolol succinate.

Research Question or Hypothesis: This study aimed to compare outcomes associated with the use of carvedilol versus metoprolol succinate in patients with HFrEF and concomitant cocaine use.

Study Design: This is a single health-system, retrospective, cohort study at academic medical centers in Ohio.

Methods: Adult patients with HFrEF, cocaine use, and an outpatient prescription for carvedilol or metoprolol succinate between January 2013 and November 2018 were evaluated for inclusion. The incidence of a composite of improvement in left ventricular ejection fraction (LVEF) to >40%, maintenance of or improvement to New York Heart Association (NYHA) classification I or II, or no heart failure (HF)-related hospitalization was assessed as well as each individual outcome separately. Risk factors for HF-related hospitalization were identified through a multivariate logistic regression.

Results: 129 patients (90 carvedilol, 39 metoprolol succinate) were included in the final analysis. No significant difference was found for carvedilol compared to metoprolol succinate in the composite outcome (90 vs. 95%, 95% confidence interval -0.055 to 0.155) or in the individual LVEF (40 vs. 39%, P = 0.85), NYHA classification (88 vs. 95%, P = 0.68), or HF-related hospitalization (30 vs. 23%, P = 0.55) outcomes. An increased risk of HF-related hospitalization was found with age > 50 years and habitual cocaine use while enrollment NYHA classification I or II was protective (Hosmer-Lemeshow statistic P = 0.96).

Conclusion: Carvedilol and metoprolol succinate have similar efficacy in the treatment of patients with HFrEF and concomitant cocaine use. Patients age > 50 years and those with habitual cocaine use are at a higher risk for HF-related hospitalization.

Ambulatory Care

321 | Exploring the medication experience of patients with heart failure to optimize medication therapy management (MTM) service: A qualitative study

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Introduction: Medication experience, which has been a practical concept applied in medication therapy management (MTM) services delivered by pharmacists, provides an understanding of patients' medication taking behavior and guides health care practitioners to identify medication-related problems (MRP). Non-adherence to polypharmacy is a major MRP in Heart failure (HF) patients that causes hospitalization and increases treatment burden. It's important for MTM service to investigate the medication experience of the group, yet is unclear.

Research Question or Hypothesis: To explore the medication experience of HF patients: understanding how they think the medications, knowing the beliefs and expectations of medications, realizing how life and feelings be changed, and including why they self-adjust their medication.

Study Design: A qualitative research using hermeneutic phenomenology approach to interpret the findings.

Methods: A semi-structured guide was used to interview participants. Patients with HFrEF who had been prescribed HF medications for at least 6 months were recruited from pharmacy clinics or cardiology clinics. All interviews were performed by the pharmacist practicing in ambulatory care. Thematic analysis was used by Atlas.ti 8.0 software to interpret transcripts.

Results: Nine interviews were conducted. Each participants took at least five prescription drugs. Aged from 57-73. Hypertension and diabetes were the two most common comorbidities. There were four main themes identified: Medications keep them alive; Patients still had expectations and beliefs of a “tired heart”; Patients are living with a double-edged sword; Patients wanted to be the masters of their own hearts.

Conclusion: HF patients experienced troubles of life caused by drugs. The yearning for medical information were noticed, which may be an important area for MTM services. Although the sample sizes were small, the significance of this study was that finding the expectation gaps towards to their HF medications may be the cause of MRP. Healthcare professionals are encouraged to have more dialogues with their HF patients to optimize long-term care.

322 | Ambulatory pharmacists reduce medication related problems (MRPs) through Transitional Care Management (TCM) collaborative practice with hospitalists

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Introduction: The transition between hospital and community can result in medication related problems (MRPs) leading to hospital readmissions. Resolution of MRPs after discharge is challenging due to complexities of navigating the healthcare system. The national

30-day all-cause readmission rate for 2018 was 18.5% and 14.6% for Arizona.

Research Question or Hypothesis: What is the impact of a pharmacist collaborative practice for Transitional Care Management (TCM) on resolution of MRPs to decrease risk of hospital readmission?

Study Design: Retrospective chart review, multi-center pilot study.

Methods: Patients discharged from one of five hospitals within a large health system were provided with a 24-7 nurse helpline. Inbound calls with at least one MRP were directed to the pharmacist. The collaborative practice with the hospitalist allowed the pharmacist to resolve MRPs such as therapeutic interchanges, discontinue duplicate therapy, and transmit new prescriptions. Outcomes were collected through chart review. The primary outcome is the number of pharmacist interventions. The secondary outcome is 30-day all-cause readmission rate.

Results: A total of 88 patients were included in the analysis. The primary outcome of pharmacist interventions was 7.1 per patient. There were 4.8 clinical interventions and 2.3 operational interventions per patient. Common clinical interventions include: medication education 20%, medication reconciliation 17% and drug therapy recommendation 11%. Common operational interventions include: transmit new prescription 18% and copay assistance 7%. The secondary outcome of 30-day all-cause readmission rate was 8%. On average 40 minutes was spent per patient.

Conclusion: This pilot study demonstrates pharmacists can resolve MRPs after hospital discharge, under collaborative practice, and reduce 30-day all-cause readmissions. This pilot study supported the approval of one pharmacist FTE position financially supported by the TCM program with anticipated growth in 2020.

Clinical Administration

323 | An implementation science approach to improving intravenous albumin stewardship in adult inpatients

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Introduction: Although albumin use in inpatients is common, evidence for improved outcomes over crystalloids are limited, making albumin stewardship an attractive improvement target given its high relative costs. Retrospective internal evaluations demonstrated limited guideline-concordant albumin prescribing and demonstrated patient harm associated with inappropriate dosing. We hypothesized that directing providers to evidence-based albumin use with clinical decision support and institutional guidelines would improve appropriate albumin stewardship.

Research Question or Hypothesis: Does a pharmacist-led, multifaceted approach to adult albumin stewardship optimize albumin use at an academic medical center?

Study Design: Retrospective cohort study

Methods: This retrospective, cohort study evaluated the impact of a multifaceted intervention on albumin use in adult inpatients at a tertiary academic medical center 15 months before and after implementation began (January 2017 to June 2019). Using the precede-proceed implementation science model, we performed a gap analysis and evaluated predisposing, enabling and reinforcing factors before implementing and evaluating the intervention. Interventions included institutional guidelines, an indication-based order set with clinical decision support, and an education and awareness campaign. The primary outcome was the monthly volume of albumin administered normalized for inpatient census days (mL/1000 patient-days). Secondary outcomes included aggregate volume of albumin administered, direct drug costs, percentage of guideline-concordant albumin orders, and provider prescribing confidence. Analyses were performed using Stata version 15; the primary outcome was evaluated using descriptive statistics and an unpaired t-test.

Results: Across the study period, 19,358 albumin doses were given to 4,946 patients. Mean monthly albumin use (mL/1000 patient-days) was 18,386 +/- 2,533 before and 15,561 +/- 2,538 after the intervention (P = 0.0025). Total albumin use was reduced by 25,653 mL/1000 patient-days, resulting in a direct cost savings of $169,273.

Conclusion: A multifaceted intervention with an emphasis on an evidence-based decision support significantly reduced albumin prescribing at an academic medical center.

Community Pharmacy Practice

324 | Assessment of the implementation of pharmacists' prescriptive authority to furnish hormonal contraceptives, naloxone, and nicotine replacement therapy in California as allowed by the board of pharmacy

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Introduction: California Senate Bill 493 expands pharmacists' scope of practice by authorizing a pharmacist to furnish self-administered hormonal contraceptives, naloxone, and nicotine replacement therapy (NRT). However, implementation of services has been limited for various reasons, including lack of reimbursement, time, labor, training, or awareness. This study is designed to assess the implementation of the aforementioned services in order to facilitate the development of strategies to expand them.

Research Question or Hypothesis: To assess the implementation of pharmacists' prescriptive authority to furnish hormonal contraceptives, naloxone and NRT in California as allowed by the Board of Pharmacy.

Study Design: IRB-approved descriptive study utilizing a web-based survey instrument.

Methods: The research methodology is quantitative analysis of data collection using an anonymous questionnaire administered via SurveyMonkey. This survey is distributed to pharmacists, intern-pharmacists, pharmacy technicians in California. The survey consists of ten questions designed to gather information regarding participants' awareness of pharmacists' prescriptive authority. Responses are collected anonymously and in aggregate. Original data is collected from human subjects without archival data and are analyzed using Microsoft Excel.

Results: There are a total of 84 respondents: 57% pharmacists, 26% intern pharmacists, 5% pharmacy technicians, and 12% unidentified. Most respondents are aware that pharmacists have the authority to furnish hormonal contraceptives (83%), naloxone (79%) and NRT (76%).

Respondents report that they offer services for the following: contraceptives (50%), naloxone (57%) and NRT (40%). However, the primary barrier to providing the services is the "lack of time and labor" (31%).

Conclusion: The results demonstrate that there is an awareness of pharmacists' prescriptive authority to furnish contraceptives, naloxone, and NRT, however lack of time and labor impede pharmacists' ability to utilize the expanded scope of practice.

Critical Care

325 | Efficacy and safety of phenytoin in traumatic brain injury in Level 1 trauma center in QATAR

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Introduction: Traumatic brain injury (TBI) is the leading cause of premature mortality and long-term disability. Early onset post traumatic seizure is a major complication of TBI which may lead to poor outcomes. We aimed to compare phenytoin prophylaxis to no phenytoin treatment in TBI patients.

Research Question or Hypothesis: Administering no phenytoin is as effective as phenytoin post-TBI prophylaxis in preventing seizures.

Study Design: This is a retrospective study

Methods: This was a retrospective cohort study based on reviewing patient charts from May 2016 to December 2017, at level 1 trauma center in Doha, Qatar. Patients were divided into 2 groups based on phenytoin use. Outcomes included the early onset (within 10 days of TBI) of seizure, hospital stay, and mortality. Data were analyzed and compared using Chi-square test, with $P < 0.05$ as significant.

Results: Of 634 patients included in the study, 181 patients received phenytoin while 453 patients did not receive any seizure prophylaxis. 22.7 % of the patients who developed seizures after reviving phenytoin had previous history of seizures. Based on the severity of TBI, 3.4 % of the "mild"TBI group (GCS = 13-15) received phenytoin, whereas 43.9 % of the "moderate" TBI group (GCS = 9-12), and 52.7 % of the "severe " TBI group (GCS = 3-8) received phenytoin. Overall, 7.1 % developed early seizures among the phenytoin, group while none developed seizures among the non-phenytoin group ($P = 0.03$). Liver enzyme elevation and hypotension with phenytoin were not significant.

Conclusion: Non-Phenytoin use was associated with a reduction in early seizure onset in TBI patient with no significant side effects and potentially less cost.

326 | Population pharmacokinetics of cefpirome in critically ill patients during extracorporeal membrane oxygenation

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Introduction: Patients receiving veno-arterial extracorporeal membrane oxygenation (VA-ECMO) should be administered antibiotics such as cefpirome, fourth-generation cephalosporin, due to the high risk of infection. Although pharmacokinetics (PK) of drugs are generally expected to be altered in patients receiving ECMO, no previous study on the PK changes of cefpirome during ECMO has been investigated.

Research Question or Hypothesis: Will the PK parameters of cefpirome change in patients receiving ECMO?

Study Design: A prospective cohort, population PK study of cefpirome

Methods: This study included critically ill patients who received cefpirome during VA ECMO as per hospital protocol. Blood samples were collected on ECMO (ON-ECMO) and after ECMO termination (OFF-ECMO as control) at 0 min (predosing) and 0.5-1 h, 2-3 h, 4-6 h, 8-10 h, and 12 h from cefpirome administration. A population PK model was developed using nonlinear mixed effects modelling. To validate the final PK model, nonparametric bootstrap analysis was performed.

Results: Fifteen adult patients were eligible. The PK of cefpirome was best explained by a two-compartment model with proportional residual errors. The final PK model was described as follows: clearance (CL) = $5.7 \times 0.5^{\text{(serum creatinine (mg/dL)/1.6)}} \times 1.4^{\text{ECMO (ON-ECMO = 1, OFF-ECMO = 0)}}$ L/h, coefficient of variation (CV) = 35.1%; central volume of distribution (V1) = $2.7 \times 4.2^{\text{ECMO}}$ L, 37.4%; peripheral volume of distribution (V2) = 16.7 L, 47.5%; intercompartmental clearance = 9.43 L/h. Interindividual variability (IIV) were included for CL, V1 and V2. All PK parameters were included in 95% CI of bootstrap result. In our PK model, when serum creatinine level was equal, the presence of ECMO was reported to increase CL and V1 by 1.4- and 4.2-fold respectively.

Conclusion: We have established the changes of PK parameter that CL and V1 of cefpirome were increased in patients receiving VA-ECMO compared with patients not receiving VA-ECMO.

Drug Information

327 | The accuracy and completeness of Google snippets

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Introduction: The internet has become a widely used health and drug information resource for consumers because of accessibility. In 2014, Google introduced the "Snippet Block" or Google Snippets to programmatically search available websites to answer a question entered into the search bar without the need for the user to enter any websites. This new feature offers consumers an even easier and expedited way to obtain drug information.

Research Question or Hypothesis: This study evaluated the accuracy and completeness of drug information found in Google Snippets compared to the U.S. Food and Drug Administration medication guides of ten drugs.

Study Design: Prospective, cross sectional, observational study

Methods: Ten outpatient drugs were selected from the 2018 Clinical Drugstats Database Medical Expenditure Panel Survey. The six domains in the medication guide for each drug were entered as questions into the Google search engine to find the Google snippet. The accuracy and completeness of drug information in the Google Snippets were quantified by two different pharmacists using a scoring system of 1 (less than 25% accurate/complete information) to 5 (100% accurate/complete information).

Results: For five out of the six domains, the information in the Google Snippets had less than 50% accuracy and completeness compared to the medication guides. The average accuracy and completeness scores of the Google Snippets were highest for the "What are the ingredients of [the drug]?" domain, with scores of 3.38 (51-75%) and 3.00 (51-75%), respectively. The domain that had the lowest score was the "How to take [drug]?" with averages of 1.00 (<25%) for both accuracy and completeness.

Conclusion: The use of Google Snippets may be easy and convenient for consumers; however, this study suggests there is inaccurate and incomplete drug information found in this source when compared to the medication guide.

328 | Pharmacists' familiarity with the Food and Drug Administration (FDA) approval process and breakthrough therapy designation

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Introduction: Food and Drug Administration (FDA) accelerated approval pathways were created to accelerate the drug approval process for rare medical conditions. Created in 2012, the Breakthrough Therapy Designation (BTD) is the most recent. Surveys suggest the BTD terminology results in an exaggerated perceived benefit by both physicians and consumers.

Research Question or Hypothesis: What is the pharmacists' perception and knowledge of FDA and BTD drug approval process?

Study Design: Cross-sectional survey

Methods: Clinical pharmacists were identified using publicly available professional membership information. The survey was replicated from published surveys and consisted of questions related to the FDA approval process and the BTD. Additionally, there were questions related to 4 hypothetical media releases for a new cancer drug. Confidence intervals using the Wilson method and the Wald method and associations using the Pearson $\chi 2$ test and Cochran-Mantel-Haenszel were included. A 2-tailed P value less than .05 was considered significant.

Results: Approximately ten percent of the pharmacists responded to the survey. The majority of participants were women (70.2%) and had completed post-graduate training (85.8%). Nine percent (95% CI 5.8 to 13.6) answered all 3 questions about the FDA approval process questions correctly. While only 24% of participants identified as being familiar with the BTD, the majority answered at least 2 of the 3 answers (78%) correctly. Nonetheless, 88.5% (95% CI 83.5 to 92.2) preferred the drug designated *Breakthrough* in the hypothetical scenario. In the mock media releases, significantly more pharmacists thought there was strong evidence of benefit in the breakthrough/

warning group compared to facts alone (between group difference 32.8%; 95% CI 14.5% to 51.1%; $P < 0.001$).

Conclusion: Pharmacists tend to have a better familiarity with the FDA approval process and BTD than physicians, but they still feel unfamiliar with the implications of the BTD. Pharmacists preferred a drug with BTD for patients and may overestimate the proven benefit demonstrated by these drugs.

Education/Training

329 | Impact of group size on oral exam scores in a didactic ambulatory care elective

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Introduction: In pharmacy education, student group work is often used to build the skills and abilities required to work on a healthcare team. However, there is mixed data to determine if group size may ultimately impact individual grade performance and this data is largely limited to undergraduate education.

Research Question or Hypothesis: In a didactic ambulatory care elective, does group size for course projects impact individual performance on midpoint and final exams?

Study Design: Retrospective observational study

Methods: In a semester-long ambulatory care elective, students work in groups to evaluate 5-6 patient cases, identify and review pertinent primary literature and communicate a treatment plan in SOAP format. Students are assessed using a midterm and final exam, in which they review a patient case, develop an evidenced-based plan which is presented orally to a faculty member. Group size has fluctuated over the years based on many factors including course enrollment, student evaluation of workload and faculty availability. A Pearson correlation was calculated using SAS 9.4 TS Level 1 M3 to determine if group size affected individual performance on the midterm and final exams. The study was exempted by the institution's research review board.

Results: From 2010-2018, a total of 165 students were enrolled in the ambulatory care elective, with an average of 18 students enrolled each offering. Group size ranged from 2-5 members. The majority of students were in a group of 5 members (48.5%) followed by 3 and 4 member groups (20% each). There was no correlation found between group size and individual midterm exam scores ($r = -0.116$; $P = 0.1634$) or final exam scores ($r = 0.123$; $P = 0.1149$).

Conclusion: Group sizes in a didactic ambulatory care elective may vary without negatively impacting individual student performance on exams. This may be useful when external factors such as overall class size or workload influence group size.

330 | Incorporation of reflective digital storytelling in pharmacy pedagogy

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Introduction: Understanding integrative medicine and the role pharmacist play in this setting is a core objective in the Complementary and Alternative Medicine (CAM) course. At the Chinese University of Hong Kong School of Pharmacy, the CAM course is delivered to all final year pharmacy students. It is observed that traditional teaching components such as lectures and written assignments resulted in suboptimal comprehension of the subject from course evaluation surveys. We aimed to investigate the use of reflective digital storytelling in engaging and improving student learning.

Research Question or Hypothesis: The incorporation of "Reflective Digital Portrayal" element in the CAM course is expected to result in better understanding of integrative medicine.

Study Design: We employed an observational cohort design comparing the latest course evaluation survey results with previous year.

Methods: Reflective digital portrayal was implemented in the current 2018-19 school year. Students were divided into five groups to examine various disease/conditions (eg. respiratory diseases, stroke rehabilitation, cancer supportive care, pain management, and pediatric ailments). They then reenacted how integrative medicine is practiced and role of pharmacists in managing those patients in a multimedia video. Students' feedback were collected after course completion. Wilcoxon signed-rank test was used to examine the primary endpoint, the course satisfaction score difference between 2018-19 and 2017-18 school years.

Results: Fifty-seven completed course evaluation surveys were collected. Students completed the course in 2018-19 school year gave a significant higher overall course satisfaction score compared to the previous year, 4.89 out 6 vs. 4.42 (mean difference + 0.47, $P < 0.02$). Higher percentage of students "somewhat agree" or "agree" the course "effectively prepared you for pharmacy practice in the area of integrative medicine", 89.4% vs. 62.5%. More students also indicated "the course was stimulating", 79.5% vs. 47.7%.

Conclusion: Immersive active learning such as reflective digital portrayal may be a better way to improve learning outcomes for the topic of CAM.

331 | Using entrustable professional activities (EPAs) to evaluate pharmacist skills in a 3-year accelerated pharmacy curriculum through surveying practice faculty, preceptors and community stakeholders

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Introduction: The American Association of Colleges of Pharmacy (AACP) recommends utilizing EPAs to ensure students are practice-ready upon graduation. EPAs are core activities and tasks that new graduates should be able to complete independently, and can therefore guide coverage of clinical skills within the curriculum. To date, AACP has not provided recommendations on how to ensure these EPA's are adequately covered.

Research Question or Hypothesis: How will pharmacy practice faculty, preceptors and community partners categorize EPA's into established tiers?

Study Design: Using a previously developed tier system to categorize EPA's a quantitative study was conducted to validate the tier system through input from practice faculty, preceptors and community partners. Skills were defined as: Tier 1 - covered and required assessment within the classroom skills based curricula (pre-APPE); Tier 2 - covered but no required assessment within classroom skills based curricula (pre-APPE); Tier 3 - covered via APPE experiences, optionally covered in the classroom skills based curricula (pre-APPE)

Methods: Practice faculty, preceptors and community partners were asked to complete a survey to determine how they would categorize each EPA using the tiers. A mean was calculated for each EPA and the resulting score was used to assign each skill a final tier categorization.

Results: A total of 29 pharmacy practice faculty, preceptors and community partners associated with Pacific University Oregon School of Pharmacy completed the survey. Using this data, 5/15 (33%) EPA's were categorized as tier 1, 9/15 (60%) were categorized as tier 2, 1/15 (6.7%) were categorized as tier 3.

Conclusion: Having faculty, preceptors and community partners provide input to the tiers for each EPA aided in finalizing the backbone of our skills based curriculum. These categories were used in skills based curriculum mapping, planning and are included within course syllabi. Identifying if other programs would be able to agree on tier categorization could be a useful next step.

Emergency Medicine

332 | Opioid stewardship in the emergency department—Assessment of chronic pain through the use of an Electronic Chronic Pain Questionnaire (eCPQ) and CURES data

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Introduction: There are a significant number of patients with chronic pain who are routinely seen in the emergency department. This project was developed in an effort to provide a meaningful classification of the types of chronic pain while guiding healthcare providers toward appropriate use of prescription opioids.

Research Question or Hypothesis: Can using a validated electronic chronic pain Questionnaire (eCPQ) along with data from CURES guide Emergency Medicine physicians toward guideline-recommended therapy for the treatment of chronic pain and reduce over-prescribing of opioids?

Study Design: This was a prospective cohort study of patients aged ≥18 seen in the emergency department for chronic pain between July 2018 and June 2019. A total of 200 hundred patients were enrolled.

Methods: Patients with a diagnosis of chronic pain were identified and administered the validated chronic pain questionnaire (eCPQ) to determine the type of pain, nociceptive or neuropathic. A CURES report was generated for each patient. The combined results were presented to the ED physician along with a thorough review of the electronic medical record. The ED pharmacist recommended an appropriate pain regimen based on the results.

Results: There was a reduction of opioid prescriptions in the Intervention group, decreasing by 48.5% among patients identified as having neuropathic pain, a 14.5% improvement over the 34% discontinuation rate in the Control group. Similarly, there was a reduction of opioid and benzodiazepine prescriptions, particularly in patients with neuropathic pain. Overall, there was a significant difference between discontinuation in the Intervention group versus the Control group (15.1% and 2%, respectively). Among patients who were classified as having neuropathic pain, there was also a significant decrease between the Intervention and Control groups (21.2% and 0%, respectively).

Conclusion: Through the use of the eCPQ screener and CURES database, providers were able to initiate appropriate therapy for patients experiencing chronic pain while reducing opioid utilization.

333 | Antibiotic prescribing patterns for urinary tract infections within emergency department and urgent care settings

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Introduction: Urinary tract infections (UTI) are a common reason for emergency department (ED) and urgent care (UC) visits. Fluoroquinolones (FQ) are frequently prescribed for treatment of UTI in the outpatient setting; however, data evaluating prescribing patterns after FDA safety warnings is limited, especially in UC.

Research Question or Hypothesis: To investigate and compare antimicrobial prescribing for treatment of UTI in a single-site ED and an off-site UC in an urban, academic health system.
Study Design: Retrospective
Methods: ICD-10 codes were used to identify patients presenting with a UTI to the ED or UC between January and June 2018.Those 18 years or older with uncomplicated, complicated UTI, or pyelonephritis were included. Exclusion criteria were catheter-related UTI, urinary tract abnormalities, immunocompromised, or hospitalization. Primary outcome was FQ prescribing rate for all UTI in the ED and UC. Secondary outcomes were rates of non-FQ prescribing, re-presentation, bug-drug mismatch, and treatment durations. Chi squared or Fisher's exact test was performed for categorical variables and Mann-Whitney *U*test for continuous data. Multivariate logistic regression identified predictors of fluoroquinolone use.
Results: 184 patients were included. Patients in ED (n = 104) and UC (n = 80) were close in age and mostly female. FQ prescribing rate was similar in ED and UC (21.2% vs. 16.3%, $P = 0.4$). Non-FQs prescribed in ED and UC were nitrofurantoin (20.2% vs 53.6%), beta-lactams (46.1% vs 22.6%), and trimethoprim/sulfamethoxazole (12.5% vs. 5%). A longer than recommended duration was identified in 46.3% UC patients compared to 21.2% ED patients. Of 11 patients with bug-drug mismatch, 10 received follow-up. Thirty-day re-presentation with persistent UTI symptoms occurred more frequently in the ED compared to UC (13.5% vs. 7.5%). Predictors of FQ prescribing on logistic regression ($P < 0.05$) were male, recurrent UTI, and malignancy.
Conclusion: FQ prescribing rate for UTI was low with no difference between ED and UC. Opportunity exists to improve treatment duration and antimicrobial choice.

Endocrinology

334 | Impact of a pharmacist-led intervention on glycemic control in diabetic patients in a setting with economic constraints

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Introduction: Improving glycemic control is associated with good cardiovascular outcomes in diabetic patients. In developed practice settings, clinical pharmacist interventions have a positive impact on the health of diabetic patients. A similar impact was not ascertained in environments with socio-economic challenges.
Research Question or Hypothesis: Assessment of a structured clinical pharmacist intervention: insulin dose adjustment, addition of pre-prandial mid-day regular insulin, patient education, and follow-up, on glycemic control for diabetic patients on twice-daily pre-mixed insulin therapy.
Study Design: Randomized open label clinical trial.
Methods: 120 diabetic patients were recruited from Ministry of Health hospitals (with a restricted formulary for insulin options) and randomly allocated into control intervention groups. Inclusion and exclusion criteria were developed to avoid enrollment of patients either at high risk of serious hypoglycemia or with poor tolerance to potential hypoglycemic episodes.
Results: After three months of follow up, patients in the intervention group achieved twice as much HbA1c reduction as in the control group (-1.2 ± 0.15 vs. -0.58 ± 0.15, $P < 0.01$). The overall odds ratio (OR) for HbA1c reduction at least by 1% for intervention subjects was 3.2 (95% CI 1.45-7.08). OR remained high for particular patient groups; HbA1c >8.5% (4.8, 95% CI 1.91-12), BMI >30 kg/m2 (2.68, 95% CI 1.05-6.83), illiterate patients (13.66, 95% CI 3.56-52.45), and age > 50 (2.86, 95% CI 1-8.18). While higher HbA1c favored a better glycemic control outcome in the intervention group (OR 18.67, 95% CI 2.07-168.2), BMI, illiteracy, or age did not appear to have this effect.
Conclusion: Using the available therapeutic tools in economically challenged environments, intervention by clinical pharmacists enabled more patients to achieve HbA1c reduction of ≥1%. Factors related to the socioeconomic milieu (illiteracy and obesity) did not seem to confound a positive outcome. The impact of the clinical pharmacist intervention plateaued within three months for most of the observed patients.

335 | The comparison of orlistat and lorcaserin monotherapy with their combination therapy in short-term weight loss effect in Asian population

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Introduction: One in every two adults in Taiwan is overweight or obese, body mass index (BMI) >25 kg/m2 according to Asia-Pacific guidelines. The weight loss medications currently approved in Taiwan are orlistat (2000) and lorcaserin (2017). Both have significant effects on weight reduction. However, the synergic effect of the two drugs remains unclear.
Research Question or Hypothesis: Is orlistat dual therapy with lorcaserin more effective than their monotherapy in weight reduction?
Study Design: A retrospective observational study of outpatients from a medical center in Taiwan.

Methods: Patients with BMI >25 kg/m2 or > 23 kg/m2 with at least one weight-related comorbidity were included. These patients had either orlistat 120 mg BID, lorcaserin 10 mg BID or combined therapy with orlistat 120 mg QD for three months between 2018-2019 and classified into three groups. The outcome was absolute and percentage change in weight from baseline to three months. ANOVA and post-hoc test were used to compare the outcome and identify the difference between the groups.

Results: A total of 83 patients were enrolled, of whom 13 patients (15.7%) used orlistat, 41 patients (49.4%) used lorcaserin and 29 patients (34.9%) had dual therapy. Baseline mean body weight were 86.4 ± 17.78 kg, 91.6 ± 28.13 kg and 90.4 ± 17.48 kg respectively. After three months, the mean weight reduction in relative percentage were 4.0 +/- 2.92 for orlistat, 6.3 +/- 3.88 for lorcaserin and 4.4 +/- 2.63 for dual therapy. Weight reduction was significant in all groups ($P < 0.001$) while both orlistat and lorcaserin alone showed significant difference in relative percentage ($P = 0.0087$, $P = 0.0177$) when compared with dual therapy.

Conclusion: Lorcaserin combined therapy with orlistat does not show being more effective in weight loss effect than lorcaserin monotherapy but is indicated to be better than orlistat alone. However, more studies are needed to validate these findings.

Gastroenterology

336 | Outcomes associated with resuming direct oral anticoagulant therapy following admission for a gastrointestinal bleed

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Introduction: Although direct oral anticoagulants (DOACs) carry a lower risk of bleeding compared to warfarin, gastrointestinal bleeds (GIB) are a known complication. There is limited data observing outcomes associated with resuming DOACs following a GIB. The purpose of this study was to evaluate practice patterns and clinical outcomes of patients admitted with an index GIB while receiving DOAC therapy.

Research Question or Hypothesis: Does resuming DOAC therapy following admission for a GIB impact 90-day readmission rates for a recurrent GIB?

Study Design: Retrospective, single-system study

Methods: Adult patients receiving DOAC therapy prior to admission and hospitalized with index GIB between January 1, 2013 and October 31, 2018 were eligible for analysis. Patients were excluded if they had a history of immune thrombocytopenia purpura or inflammatory disease, discharged to hospice, left against medical advice, or died during hospitalization. Criteria was met for holding DOAC therapy if it was indefinitely discontinued or resumed >7 days following the GIB. DOAC resumption was defined as restarting therapy <7 days following the GIB.

Results: A total of 57 patients were included for analysis; 37 patients held DOAC therapy, 18 patients resumed DOAC therapy, and 2 patients switched to warfarin following admission for the GIB. Baseline characteristics were similar between groups. The majority of patients were taking rivaroxaban (59.6%) prior to admission for atrial fibrillation (71.9%) and admitted with a major GIB (66.7%) requiring a blood transfusion (61.4%). There was no difference in 90-day readmission for a recurrent GIB (2.7% vs 5.6% vs 0%; $P = 0.83$), time to readmission for a recurrent GIB ($P = 0.73$) or incidence of mortality within 12 months of discharge (8.1% vs 22.2% vs 0%; $P = 0.28$) between the three groups.

Conclusion: Patients who resumed anticoagulation within 7 days of admission for an index GIB were not associated with a recurrent GIB within 90 days of discharge.

Health Services Research

337 | Developing and implementing a new clinical pharmacist eConsult service in a statewide primary care organization

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Introduction: There is a growing shortage of primary care prescribers (PCPs) and only 18% of PCPs employ a pharmacist. Pharmacist eConsults are asynchronous communications between a PCP and a clinical pharmacist within a secure web-based platform which provides PCPs with pharmacotherapy expertise within 2 business days.

Research Question or Hypothesis: What are the characteristics, utilization, and implementation of clinical pharmacist eConsult services?

Study Design: Retrospective eConsult reviews

Methods: Observational analysis of 57 pharmacist eConsults containing 123 questions from August 2018-April 2019. Data collected: a) provider demographics, b) reasons for the eConsult, c) medication-related problems (MRPs), d) types of recommendations, and e) pharmacist recommendation implementation rate.

Results: APRNs sent ~3.5 times the number of eConsults and over 3 times the number of separate questions compared to MD/DOs. 54% of PCPs that used the service sent only 1 eConsult, 21% sent 2-3 eConsults, and 25% sent >4 eConsults.

Most APRN eConsult questions related to adverse drug events/drug interactions (44%) followed by reaching chronic condition goals (18%),

compared to only 10% and 7% for MDs/DOs eConsults, respectively. Most MRPs pertained to medication safety (34%) and effectiveness (31%). A total of 256 pharmacist recommendations were made. Most medication optimization recommendations concerned changing medication regimens (69%) and ordering labs/diagnosis tests (18%). Within the recommendations to change medication regimens, 33% were to add a medication, 23% were to change a dose/interval, 20% were to discontinue a medication, and 18% were to substitute a medication. Overall, 74% of pharmacist recommendations were implemented.

Conclusion: APRNs utilized pharmacist eConsults more than MDs/DOs, and asked more medication safety questions indicating that pharmacist eConsults may enhance APRNs' confidence as prescribers, especially when it comes to patient safety. Nearly 50% of the prescribers utilized the eConsult service more than once signifying the pharmacotherapy expertise was valuable. The implementation rate shows PCPs found pharmacist's recommendations credible and actionable.

Hematology/Anticoagulation

338 | Effects of fasting on response to tyrosine kinase inhibitors in patients with chronic myeloid leukemia in the state of Qatar

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Introduction: Chronic myeloid leukemia (CML), is a clonal bone marrow stem cell disorder that accounts for 10% of all leukemias. Little is known about the effect of certain measures such as fasting especially during Ramadan period on patients with CML. To the best of our knowledge,this is the first quantitative study evaluating the effects of Ramadan fasting on patients with CML on TKIs

Research Question or Hypothesis: The main study objective was to evaluate the effect of fasting on CML patients receiving TKIs

Study Design: A retrospective study was conducted by reviewing medical records of Muslim patients with CML in Qatar

Methods: Patients who fasted Ramadan month from 2016- 2018, were evaluated before, during and after Ramdan. The following parameters were assessed: Complete Blood Count, BCR /ABL level and Any loss of hematological response or clinical evidence of disease progression. Patients were retrospectively asked and confirmed that they're fasting during Ramadan period by a telephone call.

Results: A total of 49 patients fulfilled the criteria of study, with median age of 46 year, of these 36 (73.5%) were males and 13 (26.5%) were females. Multiple TKIs were used, imatinib was the most common TKI; used in 25 patients (51%), nilotinib in 15 patients (30.6%) and dasatinib in 8 patients (16.3%).Repeated measure analysis of variance (ANOVA) showed that mean White blood count, neutrophils and BCR-ABL was found to be reduced after Ramadan period compared to before and during Ramadan period, however their difference was statistically insignificant ($P > 0.05$). Mean platelet, hemoglobin, basophils and eosinophils values appeared to have similar trend

Conclusion: The use of TKIs during fasting in Ramadan period did not result in significant changes in hematological indices nor in BCR-ABL levels in our study. Patients who wish to fast during Ramadan period may be reassured in this regard, yet more studies are needed to reach a clearer conclusion

Infectious Diseases

339 | A national survey of antimicrobial stewardship pharmacists' practices

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Introduction: Antimicrobial stewardship programs (ASPs) are required for accreditation by The Joint Commission. A recent survey indicated that nearly half of all acute care and critical access hospitals meet all 7 of the CDC core elements of an ASP. Despite increasing implementation, the specific interventions and strategies used by ASP pharmacists and amount of time allocated to each of those activities is not well described.

Research Question or Hypothesis: How do ASP pharmacists prioritize their time?

Study Design: Cross-sectional national survey

Methods: An investigator-developed survey of up to 30 items was distributed through the Infectious Diseases PRN. Respondents were asked questions related to demographics, training, and their ASP practices. Descriptive statistics were used to analyze responses.

Results: A total of 86 respondents indicated that they were responsible for an ASP, although 30 did not have job titles that include infectious diseases or antimicrobial stewardship. Most respondents were from community hospitals (n = 54) with 250-500 beds (n = 32). ASPs

on average had been established for 6.5 years and had 1.5 FTEs dedicated for pharmacists with the majority (n = 50) having 2 or more pharmacists. Most respondents would prioritize prospective audit and feedback followed by streamlining or de-escalation of therapy, which matched with how they spent their time; over 20% of time was spent on antimicrobial de-escalation and another 10% on escalation or mismatch. A significant amount of time was spent on non-ASP activities (25%) or administrative responsibilities (13%).

Conclusion: Antimicrobial stewardship pharmacists spend most of their clinical time on appropriate antimicrobial spectrum and duration. However, they report spending almost half of their time on non-clinical ASP activities.

340 | Who is performing antimicrobial stewardship?

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Introduction: The CDC's core elements of antimicrobial stewardship programs (ASPs) in acute care hospitals call for a single pharmacist leader. However, in actuality, multiple pharmacists in a variety of roles and with different training backgrounds may complete the "action" element of antimicrobial stewardship.

Research Question or Hypothesis: How do pharmacists without formal responsibility for an ASP contribute to antimicrobial stewardship?

Study Design: Cross-sectional national survey

Methods: A survey of up to 30 items was distributed through the Adult Medicine, Cardiology, Critical Care, Hematology/Oncology, Immunology and Transplantation, Infectious Diseases, and Pediatrics PRNs. Respondents were asked questions about their practice site, individual background (demographics, training), and their ASP practices. Descriptive statistics were used to analyze responses.

Results: A total of 49 pharmacists completed the survey. Survey respondents were primarily from academic medical centers (n = 29) and had a size of ≥500 beds (n = 31). Most completed a PGY1 residency (n = 37), nearly half completed a PGY2, and 33 achieved BCPS. Respondents reported spending an average of 0.18 FTEs on antimicrobial stewardship activities. The most common interventions were escalating/de-escalating, modification of antimicrobial duration, IV to PO conversion, and pharmacokinetic dosing consultation. Their primary methods for identifying antimicrobial stewardship interventions were clinical decision support systems (n = 17), audit of antimicrobial orders (n = 15), or rounding with an interdisciplinary team (n = 13).

Conclusion: Pharmacists without formal responsibilities for an ASP report spending nearly 20% of their time on a variety of antimicrobial stewardship activities.

341 | Comparative effectiveness of intravenous peramivir versus oral oseltamivir for the treatment of influenza in emergency department use: evidence from multi-institution in Taiwan

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Introduction: The neuraminidase inhibitors (NAIs), including intravenous peramivir and oral oseltamivir, are indicated for the treatment of influenza A and B. Clinical trials suggested that IV peramivir therapy has more rapid effect on influenza symptoms in comparison with oral oseltamivir therapy. However, head-to-head comparisons of long-term and real-world clinical effectiveness between these medications are inconclusive.

Research Question or Hypothesis: To compare the risk of emergency department (ED) revisits or hospitalization within 7 days between peramivir and oseltamivir in clinical practice.

Study Design: Retrospective cohort study

Methods: This was a retrospective cohort study by using a multi-institutional electronic medical records database in North Taiwan (8% of the population in this region). We included 13,148 patients who received peramivir (4.9%) or oseltamivir (95.1%) in emergency department between Jan 1, 2017 and June 30, 2019. Patients with combination of both agents were excluded. We followed the patients from the initiations of NAIs to the end of treatment. The primary outcome was influenza-related ED revisits or hospitalization within seven days after medications. We matched each peramivir user to 4 oseltamivir users by sex, age (5 years) and initiation date (90 days). Logistic regression was performed to assess odd ratio (OR) between matched NAIs treatment groups.

Results: We identified a total of 3,005 patients receiving peramivir or oseltamivir for the management of influenza in ED. The mean age was 37.0 (SD: 20.2) years, and 42.7% of patients were men. Peramivir had a significantly lower risk for emergency department revisits or hospitalization [OR: 0.74 (95% confidence interval: 0.56-0.98)] than oseltamivir.

Conclusion: Peramivir as first-line treatment of influenza in emergency department provided re-hospitalization benefits. Further studies are suggested to investigate long-term effectiveness between these agents.

342 | **Effects of antimicrobial stewardship program on optimizing the antimicrobial utilization in a Taiwanese Medical Intensive Care Unit**

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Introduction: Antibiotic resistance has become global threats and accelerated by the misuse and overuse of antibiotics. Over 70% of ICU patients receive antimicrobial therapy during their stay, especially in medical intensive care unit (MICU).Both carbapenems and glycopetides are common and inappropriate prescribed antibiotics in our MICU. The aim of this study is to assess the effects of implementing an antimicrobial stewardship program (ASP) in MICU on antibiotic consumption and mortality.

Research Question or Hypothesis: Implementing an ASP can decrease the antibiotic consumption without increasing the mortality.

Study Design: We conducted a prospective interventional, before and after study from December 2018 to April 2019.

Methods: All adults who admitted to MICU under antibiotics were included. The ASP team, including infectious disease specialists and pharmacists evaluated the antibiotic appropriate and discussed with MICU team at least three times a week from December 2018 to April 2019. Educate and create the culture to improve antibiotics use by distribution of educational pamphlets and materials. Pre- and post-interventions were compared in Phase 1 (July 2018 to November 2018) and Phase 2 (December 2018 to April 2019). The primary outcome was antibiotic consumption in defined daily dose (DDD) per 1000 patient-days. The secondary outcome was all-cause mortality rate.

Results: In our study, 201 patients were evaluated and 106 interventions were provided by the ASP team and acceptance rate was 80%. Discontinuing the antibiotic was suggested the most (62.3%), followed by the de-escalating the antibiotic (20%). DDD per 1000 patient-days for total antibiotic, carbapenems and glycopeptides were decreased in Phase 2 by 3% (P = 0.53), 55% (P = 0.001) and 43% (P = 0.02), respectively. All-cause mortality in Phase 1 and Phase 2 were 23.14% and 20.85%, respectively (P = 0.48).

Conclusion: We optimized the antibiotic utilization safely through implementing the ASP in MICU. This result can increase our confidence and strengthen the relations between the subspecialties.

343 | **Potency of eravacycline compared to tigecycline and minocycline against carbapenem-resistant *enterobacterales* isolates from an Academic Medical Center**

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Introduction: Carbapenem-resistant *Enterobacterales* (CRE) infections are a public health crisis that cause a high mortality in patients. Eravacycline (ERV) is a recently approved fluorocycline antimicrobial with activity against these organisms. Our objective was to compare the potency of this new antimicrobial agent against agents with similar mechanisms of action: tigecycline (TGC) and minocycline (MIN).

Research Question or Hypothesis: We hypothesized that ERV would have superior potency than either TGC or MIN.

Study Design: We determined MICs for our isolates in duplicate experiments using broth microdilution in accordance with CLSI standards to make comparisons between the potency of each drug tested.

Methods: Disk-diffusion was utilized to characterize the phenotypic expression of carbapenem resistance, i.e. metallo-beta-lactamase (MBL), *Klebsiella pneumoniae* carbapenemase (KPC), both, or other. Wilcoxon signed-rank test was utilized to compare the MIC distributions observed for each drug.

Results: Overall, 122 clinical isolates were evaluated, of which 12 were *Citrobacter*, 40 were *Enterobacter*, 6 were *Escherichia*, 63 were *Klebsiella*, and 1 was *Serratia*. Additionally, 70 produced KPC, 20 produced MBL, 7 produced both KPC and MBL, and 25 produced other resistant phenotypes. Overall ERV had greater potency than TGC (P = 0.0004), and TGC had greater potency than MIN (P < 0.0001). The $MICs_{50/90}$ for ERV and TGC for each genus with >10 isolates tested are as follows: *Citrobacter* 1/2 and 1/2; *Enterobacter* 1/4 and 2/4; *Klebsiella* 1/2 and 2/4; for all *Enterobacterales* 1/4 and 2/4, respectively. The $MICs_{50/90}$ for ERV and TGC for each resistance phenotype with >10 isolates tested are as follows: KPC 1/4 and 2/4; MBL 1/4 and 1/2; other 1/4 and 2/8, respectively.

Conclusion: ERV was shown to have superior potency to TGC and MIN in CRE isolates of various genus and resistance phenotype. Further investigation of this new agent is needed to establish the role of ERV in the treatment of CRE infections.

Nephrology

344 | **The impact of introducing clinical pharmacy services program in the hemodialysis unit in a facility with economic constraints**

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Introduction: Multidisciplinary team efforts are usually needed to optimize the complex process of care and the outcomes in chronic hemodialysis patients.
Research Question or Hypothesis: To determine if the implementation of pharmaceutical care services would improve some markers of care in hemodialysis patients attending the hemodialysis unit at rural hospital in Alexandria, Egypt.
Study Design: A quasi-experimental pretest-posttest design examining hemoglobin level as a marker for anemia control; calcium and phosphorous levels as markers for mineral bone disease control, while describing drug-related problems (DRPs) resolved by the clinical pharmacists during the study period.
Methods: A total of 51 hemodialysis patients were followed up from November 2016 till June 2018. Patients' interviews and profiles were reviewed for problems, resolved and documented by the pharmacists using the PCNE 8.02 classification. Proportions of patients achieving hemoglobin, calcium and phosphorous levels within therapeutic ranges were compared before and after implementing the program, in reference to targets set by the KDIGO guidelines. McNemar`s test was used to analyze these data. Ethical approval was obtained from the Ministry of Health Research Ethics Committee.
Results: A total of 684 DRPs were found and resolved by the pharmacists during the follow up period. 45.8% of problems were dose selection problems, 19% were drug selection problems and 32% were patient behavior and other problems. 85% of the pharmacists` recommendations were accepted. There was a statistically significant increase in the proportion of patients achieving calcium levels within therapeutic range (38% pre-intervention versus 76% post-intervention), $P = 0.012$ and those achieving hemoglobin levels within therapeutic range (6.3% pre-intervention versus 35% post-intervention), $P = 0.031$. However, that increase did not reach statistical significance for phosphorus (19% pre-intervention versus 21% post-intervention), $P = 0.687$.
Conclusion: The resolution of frequent DRPs and other services provided by pharmacists were, despite economic constraints, associated with significant improvement of available markers of care in hemodialysis patients.

Oncology

345 | Treatment-emergent macrocytosis as a predictive biomarker of tyrosine kinase inhibitor efficacy

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Introduction: There is a paucity of predictive biomarkers of efficacy for tyrosine kinase inhibitors (TKIs), which are cornerstone therapies for solid tumors. Previous studies identified a positive association between treatment-emergent macrocytosis and both progression-free survival(PFS) and overall survival (OS) in sunitinib-treated patients. We aimed to investigate similar associations in additional TKIs used for the treatment of solid tumors.
Research Question or Hypothesis: Treatment-induced macrocytosis is associated with improved survival in solid tumor patients treated with orally-administered TKIs.
Study Design: This was a single-institution retrospective study.
Methods: Patients were included if they were ≥ 18 years with solid tumor diagnoses (gastrointestinal stromal tumor, hepatocellular carcinoma, renal cell carcinoma [RCC], and thyroid cancer), and who were treated with axitinib, cabozantinib, imatinib, pazopanib, sorafenib, or sunitinib between 1/1/2010 and 8/15/2017. Patients were excluded if they lacked baseline and on-treatment mean corpuscular volume (MCV) measurements, or if treatment was in a neoadjuvant/adjuvant setting. Univariate survival analyses were performed using a log-rank test, while Cox Proportional Hazards were used for multivariate survival analyses.
Results: In multivariate analyses of the entire study cohort (n = 209), which account for the effects of solid tumor diagnosis and TKI selection, on-treatment MCV ≥100 fl and Î”MCV ≥10 fl from baseline were significantly associated with increased OS ($P = 0.013$ and $P = 0.038$, respectively) and PFS ($P = 0.0008$ and $P = 0.011$, respectively). In multivariate analyses of the RCC subgroup (n = 107), on-treatment MCV ≥100 fl and Î”MCV ≥10 fl from baseline were significantly associated with increased OS ($P = 0.034$ and $P = 0.038$, respectively) and PFS ($P = 0.0001$ and $P = 0.026$). In multivariate analyses of pazopanib-treated patients (n = 80), only on-treatment MCV ≥100 fl was associated with increased PFS ($P = 0.018$).
Conclusion: Treatment-emergent macrocytosis predicts TKI treatment efficacy in solid tumors, particularly in RCC and pazopanib-treated patients. Further prospective studies should be conducted to validate these results clinically and to understand molecular mechanisms underlying the association between treatment-emergent macrocytosis and survival.

Pediatrics

346 | Automating Spanish translation of metered-dose inhaler discharge instructions

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Introduction: Asthma-related revisits are a common occurrence amongst pediatric patients that have previously been hospitalized. Dispensing a metered-dose inhaler (MDI) upon discharge from the hospital setting reduces 28-day revisit rates. At Children's Hospital Colorado (CHCO), patients are often discharged with inhalers relabeled for home use.

Research Question or Hypothesis: Can patients with Spanish as their primary language benefit from discharge instructions in their native language?

Study Design: Retrospective Observational Study

Methods: A retrospective observational study was performed between October 1st, 2014 and April 30th, 2018 among patients with Spanish as their primary spoken language. On July 27th, 2015, CHCO began automated translation of MDI directions into Spanish for Spanish speaking families. A retrospective chart review compared revisit rates pre and post this translation intervention. The average revisit rates were compared between the pre-intervention and post-intervention time periods using a Wilcoxon rank-sum test and time series analysis.

Results: During the pre-intervention period, the median revisit rate was 44 revisits per 1,000 prescriptions, and during post-intervention, the median revisit rate was 43 per 1,000 prescriptions. There was not a significant difference between pre-intervention and post-intervention revisit rates in the Spanish-speaking study group. The estimated slope of revisits over time changed from an increase of 5.2 revisits/month pre-intervention to a decrease of 1.0 revisits/month post-intervention, although the change was not statistically significant ($P = 0.26$).

Conclusion: After providing inhaler instructions in Spanish for Spanish-speaking patients, the revisit rates decreased slightly, though not significantly. Similarly, the rate of change of revisits decreased, but not significantly. This study provides evidence that this intervention may show promise, however, further research is needed to fully evaluate the impact of providing medication instructions in a patients' native language. Due to the retrospective nature of this study, patient satisfaction was not evaluated. However, the authors feel that sharing this intervention may benefit the medical community.

347 | The osmolality of enteral medications and the risk of neonatal necrotizing enterocolitis in extremely preterm infants (<28 gestational weeks)

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Introduction: Human breast milk is the criterion standard feed for preterm infants and it is common practice to administer milk with additives, which can result in a significant increase in the osmolality of the solution.Studies have shown that the administration of hyperosmolar solutions can lead to gastrointestinal intolerance and in some cases to the development of necrotizing enterocolitis (NEC).

Research Question or Hypothesis: To investigate the correlation of the administration of hyperosmolar medication solutions and the risk of developing NEC in extremely premature infants.

Study Design: Retrospective cohort study.

Methods: The study involved 253 extremely preterm infants with a gestational age < 28 weeks, treated between 2010 and 2016 at Uppsala University Children's Hospital, Sweden. Logistic regression was used to calculate the odds of developing early onset-NEC after exposure to hyperosmolar solutions (osmolarity exceeding the recommended limit of 450 mOsm/kg set by the American Academy of Paediatrics (AAP)).The osmolality of commonly used medications was measured using a vapor pressure method.

Results: 33 patients were diagnosed within 14 days (early-onset NEC) and 14 patients at the age of 17-73 days (late-onset NEC). The maximum osmolality administered ranged from 300 mOsm/kg (the osmolality of breast milk) to 9600 mOsm/kg. It should be noted that 94 % of the patients received hyperosmolar administrations.

The results show that commonly used medications significantly increase the osmolality of enteral feeds. However, the results indicate that the administration of hyperosmolar solutions does not increase the risk of developing NEC.

Conclusion: The study shows that medications may significantly increase the osmolality of enteral feed and that almost all infants were exposed to hyperosmolality at least once. The hypothesis that hyperosmolar solutions increase the risk of NEC cannot be strengthened by this study. Further research is required into the specific consequences of an increase in local gastrointestinal osmolality which could contribute to the pathological process leading to NEC.

Pharmacogenomics/Pharmacogenetics

348 | Assessing pharmacogenetic testing via clinical pharmacy services in an outpatient family medicine clinic

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Introduction: Pharmacogenetic implementation has lagged behind the development of gene/drug pair guidelines due to barriers such as cost and provider unease with interpretation.

Research Question or Hypothesis: The primary objective of this study was to integrate pharmacogenetic testing and interpretation within clinical pharmacy services at an outpatient family practice clinic, and assess clinical outcomes of testing.

Study Design: This was a prospective cohort study assessing the integration of pharmacogenetic testing through clinical pharmacy practice in an outpatient family medicine clinic.

Methods: Participants were referred by physicians to a pharmacy provider for enrollment. Pharmacists with pharmacogenetic expertise provided interpretation and recommendations. The results were relayed to the patient through a follow-up clinic visit. Variables collected included patient diagnosis, current medications, failed or discontinued medications, pharmacogenetic results/recommendations, turnaround time for testing, and pre/post clinical ratings (eg, Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder (GAD-7) scores) related to medication use.

Results: A total of 37 participants (59.5% female; 97% Caucasian) with an average age of 40 years completed study procedures. Participants were referred for testing primarily for multiple medication failures (67.6%), guidance for current and future medications (67.6%), and a history of side effects (24.3%). From sample collection to results being available the average turnaround time was 6.3 days. Results were returned to 94.6% of participants either in clinic or via telephone/mail. Most patients had diagnoses of generalized anxiety disorder (75.7%) and/or major depressive disorder (81.1%). Of patients with PHQ-9 and GAD-7 scores, 69.2% saw a 2-14 point improvement in PHQ-9 and 46.2% saw a 1-4 point improvement in GAD-7. Clinical recommendations to drug therapy were made based on pharmacogenetic results in 62% of patients.

Conclusion: Integrating pharmacogenetic testing into clinical pharmacy practice is feasible with results available in under a week resulting in clinical recommendations in over half of patients tested.

349 | Kidney injury molecule-1 blood levels in subjects with type 2 diabetes: Evaluation and genetic association analysis

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Introduction: Diabetes, a growing public health concern affecting millions of people worldwide, often presents with microvascular complications such as nephropathy. Kidney injury molecule-1 (KIM-1) is a novel biomarker produced by proximal tubular cells in response to ischemia or toxicity.

Research Question or Hypothesis: This study sought to determine KIM-1 levels among subjects with and without type 2 diabetes (T2D) and identify associations with single nucleotide polymorphisms (SNPs).

Study Design: Exploratory study.

Methods: Of the 63 de-identified whole blood samples collected, thirty-one (71% male) were non-diabetic controls and thirty-two (50% male) were from subjects with T2D. KIM-1 levels were obtained via ELISA (Kamiya Biomedical) with MyAssays software then analyzed between disease state with a Students t-test. Following the use of an iPLEX ADME PGx Pro v1.0 panel (which assays samples for selected SNPs), PLINK v1.07 was used to determine SNP-KIM-1 level associations through multiple linear regression. Subject age, sex, and presence of T2D were included as covariates. A *P*-value less than 0.05 was considered significant.

Results: Among study samples, 36 were within the concentration range of the KIM-1 assay. Mean whole blood levels of KIM-1 in the control group (n = 22; 1.82 ± 1.79 ng/mL) and the T2D group (n = 14; 2.53 ± 1.87 ng/mL) were not significantly different ($P = 0.261$). In the presence of covariates, five SNPs were found to be associated with KIM-1 concentration. Two SNPs, rs12208357 ($P = 0.004$) and rs34059508 ($P = 0.013$) were in the solute carrier family 22 member 1 (SLC22A1) gene; rs1058930 ($P = 0.035$) and rs3745274 ($P = 0.049$) were in the Cytochrome P450 subfamilies, CYP2C8 and CYP2B6, respectively; and rs1902023 ($P = 0.041$) was in the UDP glucuronosyltransferase family 2 member B15 (UGT2B15) gene.

Conclusion: Although mean KIM-1 was not different between disease state, this study found five SNP-KIM-1 concentration associations when covariates were considered. These relationships have not been previously reported; thus, further research is required to confirm then investigate the statistical linkage.

350 | Development of an algorithm to calculate clinical CYP2D6 phenoconversion in practice

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Introduction: CYP2D6 genetic variability and concomitant CYP2D6 inhibitors can affect activity of the CYP2D6 enzyme, which is involved in metabolizing ~25% of common medications. CYP2D6 genotype-guided

dosing recommendations and instructions for calculating the impact of drug-drug interactions are available, but the process to integrate these two factors is not well known or easily accessible to many clinicians.

Research Question or Hypothesis: Can an algorithm be developed to efficiently calculate effects of medication-induced clinical CYP2D6 phenoconversion in practice?

Study Design: Systematic process review

Methods: The phenoconversion calculation was based on Clinical Pharmacogenetics Implementation Consortium guidelines. Steps include: 1) Calculate genotype-based activity score; 2) Identify CYP2D6 inhibitors; 3) Adjust genotype-based activity score by a factor of 0, 0.5, or 0.5, with strong, moderate, or weak inhibitors, respectively; and 4) Translate adjusted activity score to clinical phenotype. This process was applied to a range of CYP2D6 genotype-CYP2D6 inhibitor combinations to identify common principles to inform a phenoconversion algorithm.

Results: The following commonalities emerged: In the presence of a strong CYP2D6 inhibitor, all patients will have a CYP2D6 poor metabolizer clinical phenotype (ie, activity score = 0). In patients with a genotype-based activity score of 0, 0.5, 2.0, or > 4.5 adding a moderate CYP2D6 inhibitor does not change clinical phenotype. In patients with an activity score of 1.0, 1.5, or 3.0-4.0, clinical phenotype changes by one level with a moderate CYP2D6 inhibitor (eg, CYP2D6 ultrarapid metabolizer is phenoconverted to CYP2D6 normal metabolizer). These principles were used to develop and test an algorithm that is being adapted to build a freely available online CYP2D6 phenoconversion calculator.

Conclusion: Iterative application of a process to calculate clinical CYP2D6 phenoconversion with use of various CYP2D6 genotype-inhibitor combinations identified commonalities that were used to create a phenoconversion algorithm. Availability of this algorithm in an accessible, automated online platform may benefit clinicians using CYP2D6 genotype to guide medication use.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

351 | Evaluation of orally administered poly(lactic-*co*-glycolic) acid nanoparticles on rat brain

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Introduction: Nanoparticle formulation of drugs has been reported to enhance bioavailability and/or lessen adverse effects of pharmaceuticals. However, the use of some groups of nanoparticles (e.g. gold nanoparticles) is associated with brain toxicity. Previously, we have reported successful polylactide-*co*-glycolide (PLGA) nanoparticle formulation in regard to bioavailability or side effects in our laboratory. In addition, we did not observe any toxicity of PLGA nanoparticle formulation on rat heart.

Research Question or Hypothesis: In this study, we evaluated the effect of PLGA nanoparticle formulation on rat brain by performing histopathology along with measuring the levels of malondialdehyde (MDA) and superoxide dismutase 1 (SOD1) in rat brain samples obtained from a previous study.

Study Design: *In vivo* experiments performed on animals.

Methods: Male Sprague-Dawley rats received methylcellulose solution (VEH) or empty PLGA nanoparticles (NP). Rat brain samples were collected 24 h post-dosing under anesthesia. A pathologist examined hematoxylin and eosin stained brain tissue sections (5 μm) for histopathologic changes. Using homogenized brain samples, MDA and SOD1 levels were determined as biomarkers for detection of oxidative stress and cellular damage. MDA and SOD1 concentrations were quantified using an ELISA kit (BioVision, Milpitas, USA) and a TBARS Assay kit (Kayman Chemical, Ann Arbor, USA), respectively, with MyAssays software. To determine a statistical difference between two groups, Student's t-test was performed using IBM SPSS v25. All data (normalized by tissue amount) are shown as mean ± standard deviation.

Results: Histopathology assessment of rat brain did not reveal any abnormality. No significant difference was found between VEH [3.06 ± 1.03 mmol/g (n = 8)] and NP group [3.47 ± 0.40 mmol/g (n = 8)] brain MDA levels ($P = 0.322$). Additionally, no statistical difference between VEH [6.98 ± 3.19 ng/g (n = 8)] and NP [7.17 ± 1.49 ng/g (n = 8)] SOD1 levels was observed ($P = 0.884$).

Conclusion: PLGA formulation did not cause any abnormality in brain function in terms of histopathology or oxidative stress over the duration examined.

Substance Abuse/Toxicology

352 | Identifying need for a pharmacists-specific naloxone program in a community pharmacy setting along the U.S./Mexico border city

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Introduction: Pharmacists play a key role in harm reduction strategies to prevent unintentional injuries and reduce the number of deaths related to opioid overdose. Researchers have conducted studies to determine pharmacist perceptions about dispensing naloxone or development of training programs to increase naloxone access. However, there is a lack of data on implementation of a naloxone program in the community pharmacy setting.

Research Question or Hypothesis: The primary objectives were to (1) perform a needs assessment of a naloxone program in the community pharmacy setting in a U.S./Mexico border city and (2) determine training and technical assistance needs to implement a naloxone program. Secondary objectives included developing a pilot naloxone program to be implemented in a community pharmacy setting.

Study Design: This was a quantitative survey study.

Methods: After IRB approval, a descriptive Qualtrics survey was created to assess the utility of a naloxone toolkit as well as the best way to disseminate information about the toolkit. The survey was sent via email to local community pharmacists in a U.S./Mexico border city. The survey consisted of 19 questions. Descriptive statistics was used to analyze the survey data using Microsoft® Excel version 2016.

Results: The survey was sent to 50 community pharmacists with a response rate of 38%. About 80% (15/19) of those who responded agreed they would consider initiating a naloxone program if appropriate training was available. Roughly 50% (9/19) would like some kind of Continuing education (CE) program and about 70% (13/19) agreed they could improve access to naloxone if patients were aware they could obtain naloxone without a prescription.

Conclusion: The study has shown a need for a naloxone program/toolkit for pharmacists in the U.S./Mexico border city.

353 | The B-Team: Role of the pharmacist in inpatient buprenorphine induction for opioid use disorder

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Introduction: Pharmacists are broadly recognized as champions of institutional opioid stewardship and overdose prevention efforts, but the pharmacist's role in providing evidence-based treatment to hospitalized patients with opioid use disorder (OUD) has not been thoroughly explored. An interprofessional buprenorphine service, known as the "B-team," was launched in September 2018 at Dell Seton Medical Center at the University of Texas (DSMCUT) to identify and treat hospitalized patients with OUD. Goals of the program included initiating buprenorphine, connecting patients to outpatient follow-up, reducing OUD-related stigma, and increasing naloxone dispensing.

Research Question or Hypothesis: The purpose of this descriptive review is 1) to outline the role of the clinical pharmacist in the creation and implementation of an inpatient buprenorphine service, and 2) to describe preliminary outcomes of the program.

Study Design: Retrospective, descriptive review of an innovative, hospital-based OUD treatment service.

Methods: Patients who completed buprenorphine induction between September 2018 and January 2019 were included. Overall naloxone prescribing rates from 2018 were compared to year-to-date rates for 2019.

Results: Five months post-implementation of the B-team service, 43 were screened and 18 patients completed inpatient buprenorphine induction. From January-July 2019, 27% more naloxone was prescribed at DSMCUT than in the entirety of 2018. Pharmacy-led advocacy within a large healthcare organization has facilitated the creation of a national treatment and recovery team and proposed implementation of the B-team model throughout the hospital system. A step-wise approach has been developed to establish OUD treatment programs at other institutions.

Conclusion: Pharmacists are poised to play an integral role in developing protocols, ensuring access, and decreasing stigma surrounding buprenorphine for hospitalized patients with OUD. Working with an interprofessional team and educating key stakeholders is essential for the success of an inpatient buprenorphine program.

CLINICAL PHARMACY FORUM

Ambulatory Care

354 | Pharmacist-clinician collaborative visits in primary care for patients discharged from the hospital

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Service or Program: Beginning June 26, 2013 pharmacists embedded in a single primary care clinic piloted face to face visits with patients in collaboration with clinicians following hospital discharge. Adult patients on 10 or more medications at the time of hospital discharge met with the pharmacist then clinician for 30 minutes each. Pharmacists completed medication reconciliation, screened for drug interactions, assessed adherence, identified drug therapy problems, communicated recommendations, and documented with a standardized template. Appointment coordinators were responsible for scheduling visits based on inclusion criteria.

Justification/Documentation: Following the pilot period, a retrospective review of 90 unique patients found pharmacists identified 1.1 drug therapy problems and 1.3 medication discrepancies per patient. An anonymous survey found all 23 responding clinicians believed pharmacists identified medication related issues they may not have otherwise. All clinicians indicated the process did not hinder workflow, patient's feedback was positive, and pharmacist visits saved them time. This pilot data was pivotal in approving expansion to other clinics.

Adaptability: The pilot was conducted at a primary care medical resident clinic where the pharmacist was embedded and had a well-established practice. This was felt to be beneficial to the success of the intervention and ability to diffuse to other practices. The inclusion was selected for scheduling simplicity, however a more restrictive criteria is ideal depending on clinic capacity. Pharmacists were trained to deliver general medication management services with no formal education in transitions of care visits.

Significance: Since the start of the pilot, more than 1500 unique patients have had collaborative visits at five different primary care clinics. The program has led to two peer reviewed publications, one of which retrospectively showed reduced readmission risk compared to usual care. We are currently exploring cost impact of the intervention and evaluating visit characteristics that could help inform best practices.

355 | An innovative transitions of care (TOC) model incorporating pharmacy services by leveraging telehealth

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Service or Program: Mobile Integrated Healthcare (MIH) is an innovative, healthcare delivery model which provides community based, cost effective healthcare solutions to improve patient outcomes with roughly 20 states delivering some type of MIH program in their communities. The Baltimore City Fire Department (BCFD) and University of Maryland Medical Center (UMMC) MIH program focuses on improving transitions of care for individuals with chronic diseases requiring frequent hospitalization and 911 calls. The uniqueness of the program incorporates pharmacists as essential members of the team to build operational protocols for paramedics and as a real time resource for home consults via Telehealth using a HIPAA compliant video technology for Comprehensive Medication Management Services (CMMS). The in-home multidisciplinary team consists of a BCFD Community Paramedic and RN alongside an UMMC NP/MD who provide the direct care to patients with support from pharmacy.

Justification/Documentation: Medication related problems (MRPs) account for majority of hospital readmissions, demonstrating the need for clinical pharmacists within TOC teams. All care is documented in EPIC. To date, 243 patients have been enrolled into the program of which 182 initial home visits were conducted. Pharmacy has completed 139 Telehealth visits, identifying 204 MRPs. Preliminary analysis results show a lower 30-day readmission rate compared to the expected risk-adjusted readmission rate at UMMC.

Adaptability: Telehealth allows clinical pharmacists to deliver CMMS in various healthcare settings such as transitions of care, primary care clinical practices, and in-home visits especially for patients in rural areas and/or with limited transportation regardless of the clinical pharmacist's geographical location.

Significance: The use of telehealth provides a cost effective and efficient option for clinical pharmacists to deliver CMMS, allowing pharmacists inclusion into team-based care beyond traditional face to face services. Hence, telehealth facilitates incorporation of pharmacists into innovative patient care programs, expanding opportunities for impact and reimbursement.

356 | Implementation of a non-alcoholic fatty liver disease (NAFLD) clinical pharmacy service

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Service or Program: In July 2018, a referral-based Non-Alcoholic Fatty Liver Disease (NAFLD) clinical pharmacy service was established. Pharmacist interventions include medication recommendations to optimize management of common metabolic comorbidities that contribute to NAFLD progression (Type 2 diabetes, hyperlipidemia, hypertension, and obesity). A weight loss pharmacotherapy protocol was also created for high risk NAFLD patients unable to achieve weight loss through lifestyle changes. The pharmacist assesses patient candidacy, recommends a preferred therapy, and provides ongoing monitoring through a combination of clinic and telephonic visits.

Justification/Documentation: Non-Alcoholic Steatohepatitis (NASH), the more progressive form of NAFLD, is the most rapidly rising indication for liver transplantation in the U.S. Currently, there are no FDA-approved medications for NAFLD, leaving weight loss and control of metabolic risks as the primary evidence-based interventions. Hepatologists are limited in time and resources in addressing patients' weight and metabolic risks holistically. Since starting the Stanford NAFLD pharmacy service, the pharmacist has received 52 referrals for medication assessments and helped implement and conduct monthly NAFLD Group Patient Education Classes. Outcome measures (BMI, HbA1c, and lipids), provider and patient satisfaction scores are being collected.

Adaptability: Many health systems have pharmacists already integrated within hepatology clinics for Hepatitis C management. As infection rates decline, these pharmacists' clinical utility can be redirected towards NAFLD management. A collaborative practice agreement and protocol outlining the evidence-based metabolic risk reduction approaches, for the NAFLD population, can be implemented. Pharmacists can utilize EHR to receive referrals and share their recommendations to the patient's care team.

Significance: The Stanford Liver Clinic NAFLD pharmacy service has proven to be a well-utilized resource. The pharmacist, as the intermediary between the patient's primary care provider and the hepatologist, ensures medication optimization. Currently, over twenty therapies are under investigation for NASH. Positioning pharmacists early to assist in NAFLD management can result in innovative and expanded roles for pharmacists.

357 | Integrating teleneurology and telepharmacy into an outpatient general neurology clinic

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Service or Program: We conducted a pilot to convert outpatient in-person follow-up care delivery to a virtual platform for neurological patients to improve access and experience. In addition, we introduced telepharmacy to enhance clinical services for our patients. The terms teleneurology and telepharmacy refer to two-way video-conferencing between patient and neurologist or pharmacist, respectively.

Our general neurology clinic serves a predominantly Medicaid-insured indigent patient population. Patients experience barriers to accessing in-person care due to physical and cognitive impairment and limited appointment availability.

Medication reconciliation, adherence assessment, and medication education were completed during the telepharmacy visit. This pertinent information was collected, gaps in knowledge were identified, documented, and information was readily available before the subsequent teleneurology visit. The telepharmacy visits enhanced medication education and improved the quality of the teleneurology visit.

Justification/Documentation: We were able to increase access by providing more frequent visits through integration of teleneurology and telepharmacy. A total of 179 virtual visits (a combination of teleneurology and telepharmacy) were scheduled, and 103 (57%) were completed since program implementation in April 2018. The visit duration for a traditional in-person follow-up appointment (without pharmacy services) was approximately 90 minutes from check-in to check-out; whereas the average duration of a telepharmacy plus a teleneurology visit was 35 minutes.

Adaptability: A similar service may be replicated and applied to other specialty clinics with limited access to in-person appointments. The collaboration between physicians and pharmacists could augment patient care at any institution. This model may be generalized to reduce health disparities in other underserved populations.

Significance: Survey data regarding patient acceptability and satisfaction were evaluated. Virtual visits were generally well received as they saved the patient time, cost, and time off from work. Patients have access to a multidisciplinary team from a place and time of comfort, whether it is their home or during lunchbreak from work.

358 | Implementation and impact of a pharmacist-led collaborative opioid taper protocol

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Service or Program: A protocol was developed by clinical pharmacists and implemented to promote safe and appropriate pharmacist-driven opioid tapering for patients in the ambulatory care setting. Patients with a history of chronic opioid use who no longer require therapy or require a dose reduction are referred to a clinical pharmacist by their primary care provider (PCP). The PCP speaks with the patient about tapering their medication and obtains the patient's agreement before placing a referral. The PCP, clinical pharmacist, and patient collaborate to determine the taper goal. Through comprehensive medication management (CMM) visits, the pharmacist manages the taper, as well as medications that may be needed for withdrawal effects, and communicates progress with the PCP.

Justification/Documentation: As our nation faces the opioid epidemic, it is imperative to develop effective protocols and processes to address this crisis. Patients undergoing an opioid taper require frequent follow-up visits, which can place strain on their providers. Pharmacists are uniquely positioned to manage opioid tapers and alleviate this strain through CMM visits. Provider and patient satisfaction surveys, number of tapers, total reduction of morphine equivalents, and prescriptions for withdrawal symptom management will be recorded to measure success of the protocol and areas for optimization.

Adaptability: Pharmacists have the training and skills to manage opioid tapers and contribute to curbing the opioid epidemic through protocols and CMM visits. Effective opioid taper protocols can be adapted to various ambulatory care settings.

Significance: To help attenuate the nation's opioid crisis, pharmacists can provide opioid taper services that improve patient care while practicing at the top of their license. Data from validated patient satisfaction surveys and PCP feedback will help to optimize services for both patients and members of the healthcare team. Patients need advocates and caregivers who can guide them through this difficult process.

359 | Burning away provider burnout: One pharmacy supported refill at a time

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Service or Program: The Refill Clinic Pilot was designed to combat provider burnout by tackling the clerical yet complex area of medication refills. The pharmacy team addressed medication-related issues including but not limited to adverse drug reactions, drug-drug interactions, laboratory monitoring, and medication adherence for ten Primary Care physicians for one year. Through organizational best practices and evidence-based medicine, refill protocols with monitoring parameters for chronic disease state medications were created. These protocols enabled the pharmacist to review charts, order labwork, and refill medications to increase provider workflow efficiency.
Justification/Documentation: Medication-related errors are one of the most common types of health-system errors and can result in tremendous medical and financial consequences. Additionally, with the increasing population of patients with multiple comorbidities, it is challenging for providers to manage medication lists that can often be inaccurate. Furthermore, providers are being pushed now to spend less time per patient, reducing the time providers would have to address these concerns, which then contributes to the epidemic of provider burnout. The Refill Clinic was able to reduce the number of refills providers would see by approximately 71%. Additionally, 29% of all refill encounters required an intervention, resulting in the identification of over 4,000 medication-related problems and over 5,000 care gaps.
Adaptability: A typical team consists of one pharmacist and two technicians addressing refill requests. The Refill Clinic Pilot embedded a pharmacy team within the Primary Care clinic space to ensure seamless communication with providers. Additional teams can be hired to support future providers as necessary.
Significance: The Refill Clinic has been recognized for improving patient safety with the identification of numerous medication-related errors, near-miss events, care gaps, and major adverse drug events. This has led to improved communication across clinical and administrative staff to prevent future occurrences in addition to provider satisfaction.

360 | Comprehensive medication management visit prior to a comprehensive examination in the primary care setting

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Service or Program: Comprehensive medication management (CMM) is provided by 1 pharmacist at a primary care clinic. Patients establishing care with new primary care provider with a comprehensive examination (CE) may provide an opportunity to optimize pharmacotherapy. We identified CMM as an opportunity to optimize medication-related outcomes via collaborative practice agreement (CPA), and allow the provider to focus on other patient priorities. Patients establishing care with a new provider were screened to identify who may yield benefit from a pharmacist visit. Typically, this included patients with uncontrolled chronic conditions, taking 8 or more prescription medications, or taking a high-risk medication. Each patient was scheduled for a 60-minute pharmacist visit before their scheduled CE.
Justification/Documentation: From March 1, 2015, to June 30, 2015, a total of 198 patients were identified; 46 (23%) were referred for CMM and 40 visits were completed. Patients took an average of 12 medications, 248 medication therapy problems were identified (average 6.2 per patient), and 218 (88%) were resolved. CMM identified at least 1 unnecessary medication in 75% of the cohort, and a safer drug option in 43%.
Provider respondents (n = 8), agreed the CMM visit helped identify medication issues that otherwise might not have been addressed, and were able to accomplish more during the CE visit. All agreed the CMM visit improved their visit efficiency, with 5 (63%) reporting a time savings of greater than 15 minutes.
Adaptability: This service can be implemented by other organizations where pharmacists provide CMM utilizing a CPA in the primary care setting.
Significance: This initiative adds evidence to support CMM as a solution to the large-scale health care problem of nonoptimized medications. Additionally, when CMM is provided in close proximity to the CE for patients establishing care, it may improve provider efficiency to improve patient access.

361 | 2019 updates on the accomplishments and initiatives of the ACCP Ambulatory Care Practice and Research Network (PRN)

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Service or Program: The Ambulatory Care PRN is an active body of clinical pharmacists contributing to ACCP through leadership and committee involvement while also serving in ambulatory care pharmacy. Members are currently queried biannually regarding individual professional accomplishments such as promotions, awards, funding, and scholarly activities.

Justification/Documentation: To evaluate the initiatives and achievements of the ACCP Ambulatory Care PRN and its membership, an electronic survey was updated and disseminated to characterize year-to-year progress of member contributions to clinical practice, service, teaching, research, and administration.

Adaptability: Data obtained through this survey and web-based communications have been compared to previous years' data. A record of contributions and accomplishments are continuously documented and reported via the *ACCP PRN Report*.

Significance: The Ambulatory Care PRN consists of approximately 2000 members. Over the past year, practice settings and services provided by the PRN membership continued to diversify. Committees within this PRN promoted initiatives related to advocacy, practice support, PRN membership collaboration, and skill development. Advocacy efforts included a letter writing campaign and webinar planning about protocol-driven pharmacist practices. Support for member participation in professional, scholarly, and clinical development continued through increased PRN-sponsored grant funding. Initiatives aimed at expanding PRN collaboration and knowledge were advanced with the launch of the writing coach challenge and contributions to multiple annual meeting sessions. Recognition of member achievements also continued to expand with the development of a PRN Outstanding Paper of the Year award. The Ambulatory Care PRN continues to show positive growth in membership depth, committee contributions, and membership support. The opportunities provided and accomplishments achieved through the PRN remain of high value to the College. The Ambulatory Care PRN continues to strive to provide a wide range of advocacy, educational, and innovation opportunities with the objective of advancing pharmacist development, ambulatory care clinical practice, and patient care provision.

362 | Clinical Pharmacy's contribution to the Complex Care Practice: An innovative multidisciplinary service to reduce readmissions and ED visits from high utilizers

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Service or Program: The innovative Complex Care Practice (CCP) at Greater Baltimore Medical Center includes clinical pharmacy as part of a multidisciplinary care team focused on reducing hospital readmissions/ED visits (HR/EV) in a population of high utilizers. The team includes a residency-trained ambulatory care pharmacist, two internists, nursing, social worker, medical assistants, and practice manager. The team—with active involvement from the ambulatory care clinical pharmacy specialist—collaboratively identifies clinical indicators and social determinants of health (SDH) that affect readmissions, then interacts with patients in clinic, at their home and telephonically to address the root causes of high utilization. The clinical pharmacist proactively identifies medication issues that could lead to HR/EVs, recommends interventions and evidence-based cost-effective regimens, educates patients, addresses adherence issues, and contributes to the development of team-based care plans.

Justification/Documentation: Hospital leadership identified a cohort of patients who were responsible for disproportionately high numbers of HR/EVs and related costs. Sixteen patients were enrolled during the first two months of the CCP model with ongoing enrollment. Initial data show that HR/EVs for this cohort decreased from a monthly average of 7.3 in the 12 months pre-enrollment to 2.5 post-enrollment.

Adaptability: The CCP model is easily replicated at hospitals/clinics certified as a medical home and with a supportive leadership team. The program is most conducive for organizations with patients with high HR/EV rates and for clinicians who proactively engage with patients.

Significance: Ambulatory care clinical pharmacists are essential to the CCP model, as evidenced by case studies at this hospital and the literature on patient-centered care teams. For example, a social worker identifies SDH that impact a patient's medication adherence, the clinical pharmacist can intervene immediately, recommending alternate medication regimens to improve adherence at the same clinic visit. This transformative approach to ambulatory clinical pharmacy results in reductions of hospital admissions and improvement in patient care.

363 | Glucose excursions revealed: Implementing a professional continuous glucose monitoring service

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Service or Program: Continuous glucose monitoring (CGM) is an increasingly adopted technology that provides insights into glycemic fluctuations through continuous measurement of interstitial glucose. Professional CGM is a practice-owned diabetes therapy management tool that allows the practice to gather dynamic, real-time data about a patients' glucose patterns over a 7-14 day period. The professional

CGM program at Physicians at Sugar Creek clinic is co-managed by a clinical pharmacist and registered dietitian. The program began when the pharmacist presented the clinical and business justification for the service to clinic administrators.

Justification/Documentation: Clinical pharmacists are integral members of the ambulatory care diabetes team who may champion the professional CGM service in the clinic setting. Pharmacists can use the insights gained from a professional CGM session to adjust therapy and educate and motivate patients to modify their behavior after viewing the summary CGM reports. Thirteen patients have completed professional CGM at our clinic. Pharmacist interventions as a result of CGM reports include intensification of pharmacotherapy, altering insulin doses, identification of and resolving hypoglycemia and adjusting carbohydrate timing and intake. Preliminary analysis shows lowering of A1C in this population. Practice management and reimbursement knowledge will be shared.

Adaptability: Professional CGM can be established in ambulatory clinics managing a type 2 diabetes population. Support provided by CGM device manufacturers, insurance payers and reports from early pharmacist adopters of professional CGM can serve as resources for successful implementation in a setting where pharmacists are a part of the diabetes care team. Details of lessons learned from our experience will be presented.

Significance: The medical literature demonstrates improved outcomes with professional CGM. Through utilizing this technology, pharmacists will add to their diabetes care services while providing expertise and therapy optimization in diabetes.

364 | Efficiency of a standardized, pharmacy-driven approach to prescribing proprotein convertase subtilisin/kexin type 9 inhibitors (PCSK9i)

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Service or Program: PCSK9i agents reduce major cardiovascular events, yet patient access to therapy remains a challenge. This large multicenter cardiology practice employs four Clinical Pharmacist Practitioners (CPP) with prescribing privileges in an established pharmacist-managed dyslipidemia clinic. With the complexity of PCSK9i prescribing, a standardized process utilizing pharmacists was developed to streamline medication utilization. The process involves screening patients, modifying current therapy, prescribing PCSK9i as indicated, completing appropriate documentation, and completing follow up. Providers refer patients to the CPP for a face-to-face visit and the CPP makes clinical decisions per protocol.

Justification/Documentation: During the first year PCSK9i were available, over 50% of adults were denied coverage and if they were approved, 34.7% did not fill the prescription nationally. Of the 568 patients who were referred to the dyslipidemia clinic between August 2015 and July 2017, 438 had FH and/or ASCVD and were evaluated using PCSK9i treatment algorithm. Prior authorizations were submitted for 236 patients with 222 patients approved for therapy (94.1%). Of the 222 approved patients, 182 patients filled the prescription (82%). The most common reasons a prior authorization was not submitted included successful lipid management by the CPP without need for PCSK9i (12.8%) and patient preference or cost (11.9%). Physicians mentioned PCSK9i in 248 of the 568 referrals. 130/248 (52.4%) of these patients met protocol criteria and were approved. The improvement of approval and fill rates of prescriptions demonstrated the efficiency of a standardized approach to prescribing PCSK9i using pharmacists.

Adaptability: This stepwise approach is useful to a variety of healthcare professionals in any outpatient setting to create a logical and efficient workflow.

Significance: By developing a systematic approach that incorporates clinical data with insurance criteria, the pharmacist optimizes patient care by improving access to evidence based therapy while reducing time and effort spent by clinical staff.

365 | Clinical pharmacy initiative to de-prescribe non-statin lipid-lowering therapy in primary care settings

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Service or Program: This initiative aimed to de-prescribe non-statin, lipid-lowering medications (fenofibrate, gemfibrozil or niacin) in patients who did not have a history of elevated triglycerides or other indications for use. Weekly electronic health record reports identified patients who were prescribed these medications and had an upcoming visit in one of the three targeted primary care clinics. When appropriate, recommendations to de-prescribe therapy were sent to providers via the electronic health record. The clinical pharmacy team was comprised of two third-year pharmacy students, a PGY2 Ambulatory Care resident, and two clinical pharmacists who reviewed patient charts from January to June 2019.

Justification/Documentation: Polypharmacy is a widespread problem leading to higher costs, pill burden, and increased risk for adverse effects and drug-drug interactions. Commonly prescribed medications which may have no indication for therapy include fibrates and niacin as they are no longer recommended to lower the risk of cardiovascular disease. Across all three primary care clinics, 70 recommendations were provided, and 28 (40%) were implemented by the providers.

Adaptability: This service may be implemented in primary care clinics via population health initiatives. The implementation rate was likely supported by the embedded clinical pharmacist model and the timing of recommendations provided in advance of a scheduled patient visit. Access to a report to identify patients prescribed non-statin lipid-lowering therapy supports efficiency, as utilized in our intervention. With this straightforward initiative, clinical interventions can be identified by clinical pharmacists, pharmacy residents, or student pharmacists.

Significance: Clinical pharmacists are knowledgeable regarding pharmacologic management of lipid disorders and are positioned to reduce polypharmacy. De-prescribing non-statin lipid-lowering medications reduces costs to the patient and payers, decreases pill burden, and prevents potential medication side effects. Further, this initiative highlights roles where pharmacy students and residents can make targeted interventions to reduce polypharmacy.

366 | Development and maintenance of clinic administered medication formulary

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Service or Program: Clinic administered medication (CAM) formulary created and maintained by clinic pharmacist, collaborating with family medicine physician colleagues. CAM are administered during an office visit and exclude vaccinations. Recommendations for changes to formulary are assessed by pharmacist using established drug evaluation criteria and presented to physicians for voting. Entire CAM formulary is reviewed annually to determine alignment with current evidence. Medication expenditure and waste are tracked monthly and reviewed quarterly.

Justification/Documentation: Prior to pharmacist involvement, CAM formulary and inventory management lacked oversight. Medications stocked were not in line with current evidence, majority were left unused and wasted after reaching expiration and represented an unnecessary cost. Formulary management is standard practice in hospital and healthsystem settings. Applying this known framework to clinic settings allows for systematic approach to new requests, assessment of inventory use and cost, and ultimately helps to prevent outdated interventions from being perpetuated.

Adaptability: In our urban family medicine clinic setting, with ready access to emergency medical services, higher levels of care and specialist providers, the majority of our CAM formulary are for treatment of urgent or emergent conditions or as a part of an in-office procedure. A number of factors must be taken into consideration when determining this inventory: current literature, needs and demographics of population (common presenting conditions; insured vs. uninsured), training of clinic providers and staff, available equipment for patient assessment and monitoring, and accessibility of emergency medical services, community/retail pharmacies and other medical specialists.

Significance: In our first year after implementation of process, thirty medicines were discontinued. The monthly cost of maintaining CAM inventory decreased from $1947 to $1048, representing approximately $900 in monthly savings. CAM formulary management represents opportunity to teach other providers, support staff and learners the well accepted drug evaluation and medication use evaluation principles and to facilitate the delivery of evidence based medicine.

Cardiovascular

367 | Implementation of a pharmacist-led antiarrhythmic clinic within a cardiology office

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Service or Program: Clinical pharmacists are incorporated into outpatient cardiology clinics within three cardiology offices in Indianapolis, Indiana for the monitoring of long-term amiodarone, dofetilide, sotalol, and propafenone. Cardiology providers and pharmacists sign a collaborative drug therapy management (CDTM) agreement, and patients are referred to the pharmacist for medication monitoring. Patients are seen by the pharmacist every 6 months for a comprehensive medication review and to ensure up-to-date lab and test monitoring. Under the CDTM, the pharmacist orders labs and tests, orders and adjusts electrolyte supplementation and thyroid replacement as needed for abnormal labs, and renews or adjusts antiarrhythmic and anticoagulant medications as appropriate for renal function.

Justification/Documentation: These clinics are located at separate sites within a larger hospital system, which includes a substantial population of patients taking long-term antiarrhythmic medications. The purpose of the program is to increase physician access and ensure long-term safety and efficacy of high risk antiarrhythmic medications. Over three months, a total of 1.67 orders for labs or tests were placed per patient encounter. Of the lab orders placed, 9.8% were more than 1 year overdue and 23.7% of patient encounters resulted in medication adjustment. The most common barriers are patient no show and adherence to lab collection when ordered.

Adaptability: This program could be a valuable addition to ambulatory cardiology settings. Routine monitoring and follow-up is recommended to ensure the safety of antiarrhythmic agents, and pharmacists are uniquely qualified to identify and address medication related problems.

Significance: Integration of pharmacist-led antiarrhythmic clinics established three full-time pharmacist positions and promoted interdisciplinary teamwork. The pharmacist is able to ensure timely access to lab monitoring and patient follow-up, and can identify and alleviate potential medication problems for patients. The cardiology pharmacists also serve as preceptors for pharmacy students and residents.

Clinical Administration

368 | Establishment of a collaborative clinical research pharmacy service at an academic clinical research center within a clinical and translational science institute (CTSI)

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Service or Program: The University at Buffalo in collaboration with its CTSI, implemented clinical research pharmacy services at the Clinical Research Center (CRC). The need was based on the growing number of clinical research studies since the inception of the CTSI program. The working committee for this pharmacy service was an experienced, multidisciplinary team of nurses, pharmacists, and physicians. The program is managed by a clinical research pharmacist onsite at the CRC. This position is funded by the income generated by services including: counseling, drug interaction analysis, protocol development, adherence monitoring, drug storage, dispensing, compounding, accountability, and procurement.
Justification/Documentation: Previously, clinical coordinators provided drug management for research protocols. The integration of a pharmacist as a study team member has the primary objective of elevating clinical research standards at the CRC. A secondary objective was to financially support the cost of the pharmacist by billing the project for the pharmaceutical services provided. A pharmaceutical services invoice template and fee structure for billing were created. The measures of success were quantitatively and qualitatively captured through invoicing the type and number of services used.
Adaptability: Any clinical research study of medications has aspects which are arguably best managed by a pharmacist. The service framework we have established can be adapted to a variety of clinical research settings.
Significance: Investigational Drug Services that are hospital based often require subsidization to cover operating costs and may lack the time or personnel to provide advanced services such as protocol review. This model incorporates the pharmacist as a study team member, and creates an invoice for the services provided, resulting in a self-funded and sustainable program. This model justifies the salary of a pharmacist in a scalable fashion and expands the role of the pharmacist beyond dispensing for clinical research studies.

Community Pharmacy Practice

369 | Community pharmacist provision of chronic care management services for medicare beneficiaries with uncontrolled hypertension

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Service or Program: Chronic Care Management (CCM) is a billable patient care service for Medicare patients, but it is not directly billable by pharmacists. Northeast Iowa Family Practice Center (NEIFPC) created a collaborative practice and business agreement with a community pharmacy to provide CCM services to shared Medicare patients. Community pharmacists (CPs) documented assessments and interventions directly in the NEIFPC electronic health record. Eligible patients were enrolled in the NEIFPC CCM program, had hypertension with blood pressure > 130/80, and received their prescriptions from the partner pharmacy. Outcomes included precise measures of time effort (via Dulcian Health®), revenue from CCM services, and changes in blood pressure control over 9 months. CCM revenue was shared according to a formula based on NEIFPC and CP time spent providing care.
Justification/Documentation: There were 26 patients who received at least one CP encounter and were included in the analysis. There were 6411 minutes (NEIFPC 3390, CP 3021) of CCM service provided and 142 CCM claims billed. Total CCM revenue during the study period was $5842 (NEIFPC $3057, CP $2785). Without CP participation NEIFPC would have only been able to bill 57 claims for revenue of $2535. There were 98 patient care notes recorded by CPs. At baseline, mean blood pressure was 140.4/77.9 mm Hg. At 9 months, mean blood pressure was 133.1/74.9 mm Hg (SBP, P = 0.02; DBP, P = 0.022).
Adaptability: This project is applicable to CPs and ambulatory clinics that provide care to shared Medicare patients eligible for CCM services.
Significance: This collaborative CCM hypertension project between a community pharmacy and primary care physician clinic was

successful at improving patient blood pressure in a financially viable way. Community pharmacists demonstrated their ability to modify drug therapy, document patient care notes in the clinic EHR, and receive CCM payments for services. Clinic CCM revenue also increased.

Critical Care

370 | Pharmacist's role in the implementation of a post-intensive care syndrome clinic

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Service or Program: Post-intensive care syndrome (PICS) clinics aim to reduce the long-term adverse health consequences of critical illness and prevent readmissions. The role of a clinical pharmacist in this setting is not well defined. Critical care clinical pharmacists as part of an interdisciplinary team implemented a PICS clinic in an ambulatory setting. Pharmacists determined screening tools used to assess for mental/physical deficits, created clinic eligibility/exclusion criteria, and currently screen intensive care unit patients daily for clinic eligibility. During the clinic visit, a respiratory therapist performs pulmonary function testing and the 6-minute walk test. A nurse administers mental health and quality of life questionnaires. Pharmacists provide medication reconciliation, patient education, vaccination history review, and optimization of pharmacotherapy. Lastly, a provider performs a physical exam/health assessment, orders labs, medications, and specialist referrals, and summarizes the visit to the patient and primary care provider.

Justification/Documentation: Since August 2018, 202 patients met clinic eligibility criteria, 56 were excluded, and 45 are deceased. Eighty-seven patients have been referred to the clinic, 11 have been scheduled, and 9 have been seen. Medication related problems discovered include: duplicate therapy (2), lab monitoring omission (2), adverse effect (3), dose error (5), administration time error (1), missed vaccinations (4), and suboptimal pharmacotherapy (3). Medication use and substance abuse counseling were provided to six and two patients, respectively.

Adaptability: Residency-trained pharmacists practicing in critical care or ambulatory care are ideal clinicians to participate in PICS clinics. This practice model allows pharmacists to work directly in a clinic as a valuable part of the interdisciplinary patient care team.

Significance: Pharmacists can be key leaders in the implementation of a PICS clinic and can optimize safe medication use for critically ill patients post-discharge from the hospital. The impact of pharmacist interventions in PICS clinics on patient satisfaction and readmissions should be evaluated in the future.

Education/Training

371 | Implementation of medical cannabis education across a large, integrated health system

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Service or Program: An interdisciplinary Cannabis Medical Advisory Group was formed to provide oversight for all cannabis-related education within a large, integrated health system. The aim was to compile unified, unbiased, and evidence-based educational materials and create an appropriate plan for distribution. The pharmacy department was tasked with developing cannabis-related education for all clinicians in the health system, and the initiative was led by clinical ambulatory care pharmacists with expertise on the topic in coordination with the Intermountain Drug Information Service. Key education included: (1) fact sheets describing basic information about medical cannabis and state law; (2) evidence summaries for specific disease states; and (3) presentations to clinicians.

Justification/Documentation: Thirty-three states have now passed legislation regarding medical cannabis, including the 2018 Utah Medical Cannabis Act. Unfortunately, reliable sources and evidence-based information describing medical cannabis use are not readily available for clinicians. Without appropriate information, patients and clinicians are placed in a precarious situation due to the unfamiliar safety and efficacy of available formulations of medical cannabis. Pharmacists are uniquely qualified to create educational materials that promote the safe, evidence-based use of medical cannabis with the primary goal of providing high-quality patient care.

Adaptability: Hospitals and health systems may benefit from compiling information on medical cannabis where similar state laws have been passed. The information should be tailored as appropriate to address the nuances of local laws or meet the needs of the health system.

Significance: As pharmacotherapy experts, pharmacists are likely to be consulted for medical cannabis information as laws continue to change. Compilation and dissemination of evidence-based medical cannabis information is critical to ensure patients receive safe, evidence-based treatment.

372 | Expanding the scope of pharmacy services with an intern program at an academic medical center

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Service or Program: A pharmacy intern-driven program to increase pharmacy reach for medication teaching was implemented through a home-grown digital medication teaching tool. Pharmacist-led medication teaching, at our institution, was available to select patient populations due to limited resources. Pharmacists working in the satellites have designated workflow responsibilities precluding them from conducting one-on-one education sessions with patients. Pharmacy interns can be positioned to help facilitate medication education and therefore, can be engaged to serve as pharmacy extenders.

Justification/Documentation: An implementation roadmap was developed for the initiative, and a standard operating procedure was followed by pharmacy interns to prioritize patients for medication education each shift. Pharmacy interns distributed the digital tool, assisted completion of the education modules, and triaged questions to the pharmacists.

A total number of patients screened were comparable in the years 2017 (n = 2010) and 2018 (n = 1983). There was a slight decline in 2018 as a result of staff turnover. However, the overall percentage of patients educated increased from 67.5% to 73% in 2017 and 2018, respectively. The most common reasons that patients did not receive education included language barrier, declining of service, and altered mental state.

Pharmacy interns who have participated in the patient education program felt that this experience had improved their communication skills, confidence level, time management, and professionalism.

Adaptability: The same type of program may be replicated and implemented at other institutions leveraging pharmacy interns. Other pharmacy extenders such as pharmacy technicians and pharmacy students may be involved in these initiatives as well. A similar platform that incorporates technology for medication teaching may be used.

Significance: Deploying pharmacy interns for distribution of a home-grown digital tool that provides general medication teaching has shown positive outcomes, including greater pharmacy visibility, better patient experience, and higher staff engagement. Additionally, direct patient interaction enhanced the professional development of pharmacy interns.

373 | Leveraging a tenure-track/non-tenure track faculty partnership to expand clinical services and scholarship in nephrology

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Service or Program: Clinical-track faculty often cite time and limited research training as barriers to scholarship. In contrast, tenure-track faculty may not have the bandwidth to implement practice-based research interventions independently. Thus, there is a mutually beneficial opportunity to partner clinical-track and tenure-track faculty. In 2017, a tenure-track (ABP) and clinical-track (EA) faculty member practicing in nephrology at the University of Michigan College of Pharmacy created a collaborative partnership with the aim of enhancing scope of clinical service delivery and scholarly productivity.

Justification/Documentation: Initially the two faculty members met to discuss individual short and long-term goals and research interests. Several research projects were launched in the multidisciplinary chronic kidney disease (CKD) clinic, a practice site for EA. These included evaluation of a mobile application for NSAID avoidance education which produced a co-authored publication (PMID:30833128) and evaluation of a tool to assess literacy around the adverse effects of NSAIDs on kidney function (just completed). In 2018, an ambulatory care PGY2/fellowship position was created to include a focus on nephrology during PGY2 followed by a one-year fellowship focused on practice-based research. To date the resident has produced one primary author publication and one co-authored publication for submission and has received grant funding for their residency project focused on a pharmacist-led sodium education intervention in CKD. The resident also expanded clinical services in ambulatory dialysis and created a medication reconciliation process to comply with an upcoming quality incentive measure from CMS. An elective, co-coordinated by ABP and EA, was launched in partnership with the National Kidney Foundation of Michigan to provide P1-P3 students experience interacting with non-profits and engaging pharmacists in CKD awareness.

Adaptability: Another incoming resident will allow for further expansion of dialysis services.

Significance: In summary, a deliberate collaboration between a research-focused and clinically-focused faculty member can enhance clinical services and scholarship.

374 | Interdisciplinary SBIRT training for pharmacy students in a rural family medicine clinic

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Service or Program: An interdisciplinary training program on screening, brief intervention, and referral to treatment (SBIRT) was implemented in a family medicine residency clinic in rural Hawaii. At this interprofessional teaching site, on-site learners including pharmacy, medical, nursing, and behavioral health students were trained to identify and intervene in patients showing potential signs of risky substance abuse behaviors.

Student training consisted of three components:

1. An online informational module introducing the SBIRT model
2. Group role-playing using screening and brief intervention skills
3. Performing screening and brief interventions with 3-5 clinic patients under direct supervision of a trained SBIRT provider.

Justification/Documentation: According to the SAMHSA's 2017 National Survey on Drug Use and Health, about 19.7 million people had a substance abuse disorder relating to illicit drugs or alcohol use. Living in a rural community, access to healthcare resources can be limited and identifying risky behaviors before it becomes an addiction can be difficult. By training student learners they were able to apply their skills with patients and are able to take the knowledge learned to apply it to a greater population throughout their professional career.

Adaptability: This program can be implemented at any healthcare training site. All trainers received their SAMHSA SBIRT CE training certificate and provided SBIRT counseling to patients prior to training their learners. Any teaching clinical site would be able to implement this type of service for their patients while also providing the training opportunity for their learners.

Significance: Pharmacists are the most accessible healthcare provider and have the broadest reach to patients. Training student pharmacists provides them with the tools necessary to intervene on risky substance abuse behaviors before it becomes an addiction. Though the training was completed during an ambulatory care rotations, the skills learned can be applied in any pharmacy setting.

375 | Creation of a pharmacist for a day experience for elementary students

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Service or Program: The Duke Talent Identification Program (TIP) with the John P. McGovern Museum of Health and Medical Science provides gifted elementary students hands-on educational programming outside of school to augment their learning. These Academic Adventures Programs are intellectually challenging day-long workshops which cover various careers in the medical field. Our goal was to design a day-long curriculum aimed at teaching 5th and 6th grade students the basics of a career as a pharmacist.

Justification/Documentation: The Pharmacist for a Day curriculum was created in several parts. The first part of the day was dedicated to an interactive lecture which covered how to become a pharmacist, common workplaces, daily responsibilities, medication routes of administration, and components of a prescription. The second part of the day was a hands-on activity in which students were given a "filled prescription" from their technician and had to act as the pharmacist to identify errors that were present. The final part of the day was a tour of a hospital pharmacy and an interview with pharmacy staff, where the students saw leeches, the medication dispensing robot, and had the opportunity to ask pharmacists and technicians questions about their careers.

Adaptability: This Pharmacist for a Day educational program for gifted 5th and 6th grade students can be adapted at other sites around the country which offer learning experiences outside of the school setting.

Significance: This program represents the first time that a Pharmacist for a Day curriculum was implemented to educate 5th and 6th grade students about the field of pharmacy in an interactive learning environment. These students will become aware of the daily responsibilities of a pharmacist and may consider pharmacy as a future career more seriously as they begin career planning.

376 | Development and implementation of a pharmacy student-led technician continuing education program

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Service or Program: The Massachusetts General Hospital has a robust Continuing Education (CE) Program offered to Pharmacy Department employees, led by the Pharmacy Grand Rounds (PGR) Committee. The PGR Committee provides, on average, 12 hours of CE credit to pharmacists and 1 hour to technicians, annually. In 2019, the PGR Committee incorporated Longitudinal Advanced Pharmacy Practice (LAPP) students who lead CE lectures geared towards pharmacy technicians. LAPP students create CE lectures with the help and guidance of assigned members of the PGR Committee and expert pharmacist mentors from several areas within the department.

Justification/Documentation: n 2018, Massachusetts General Hospital (MGH) began the Longitudinal Advanced Pharmacy Practice (LAPP) Program with a goal of preparing students for post-graduate training. Students are on site for all six, six-week rotations. Required components of the LAPP program include teaching and service.

Historically, MGH's CE program has provided significantly more CE lectures for pharmacists. These were primarily led by pharmacists and pharmacy residents.

To further support our technicians, the need for more CEs was recognized. LAPP students were utilized to lead CE lectures as part of an effort to meet our departmental goals and satisfy the teaching and service component of the LAPP program. CE topics for pharmacy technicians were selected based on pharmacy technician suggestions that coincide with the Pharmacy Technician Certification Exam Blueprint.

Adaptability: This program can be adapted to health systems across the country, especially those with students enrolled in longitudinal advanced pharmacy practice programs.

Significance: The pharmacy student-led technician CE program at MGH allows for improved job satisfaction for the pharmacy technicians, robust teaching opportunities for the LAPP students, as well as further service for the pharmacy department.

Emergency Medicine

377 | Regional community emergency department microbiology follow-up-collaborative practice agreement

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Service or Program: Indiana University Health Arnett is a Level III trauma center community hospital in Lafayette, Indiana. Microbiology follow-up is a monitoring program for patients discharged from the emergency department (ED). In August 2016, the microbiology follow-up was transferred from nursing to the clinical pharmacist in the ED. As of July 2017, the clinical pharmacist began reviewing microbiology culture reports for two additional critical access hospitals resulting in a regional pharmacist-led program. The clinical pharmacist evaluates microbiology reports for appropriateness of empiric therapy administered and/or prescribed in the ED. Of the 5495 charts reviewed in 2018, 3.8% of patients required a change of initial therapy. This data supported the acquisition of a collaborative practice agreement for clinical pharmacist prescribing of anti-infectives for ED microbiology follow-up in the region.

Justification/Documentation: Antibiotics are some of the most commonly prescribed medications in the ED. Unfortunately, antimicrobial prescribing is predominantly empiric with final microbiology results either unavailable or reported after most patients are discharged. It is estimated that 5.6% of patients discharged from the ED receive an inappropriate medication. Systematic follow-up processes are needed to ensure appropriate antimicrobial therapy in the ED.

Adaptability: Clinical pharmacists in the ED are an innovative practice model increasingly implemented in hospitals over the last decade. Pharmacist managed microbiology follow-up should be implemented in capable EDs. With updated cost-prevention data, a collaborative practice agreement can expand and redefine a clinical pharmacist's scope of practice.

Significance: Current literature identifies implementation of ED clinical pharmacist managed antimicrobial stewardship programs as significantly reducing time to appropriate care, as well as reduced ED revisits and subsequent hospital admissions within 30 days. Most studies to date are single-centered with short durations of data collection. Our robust regional program, in association with a collaborative practice agreement, further supports the growing practice of ED clinical pharmacists.

Endocrinology

378 | Post-discharge telephonic outreach program for adult patients new to insulin

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Service or Program: A post-discharge outreach program was designed for patients dispensed insulin by the hospital-based retail pharmacy through our meds-to-beds program. Pharmacy student called patients one business day after discharge to assess their ability to accurately describe appropriate insulin administration technique, insulin side effect management, and frequency of glucose monitoring. Student provided supplemental education in these three areas, if needed, and ensured patient had all necessary supplies.

Justification/Documentation: During 30-day period, 25 patients were called, and student verbally connected with 20/25 (80%). All patients had either a new insulin prescription or a change to their pre-hospitalization regimen. Of all, 45% (9/20) of patients had not previously taken insulin at home. Fifty percent (10/20) could not explain one or more steps of insulin pen administration. Student provided education regarding pen priming, changing needle for each dose, mixing cloudy insulin, and holding needle under the skin after injection. Ten percent (2/20) of patients required follow-up intervention by a pharmacist to resolve a patient-identified issue related to insulin management.

Adaptability: In the ideal setting every patient with diabetes, and especially those new to insulin, would receive adequate education during hospitalization. Unfortunately, many hospitals have an inadequate number of diabetes educators. In addition, even when they are taught, patients often cannot recall information provided when they are acutely ill in the hospital setting. Mean time to conduct telephone call was 8.7 (range 5-15) minutes.

Significance: Hospital readmission can be avoided through effective discharge planning and patient follow-up after hospitalization. As a high-alert medication, insulin has increased risk of causing harm when not used correctly. Within this program, pharmacy students reinforced basic insulin education to ensure patients use their insulin safely and effectively following hospital discharge. The program also provided a mechanism for identifying patients with issues

requiring pharmacist intervention that potentially avoided ED visits or hospital readmission.

Gastroenterology

379 | Improved colonoscopy preparation with a pharmacist-directed pre-colonoscopy intervention program

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Service or Program: A process was developed to refer patients to a clinical pharmacist at a county medical center to educate about colonoscopy preparation, to provide medication therapy management, and to identify patient-centered challenges. Patients were referred to a pharmacist in order to increase the adherence rate to medication preparations and to improve the rate of colonoscopy completion.

Justification/Documentation: Colorectal cancer remains a significant cause of mortality and morbidity. Screening colonoscopy is an established method to decrease the incidence of colorectal cancer. Unfortunately, completing the procedure is complicated. It requires preparation, medication adjustment, and patient education. Access to gastroenterologists may also be limited. To address these challenges, we developed a novel pharmacist-directed pre-colonoscopy intervention program (PIPP) to improve medication management. We report our feasibility results on 677 patients conducted at our safety net medical center.

Adaptability: Colorectal cancer is the second most common cancer in Hispanics. This population generally has a low adherence rate in preventative programs. It is estimated that 49% of Riverside County is Hispanic, the majority of whom receives its care at our medical center. Seventy seven percent of referred patients were Hispanic. The majority had comorbidities including diabetes, hypertension, and anticoagulant use that required medication adjustments. Direct access to the PIPP decreased the time from provider referral to the procedure and increased the rate of adherence to the colonoscopy preparation. Patients did not require a pre-procedure consultation with gastroenterology.

Significance: We have demonstrated that it is feasible to use a unique program to address critical needs in completing colonoscopies. Complete preparation instructions were detailed. Medication issues were successfully addressed. Finally, there were fewer visits to gastroenterology resulting in the potential for improving access and decreasing costs. We conclude that the PIPP serves as a model for improving colonoscopy completion and potentially decreasing colon cancer.

Geriatrics

380 | Smart speakers for medication education in an independent living community for older adults

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Service or Program: Clinical pharmacists teamed with an independent living retirement community for residents over the age of 62 years to access and deploy smart speakers (Amazon Echo Dot) for in-home use. The smart speakers use software allowing the devices to be managed centrally, while minimizing technology barriers and allowing for the development of applications tailored to residents' needs. Our collaboration utilizes smart speakers to support medication optimization and enhance medication education in older adults.

Justification/Documentation: 100 residents received a smart speaker. Baseline characteristics include a mean age of 81 ± 6 years, 70% female, 93% white, and the majority received a graduate degree (59%). Common health conditions among residents include hypertension (58%), dyslipidemia (45%), arthritis (42%), hearing impairment (35%), and vision problems (28%). Residents were prescribed 7 ± 3.8 medications and 78% were prescribed medications requiring administration multiple times daily.

Adaptability: The ideal medication optimization tool would utilize information technology to incorporate knowledge and input from healthcare professionals and address patients' needs to maximize health outcomes. Our work highlights an innovative utilization of smart speakers using an application developed to empower older adults to take control of their health by optimizing medication knowledge, use, scheduling, and adherence. This approach ultimately aims to maintain resident independence and reduce unplanned healthcare visits (emergency room or urgent care) — a critical solution to streamline healthcare and reduce hospitalization, mortality and cost in older adults.

Significance: Older adults with better physical functioning are more likely to report higher quality of life and less rates of depression. Polypharmacy among older adults is common and leads to adverse outcomes. Thus, it is critical to empower older adults to manage their health and optimize their medications to keep them independent and

functional. Using smart speaker technology is a unique approach to optimize medication use and, ultimately, health outcomes in older adults.

381 | An opioid prescription tool to address optimal utilization of treatment: The OPT-OUT initiative

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Service or Program: The OPT-OUT Initiative provides education to older adults on chronic opioids for non-cancer pain. An educational tool, targeting the unique risks of opioids in older adults was developed and provided to community pharmacists to educate older adults receiving opioids for non-cancer pain. The goal of the educational intervention is to motivate older adults to discuss opioid risks and harms with their prescribing clinicians and encourage shared decision making.

Justification/Documentation: Older adults (>65 years) are at risk of unintentional opioid misuse and overdose due to polypharmacy and lack of awareness about opioid risks. Community pharmacies are uniquely positioned with trained pharmacists, directly interacting with patients at the point of opioid dispensing, to make significant impact in reducing dangerous adverse events. The OPT-OUT Initiative utilizes community pharmacists to provide evidence-based education to older adults on the risks of opioid use, safer alternatives for chronic pain management, and foster shared decision making with their clinicians. Pre- and post-education knowledge, whether the patient discussed their opioid medication with their prescribing clinician at follow up, and any changes in opioid prescribing and dosing pattern are assessed to determine the full impact of this educational intervention.

Adaptability: This project is scalable to any community pharmacy with a significant population of older adults receiving opioids for non-cancer pain. Community pharmacists are trained to educate patient on the risks of opioids in older adults and on motivational interviewing skills to empower their patients to voice their fears and questions with their clinician.

Significance: Community pharmacists are underutilized as members of the healthcare team, yet are well-positioned to provide high-level education to older adults. Minimal additional effort is needed for other pharmacies to replicate this model and engage their pharmacists. Patient-centered care hinges on the education and empowerment of patients to be part of shared decision-making for optimizing their health and well-being.

Infectious Diseases

382 | Pharmacist driven models of care for hepatitis C virus elimination: Real-world cohorts

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Service or Program: Real-world examples of pharmacist-driven models of chronic hepatitis C virus (HCV) care are emerging from several single-center and multicenter retrospective and prospective cohorts. In this descriptive analysis, data from real-world populations and two post-marketing investigator sponsored trials are included. Patient demographics, model characteristics, and sustained virologic response at 12 weeks after treatment completion, indicating cure, are reported. Five different models of care that have been implemented were chosen: 1) academic ambulatory care setting; 2) Indian Health Service; 3) specialty pharmacy; 4) Veterans Affairs Healthcare System; and 5) community pharmacist providing opioid substitution therapy (OST).

Justification/Documentation: Highly efficacious direct-acting antivirals (DAAs) provide an unprecedented opportunity to eliminate HCV globally. To eliminate HCV globally by 2030, the World Health Organization has a goal of treating 80% of people diagnosed with chronic HCV. Clinical pharmacists practice in a variety of settings and reach diverse populations. They are well positioned to expand the treater pool and directly impact the HCV cascade of care, especially linkage to care, so that HCV elimination can be achieved.

Adaptability: Delivering care where patients already access medical care improves all elements of the HCV cascade of care including screening, treatment initiation, monitoring, and outcomes. These models of care demonstrate that pharmacists already practice in places where they encounter patients who are at risk for chronic HCV. Clinical and community pharmacists can implement services to deliver medication management to improve DAA treatment uptake, adherence, patient education, monitoring, and patient outcomes.

Significance: Cure rates in HCV care delivered by pharmacists were similar or better than conventional models of care. Cure rates were greater than 90% across all populations from diverse practice settings. Innovative models using pharmacists will be essential if HCV elimination goals are to be achieved globally.

383 | Keeping Score: development of a prioritization algorithm for multidisciplinary antimicrobial stewardship interventions

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Service or Program: Assessing the impact of antimicrobial stewardship programs (ASP) can be process-based and/or outcome-based. Clinical decision support (CDS) tools in the electronic medical record can be used to prioritize stewardship interventions. The Medical University of South Carolina (MUSC) transitioned from Theradoc® to Epic® for ASP surveillance and data collection in 2018. The ASP team utilized Epic ICON® to develop a scoring algorithm with integral rules to identify and analyze inpatients who might require ASP interventions.

Justification/Documentation: At a large academic medical center, identifying patients with the most critical need for ASP interventions can be difficult. This platform utilizes a scoring algorithm to identify and prioritize patients with positive blood or central nervous system cultures, positive critical diagnostic tests, and high-risk antimicrobial use. Additional rules identify "bug-drug" mismatches and de-escalation opportunities. For example, the rules assign high priority to patients with positive blood cultures and no prescribed antibiotics, but a lower priority to restricted antimicrobial orders. We created a branched-logic flowsheet to document microorganism, presumed source, anti-infective use, ASP intervention, and recommendations, allowing for multidisciplinary documentation outside of Epic® I-vents. These data are compiled monthly for analysis of ASP interventions and process improvement.

Adaptability: In addition to meticulous intra-program testing, the accuracy of event and patient capture were assessed during the buildout and via daily comparisons between Theradoc® and Epic® for 2 weeks. The platform and training are currently being optimized for various affiliate hospital acquisitions.

Significance: A multidisciplinary approach using pre-authorization and/or prospective audit and feedback combined with institutional guidelines, personnel education, and intervention monitoring is essential for successful ASPs. Our goal with the MUSC Epic ICON® ASP platform was to showcase a CDS system that allows for streamlined, multidisciplinary communication, documentation, and analysis of outcomes. This reproducible build can help programs optimize treatment of potentially fatal infections (e.g. bacteremia) and delay emerging resistance.

Managed Care

384 | Integration of telephonic clinical pharmacy services within a team-based home care program

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Service or Program: Geisinger recently instituted a team-based home care program called Geisinger at Home (G@H). Patients are eligible for the program if they have evidence of, or risk for, significant healthcare utilization (i.e. emergency department visits or hospitalizations). Patients are cared for in the home by a care team that includes: a medical director, advanced practitioners, registered nurse case managers, community health assistants, and clinical pharmacists, along with other ancillary providers (e.g. social workers, dieticians, etc.). Pharmacists provide services telephonically including: comprehensive medication management, comprehensive medication review, drug information, and disease state management.

Justification/Documentation: Healthcare utilization is unevenly distributed with 5% of patients responsible for 50% of healthcare costs. Often, these patients are complex and have other social needs in addition to their health that need to be addressed. To better meet the needs of these patients, reduce utilization, and improve outcomes, Geisinger has implemented G@H, bringing team-based approaches to care for patients in their home.

Adaptability: Despite the challenge of implementing home-based medical care, the provision of telephonic pharmacy services in support of clinical initiatives to improve outcomes and reduce costs is highly adaptable and can be used to expand patient access to pharmacy services. All pharmacists involved are trained and credentialed using a process similar to those used throughout Geisinger's ambulatory care service line and are based on well-established best practices.

Significance: Medication related problems are common in patients with high levels of utilization and pharmacists provide necessary expertise for managing their often complex medication regimens. By working as part of a multidisciplinary team helping to optimize drug therapy though a variety of services, pharmacists are key to reducing costs and improving outcomes.

Medication Safety

385 | Association between activated partial thromboplastin time, age and bleeding events in NVAF patients receiving dabigatran

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Service or Program: The purpose of this study was to analyze the association between bleeding events and coagulation assays including activated partial thromboplastin time(APTT) and prothrombin time(PT), and to determine the risk factors for bleeding in Chinese patients with nonvalvular atrial fibrillation(NVAF) receiving dabigatran.
Justification/Documentation: We conducted a retrospective cohort study including NVAF patients receiving dabigatran 110 mg twice daily between March 2016 and November 2017. We obtained the clinical features and demographic data from the medical records and compared the baseline characteristics of the bleeding group and the no bleeding group. Receiver operating characteristic(ROC) curves and logistic regression model were used to determine the relation between APTT and bleeding events and the predictors of bleeding. Model performance was evaluated using the derivation cohort and an independent validation cohort by area under the ROC curve(AUC).
Adaptability: A total of 346 patients were included and bleeding events occurred in 39(11.2%) patients. Patients with age over 65 years (OR = 2.56 [95% CI 1.20-5.43]), hypertension(OR = 2.42 [95% CI 1.11-5.26]), decreased renal function(OR = 4.27 [95% CI 1.22-14.91]) and with concomitant use of an antiplatelet drug(OR = 3.53 [95% CI 1.28-9.74]) showed higher risk for bleeding, and APTT value of the bleeding group was higher than the no bleeding group(P = 0.014). By ROC analysis we found that the appropriate overall cut-off value of APTT ratio was 1.30, with a sensitivity of 72% and specificity of 58%. Multivariate logistic regression showed that higher age(P = 0.003; OR = 1.05 [95% CI 1.02-1.09]) and APTT ratio > 1.30(P = 0.002; OR = 3.20 [95% CI 1.23-6.73]) were independent risk factors for bleeding in patients with dabigatran therapy. The logistic regression model exhibited moderate discrimination ability, with an AUC of 0.73[95% CI 0.65-0.81] and 0.77[95% CI 0.59-0.96] in the derivation cohort(n = 346) and the validation cohort(n = 71) respectively.
Significance: Our study demonstrated that APTT ratio > 1.30(at trough level) and higher age were independent risk factors for bleeding.

386 | Establishing medical information systems to prevent inappropriate drugs in patients with G6PD deficiency

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Service or Program: To prevent G6PD patients from being prescribed inappropriate drugs, we have established effective medical alert systems and clinical decision support systems in hospital. We offered diffident reminder functions to suit various situations, such as the computerized provider order entry systems, High/low-risk drugs database, alert system that should be avoided/ consumed with caution in prescription system/ dispensing system, and automatically read and write allergy notes of National Health Insurance IC card.
Justification/Documentation: G6PD deficiency is the most common enzymopathy in the world. Approximately 400 million people are affected worldwide, and it is believed to have resulted in 16,000 deaths (GBD2017). Hemolytic anemia can occur in response to ingestion of fava beans and certain drugs or severe infection, leading to severe complications and even death. Even with the same ingredients, doses, and concentrations, symptom severity varies with genetic differences. Therefore, patients may tend to be negligent. So, how to prevent patients from getting inappropriate drugs is the top priority.
Adaptability: The assessment can be replicated in any hospitals or medical institution, and pharmacist can use the method to collect clinical data to establish medical information systems.
Significance: Referring to the UPTODATE, we recommend using the data from the G6PD deficiency favism association website to set up 56 high-risk, 86 low-risk drugs. According to ATC CODE and dosage form, we can suggest clinical staff that the drug should be avoided or used with caution. When physicians prescribed inappropriate drugs, system can remind pharmacist actively. At present, there is no consensus on inappropriate traditional Chinese medicines (TCMs) for G6PD patients. We set 6 TCMs to be avoided by international reference and set 14 TCMs to be used with caution by Chinese reference. By systems we reduced average 5 inappropriate prescriptions per week. Pharmacist can play a useful role of this piece and give better medical care.

Oncology

387 | Development of inpatient chemotherapy and supportive care therapy guidelines to promote appropriate inpatient/outpatient utilization of high-cost medications

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Service or Program: A pilot program was implemented where clinical pharmacists in a 14-hospital, integrated health system actively intervened to promote appropriate inpatient utilization of chemotherapy and oncology supportive care items.
Justification/Documentation: Outpatient chemotherapy allows for safe, convenient, cost-effective drug administration in a familiar setting, where overnight stays may be avoided and professional

assistance is available in the event adverse events occur. Some inpatient chemotherapy use is indicated, particularly in situations of oncologic emergencies, chemotherapy regimens requiring frequent dosing or high dose therapy, enrollment in clinical trials specifying inpatient use and palliation of symptoms or disease burden for patients who are not appropriate for discharge or outpatient chemotherapy. In a routine financial reimbursement analysis, it was noted that > $1,200,000 was spent providing chemotherapy and oncology supportive care items typically administered in the outpatient setting for hospital inpatients in 2017. The pharmacy team collaborated with interdisciplinary stakeholders and senior medical leadership to establish guidelines for appropriate inpatient use of these high-cost items and began actively intervening with providers to drive inpatient use the outpatient setting, where clinically appropriate to do so.

Specific clinical program goals:

- Develop appropriateness criteria for inpatient chemotherapy utilization throughout an integrated health network offering oncology services.
- Educate front-line pharmacists on criteria and tactics to engage front-line and senior medical staff leadership to promote appropriate use.
- Quantify cost savings from inpatient to outpatient conversions over a 6-month pilot period.

Adaptability: This interdisciplinary program was implemented across a 14-hospital integrated health system and would be adaptable to most facilities providing oncology services.

Significance: A total of 34 clinical pharmacist interventions over a 6-month period (October 1, 2018 - March 31, 2019) at 8 of the 14 hospitals produced hard dollar savings of $468,797. Each pharmacist intervention was peer-reviewed by oncology pharmacy leadership for quality and program development.

Other

388 | Combating burnout syndrome: A unique approach from critical care clinical pharmacists

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Service or Program: In an effort to combat burnout syndrome (BOS), the University of Illinois at Chicago College of Pharmacy implemented a rotation between 4 critical care clinical pharmacists to create time off service dedicated to scholarship and educational endeavors. For 9 months of the year, the 3 non-tenure track pharmacists practice at their primary sites: medical intensive care unit (MICU), coronary care unit (CCU), and emergency department (ED). For the other 3 months, the tenure track pharmacist practices in the CCU, and the non-tenure track pharmacists rotate between MICU, ED, and off service.

Justification/Documentation: The American Society of Health-Systems Pharmacists joined the National Academy of Medicine's Action Collaborative on Clinician Well-Being and Resilience, which identifies several factors that contribute to clinician burnout. While exact interventions to reduce BOS have not been identified, it is likely that a combination of individual- and organization-focused interventions are necessary. Research demonstrates that clinical pharmacists exhibit BOS within the dimensions of emotional exhaustion and reduced personal accomplishment. Therefore, it is anticipated that providing time dedicated to responsibilities outside of patient care may improve these areas within BOS. To assess the impact of this rotation, the pharmacists will participate in productivity logging and burnout assessment surveys.

Adaptability: This rotation can be implemented at any healthcare system with clinical pharmacists, including those that also have faculty appointments. The rotation schedule requires clinical pharmacists to be flexible with covering a variety of practice sites and possible restructuring of existing positions. Support from hospital and/or college of pharmacy leadership is also needed.

Significance: Burnout syndrome remains a serious threat to healthcare professionals, and clinical pharmacists are among several at-risk personnel. Identification of methods to target BOS is imperative to maintain complete wellness of clinical pharmacists. Providing flexible work environments and dedicated time off service through this rotation may alleviate some symptoms of BOS.

Pain Management/Analgesia

389 | Another tool for chronic pain management? Evidence describing medical cannabis use in chronic pain

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Service or Program: A team of pharmacists (ie, drug information specialists, clinical ambulatory care pharmacists) conducted an in-depth review of published evidence related to the use of medical cannabis for various disease states, including pain. The goal of the review was to compile and disseminate unbiased and evidence-based information to aid the decision-making of leaders and clinicians within a large health system. Evidence summaries for qualifying conditions were compiled by the pharmacist team, published on an internal website, and disseminated to health-system staff. The available literature suggests cannabis products may be effective for the treatment of various non-cancer related pain disorders. Depending on the product, formulation, and concentration, between 26% and 88% of patients achieved at least a 30% decrease in pain scores with a number needed to treat of 3 to 20.

Justification/Documentation: Thirty-three states have now passed legislation regarding medical cannabis, including the 2018 Utah Medical Cannabis Act. Many state medical cannabis laws, including the Utah legislation, outline qualifying conditions for which medical cannabis may be used, including pain; however, evidence describing medical cannabis use for pain was not readily available. Without appropriate information, patients and clinicians are placed in a precarious situation due to the unfamiliar safety and efficacy of medical cannabis. The pharmacy department successfully created and distributed unbiased education and information to clinicians to support evidence-based decision making.

Adaptability: Hospitals and health systems may benefit from compiling information on medical cannabis where similar state laws have been passed. The information should be tailored to address the nuances of local laws and meet the needs of the health system.

Significance: As pharmacotherapy experts, pharmacists are likely to be consulted for medical cannabis information as laws continue to change. Compilation and dissemination of evidence-based medical cannabis information is critical to ensure patients receive safe, evidence-based treatment.

390 | A standardized approach to periprocedural buprenorphine management

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Service or Program: An interprofessional team championed by Clinical Pharmacy Specialists (CPS) at a rural health care network convened to develop a standard approach to periprocedural buprenorphine management. A consensus algorithm outlines continuation of the home buprenorphine regimen, but splits the total daily dose into more frequent administration if pain is anticipated, a novel strategy to leverage the analgesic effects of the drug. The clinician may utilize full opioid agonists if post-procedural pain is anticipated. A multimodal approach is employed, including use of local or regional anesthetics when appropriate. In addition to the algorithm, the CPS assisted with implementing a standardized pre-admissions workflow, which consists of patient assessment, clinician to buprenorphine prescriber communication and patient education. The CPS was integral to clinician education prior to program implementation.

Justification/Documentation: Periprocedural management of patients taking buprenorphine for medication assisted treatment (MAT) is poorly defined, yet the number of patients presenting for procedures while on buprenorphine continues to rise with MAT expansion. Given the complexities of the drug and high risk nature of this population, CPS are well positioned to assist with:

- reducing the risk of perioperative relapse
- alleviating anxiety related to anticipation of withdrawal
- perioperative pain management
- mitigation of logistical challenges associated with therapy.

Adaptability: This periprocedural program does not require specialty service access, rather integrates buprenorphine prescribers within the periprocedural care plan, optimizing continuity of care. It is easily comprehended and utilized by all disciplines, making it generalizable. The algorithm may be easily adapted by a system of any size, with similar geographic or logistical challenges.

Significance: This program has wide-reaching utility, as health care systems nationwide encounter patients on MAT who require assistance with periprocedural management. Clinical pharmacy expertise in understanding complex pharmacology and clinical impact has a key role in optimizing patient care through harm reduction and pain management optimization in this high risk population.

Peri-Operative Care

391 | Impact of expansion of surgery pharmacy services to acute and perioperative care areas

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Service or Program: Beginning in 2017, our institution began a two-year expansion of surgery clinical pharmacy services. The addition of 5.2 full-time equivalent facilitated expansion from critical care to acute and perioperative care areas including weekend evening and weekend shifts. The expansion was implemented with goals of increasing pharmacist-led transitional care services, promoting opioid stewardship, improved operational services, and creating experiential learning opportunities for pharmacy students and residents.

Justification/Documentation: From 2017 to present, according to pharmacist interventions documented in the electronic health record, all mean monthly interventions increased 1.5-fold, transitional care interventions increased 3-fold, pain management interventions increased 1.6-fold, and intranasal naloxone prescribing increased 5-fold. These improvements and pharmacist-led enhancement of clinical decision support contributed to significant, sustained reductions in inpatient and discharge opioid prescribing for elective surgery, opioid-naive patients. Additionally, dedicated surgery pharmacist teams members led the implementation of an operating room pharmacy satellite, and supported value-based quality improvement projects on sodium nitroprusside and intravenous acetaminophen, resulting in over $500,000 in cost savings.

Adaptability: The successes, barriers overcome, and lessons learned from our implementation of acute surgical care and perioperative care pharmacy services may offer other institutions strategies for service design and justification in efforts to adhere to American Society of Health-Systems Pharmacists perioperative pharmacy services

guidelines. Our use of the Institute for Healthcare Improvement Model for improvement involved an iterative process and included representation of data over time.

Significance: Despite lack of a formal training program or pathway for surgery pharmacists, our institutional experience with expansion of surgery pharmacy services demonstrated important contributions to transitional care, opioid stewardship and safety, and improvements to the medication use system. The development of a formal training pathway for surgery pharmacy is critical to its ability to grow and advance the profession of pharmacy in this field.

Pharmacogenomics/Pharmacogenetics

392 | Establishment and utilization of pharmacogenomics econsults at Mayo Clinic

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Service or Program: Mayo Clinic's pharmacogenomics (PGx) clinic was developed by partnership between Center for Individualized Medicine and Pharmacy. Pharmacists have been providing PGx consultative services that include electronic consultations (eConsults), phone and face to face since at least 2015 when the first dedicated PGx pharmacist was hired.

PGx eConsults are ordered by health care providers, reviewed and assessed by PGx pharmacists who then document their recommendations in patients' medical records.

Justification/Documentation: Most healthcare providers are uncomfortable with PGx test results assessment. Pharmacists serve as a resource for other providers by reviewing PGx test results with emphasis on gene-drug and drug-drug interactions and provide electronic recommendations to further manage drug-related issues. Hence, this process is cost-effective for the institution and the patient. Value of eConsults is evident in the 560 PGx eConsults ordered by providers over the span of one year 2018-2019.

Adaptability: Although PGx eConsults were initiated within our general internal medicine clinic, PGx pharmacists trained other pharmacists to assess and document eConsults using a standardized template in their respective clinics. This includes, but not limited to, the following areas: Primary Care, Psychiatry, Surgery/Anesthesia, Gastroenterology, Fibromyalgia/ Pain, Oncology, HIV/Infectious Diseases. The implementation and adaptability of this service is feasible in organizations that have electronic health records.

Significance: In the last four years the utility of PGx eConsults has grown from one clinic to numerous clinics as stated above. This growth has broadened clinical pharmacists' opportunities in serving as drug experts within their respective clinics. Benefits of limiting face to face visits while maintaining quality of care are increased cost-effectiveness and scalability through the eConsult process.

393 | Implementation of pharmacogenomic services for patients with refractory psychiatric or neurologic disorders

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Service or Program: A pharmacogenomics consult service was developed for the outpatient psychiatry and neurology clinics at an academic medical center for patients with treatment resistant or refractory disease and/or medical complexity who have failed multiple medication trials or experienced medication intolerance. The clinical pharmacist meets with the patient to gather a detailed medication history and to determine goals. At a subsequent appointment, the pharmacist reviews the testing results with the patient. Incorporating pharmacogenomics into the shared decision-making process, the pharmacist works with the referring physician, other providers, and the patient to make medication recommendations.

Justification/Documentation: Payments made to a value-based service organization are based upon outcomes. Multiple treatment failures and adverse effects from medication are associated with higher rates of hospital admission/readmission and are also linked to decreased patient satisfaction and nonadherence. Clinical outcomes and patient satisfaction with the pharmacogenomics consult service will be measured.

Adaptability: This pharmacogenomics consult service can be replicated in other settings by a clinical pharmacist who has received pharmacogenomics training/education and has the ability to provide consult services. This service should be delivered in clinics in which testing for the population is either covered by a plan such as Medicare or the patient has the ability to pay out-of-pocket for non-covered costs. The patient must also meet medical necessity for testing which is typically met by medication treatment failure and/or adverse effects.

Significance: Pharmacists can play a pivotal role in the area of pharmacogenomics. Although there are some guidelines available that can help guide therapy for individual drug-gene interactions, patients with medical complexity (including those with resistant or refractory disease) pose an additional challenge. Providing personalized medicine in the form of a pharmacogenomics consult service can add value to the healthcare team by targeting patients who result in higher costs for the healthcare system.

394 | Clinical implementation of the clinical pharmacogenetics implementation consortium guidelines

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Service or Program: The implementation of preemptive pharmacogenetic testing at St. Jude Children's Research Hospital (St. Jude) is achieved through the PG4KDS protocol. Gene/drug pairs with sufficient evidence for implementation, generally determined by the availability of Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines, are integrated into the electronic health record (EHR) and coupled with clinical decision support (CDS). As of June 2019, 11 genes and 35 drugs have been implemented and are available for use as part of routine clinical care for more than 5100 patients at St. Jude.
Justification/Documentation: Prior to the creation of CPIC, one barrier to the clinical implementation of pharmacogenetics was the lack of detailed, peer-reviewed, gene/drug clinical practice guidelines. CPIC guidelines inform clinicians of how available pharmacogenetic test results may be used to inform prescribing decisions. CPIC guidelines are developed using a standard system for systematically evaluating the literature for a gene/drug association, grading the level of evidence, and assigning a strength (strong, moderate, or optional) to each prescribing recommendation.
Adaptability: St. Jude is one of many institutions worldwide that has adopted CPIC guidelines for clinical implementation (https://cpicpgx.org/implementation/). New guidelines are published each year, and existing guidelines are updated as new evidence emerges. Once published, the therapeutic recommendations in each CPIC guideline can be used by St. Jude and other institutions to implement additional gene/drug pairs into clinical practice. Each CPIC guideline provides informatics resources, such as tables that translate genotypes into phenotypes, examples of interpretive consults and CDS language, as well as workflows for implementing the gene/drug pair into an EHR that any institution can modify for its own use.
Significance: St. Jude's use of the CPIC guidelines as the foundation of its clinical pharmacogenetics implementation program serves as a model for other institutions that are considering starting a pharmacogenetics service.

395 | Implementation of a pharmacogenomics service in an academic family medicine clinic

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Service or Program: A pharmacogenomics (PGx) service for patients of a family medicine clinic was started by a clinical pharmacist working under a collaborative practice agreement. Patients 65 years old or older and taking 6 or more medications were targeted by the clinic. Patients of any age and number of medications were also referred for testing by their Primary Care Provider. A broad panel of more than 40 tests were included for all patients. More than 400 patient samples were collected and sent for analysis. The clinical pharmacist then screened the results for any significant findings. Patients were then contacted for a face-to-face visit with the pharmacist to discuss the results with the potential to change the medication or dose based on the results.
Justification/Documentation: Outcome measures include feasibility of workflow at the clinic using a financially viable model. The academic-industry partnership allowed the PGx company to provide onsite assistance related to sample collection and billing. After completion of PGx tests, results are available on the PGx company's online portal linked to the academic health system's electronic health record. Adding the broad panel of pharmacogenomics results to the other standard of care clinical information such as drug-drug interactions, kidney or liver function, pharmacists and physicians provide optimal comprehensive medication management (CMM) service to primary care patients.
Adaptability: Pharmacogenomics is a step towards prescriptions written in a more efficient and safer manner compared to the current model. The majority of prescriptions come from primary care, therefore physicians in the primary care office should have access to PGx testing, results, and application of the results. This academic-industry model can effectively be adapted to other academic or community settings.
Significance: Pharmacists are perfectly positioned to implement a PGx service as the medication experts. Pharmacogenomics results enhance the standard of care information to help optimize CMM for primary care patients.

Pulmonary

396 | Improving outcomes for COPD: Is virtual comprehensive medication therapy management (CMTM) the answer?

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Service or Program: The COPD Telehealth program is a grant-funded pilot between University of Maryland Quality Care Network (UMQCN), School of Pharmacy e-Health Center, and Eastern Shore Primary Care Practices. Utilizing a clinical pharmacist embedded in the team, CMTM and disease management is provided to COPD patients

via telehealth. Patients can participate in office or home appointments via the HIPAA compliant Zoom healthcare platform. Pharmacists communicate and document therapeutic recommendations to providers and educate patients on inhaler technique, medication implications and disease state management.

Justification/Documentation: COPD was identified as one of the top 5 chronic conditions in the UMQCN that resulted in multiple hospitalizations and significant costs. Prior CMTM initiatives have demonstrated that pharmacists can be a solution to this problem. The program was developed to improve patient adherence rates to medication regimens, identify and resolve COPD drug related problems, reduce hospitalizations and ER visits (primary diagnosis: COPD), and achieve patient satisfaction with the telehealth service. Patient care is documented in the EHR and the medication reconciliation list in the state's Data Exchanged System.

Adaptability: Policies, procedures, and workflows have been developed to seamlessly integrate the program into the individual practice's workflow, as well as patient care activities that can be adapted to other practices in the state. Sustainability plans are developed with plans for billing for telehealth.

Significance: Virtual care is at the cutting edge of healthcare. In this program, patients have the opportunity to interact with pharmacists in the comfort of their own homes, which are often remote and far from their primary care offices. This makes healthcare accessible and convenient, important when managing a disease that heavily relies on patient engagement. This program explores novel ways of delivering care that is integrated and provided as an extension of virtual patient-centric interprofessional care. Furthermore, reimbursement for telehealth services is being tested.

ADVANCES IN INTERNATIONAL CLINICAL PHARMACY PRACTICE, EDUCATION, OR TRAINING

Ambulatory Care

397 | Implementation of the first pulmonary collaborative practice agreement in Qatar: Ambulatory care pharmacy clinic initiative

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Service or Program: Clinical pharmacy coverage in inpatient settings is well established at Al Wakra Hospital, a general hospital in Qatar. In the ambulatory care setting, pharmacy collaborative practice agreement (CPA) was implemented only in the anticoagulation clinic. On January 2018, a group of clinical pharmacists worked closely with pulmonary consultants and established the first pulmonary CPA in Qatar for asthma and chronic obstructive pulmonary disease (COPD). The hospital administration supported the ambulatory care pharmacy clinic initiative, and the service started in June 2018. Pulmonary consultants refer patients to clinical pharmacists to follow-up, alter, monitor, and educate patients about pulmonary medications.

Justification/Documentation: Asthma and COPD patients are requiring and demanding extensive interventions during the initiation and maintenance of therapy. Across Hamad Medical Corporation (HMC) hospitals in Qatar, inconsistent and unstandardized asthma education services are delivered by respiratory therapists or nurses, and some facilities are lacking repertory educator, which triggered the establishment of our service. Around 189 patients visited the clinic, the majority of which are not adherent to medications and received full pharmaceutical care. More than 130 patients received 2018-2019 season flu vaccine through the clinic in collaboration with ambulatory care clinics nurses. All the 189 patients encouraged for lifestyle changes, and all their inhalers techniques were assessed, corrected, and demonstrated.

Adaptability: The agreement included detailed written roles and responsibilities for each member of the agreement and supported by a structured management protocol to allow clinical pharmacists to implement it in similar services.

Significance: The pulmonary CPA model is of significant experience to advance current ambulatory clinical pharmacist practices, and this initiative will be expanded in collaboration with the allergy and pulmonary clinics in HMC. Clinical pharmacists have high potentials and can be leading and empowering ambulatory care providers utilizing CPA in different primary care specialties.

398 | Integration of a pharmacist clinician to provide metabolic management to patients living with HIV to improve disparities in cardiovascular care

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Service or Program: An advanced practice pharmacist with PGY2 training in ambulatory care with a focus on diabetes and cardiovascular risk reduction (CVRR) was embedded in an HIV patient-centered home. Prior to this service, all pharmacist clinicians (PhC) with prescriptive authority in the clinic were infectious disease trained leaving a niche for a PhC with a focus on metabolic disease state management.

Justification/Documentation: Rates of myocardial infarction, heart failure, stroke, and cardiovascular disease are significantly increased for PLWH. A recently published study described the underutilization of guideline recommended pharmacotherapy for CVRR services in PLWH. Published literature has demonstrated 23% clinician adherence to guideline recommended stain therapy and 5% to aspirin therapy recommendations in PLWH. To evaluate our CVRR service, we conducted a retrospective review of documented clinic visits over one year. A total of 432 PLWH over age 40 who had indications for CVRR pharmacotherapy were seen by their primary care provider (PCP) and/or the PhC. The PhC only saw 12% of the population, however, the overall clinic adherence (PhC and or PCP) to guideline recommended CVRR therapy was 29% for statin prescribing and 22% for aspirin therapy.

Adaptability: Embedding advanced practice pharmacists such as a PhC with metabolic training into HIV clinics may help improve overall rates of adherence to CV risk reduction pharmacotherapy guidelines.

Significance: Unique practice sites for pharmacists can further strengthen valued interprofessional teams. This service identified two common areas of pharmacy practice (HIV and CVRR services) and combined efforts to meet the needs of this patient population. Review of this clinical service adds to the evidence that CVRR in PLWH is needed and additional measures should be implemented. Further research in this area is needed to identify reasons for the low rates of adherence to CVRR recommendations in PLWH.

Cardiovascular

399 | Anticoagulation management in care transitions after hospital initiation of warfarin: a Pharmacy driven initiative

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Service or Program: A pharmacy driven transition of care (ToC) initiative that targets patients newly started on warfarin in a secondary care hospital in Qatar. A multidisciplinary team of physicians, pharmacists, and nurses in cardiology, surgery, and internal medicine units are managing patients on warfarin through a focused ToC action plan from hospital admission to post-discharge care. Defined roles and responsibilities agreed among the team include distribution of warfarin booklets (pocket educational/ follow up booklet), monitoring of dispensed warfarin quantities, patients education, early completion of discharge summary note, improving timeliness of post discharge follow up, and ensuring proper hands off communication through verbal and written endorsements to the anticoagulation clinic clinical pharmacy specialist. Clinical pharmacists conducted several staff education sessions and ensured that team members roles were carried as described in the action plan and communicated with them in cases of discrepancies.

Justification/Documentation: A standardized ToC process for hospitalized patients on warfarin is necessary, but it lacks in our facility. A patient with high thrombosis risk admitted with a thrombotic event, initiated and discharged on warfarin with improper follow up triggered the development of this service. In 6 months, ToC of 21 patients successfully achieved a higher number of patients receiving warfarin booklets (76%), attending first ACC visit within 3 to 7 days of discharge (86%), and achieving therapeutic international normalized ratio (INR) within five days (57%).

Adaptability: Proper communication and defined roles and responsibilities are the key to the success of this service in our facility. We are planning to expand and integrate this model at a national level to include all anticoagulation clinics in Qatar.

Significance: Evidence suggests that majority of medication errors occur during ToC. Clinical pharmacists have unique roles ensuring safe and effective medication therapies and empowering them running ToC services is of great significance.

Critical Care

400 | Critical care pharmacist involvement in the management of pain, agitation, delirium, immobility, and sleep (PADIS) in intensive care unit (ICU) patients receiving mechanical ventilation (MV)

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Service or Program: Critical care pharmacists initiated a three-phase program to empower the multidisciplinary team to apply PADIS guidelines into ICU daily practice in a medical center in Taiwan. In phase I (Feb-April 2018), pharmacists provided the Confusion Assessment Method for the ICU (CAM-ICU) education targeting nurses. In phase II (May-July 2018), pharmacists standardized analgesic and sedative order sets, and involved multidisciplinary collaboration to design the ABCDEF (Assess, prevent, and manage pain; Both spontaneous awakening trials and spontaneous breathing trials; Choice of sedation and analgesia; Delirium assessment/prevention/management; Early mobility; and Family involvement) bundle protocol and checklist. Phase III (August 2018-present) involved pharmacist-led education to the ICU team, execution of daily multidisciplinary bundle rounds, and documentation on the checklist. All of these interventions were approved by the ICU committee.

Justification/Documentation: Delirium affects approximately 60%-80% of all MV patients. Delirium in ICU patients is associated with increased duration of MV and ICU length of stay (LOS). There is a

need to raise awareness of delirium in the local ICUs. The ABCDEF bundle is an evidence-based approach to decrease the risk of delirium, and improve patient outcomes. The primary outcomes to assess this program are ICU LOS and ventilator-free days. The secondary outcomes are in-hospital mortality and bundle compliance.

Adaptability: The vital elements for the successful implementation of this pharmacist-led program are multidisciplinary collaboration, and in-depth education. As long as critical care pharmacists are willing to take leadership in the ICU team, this program can be adopted in any global ICU setting.

Significance: In Taiwan, this is the first critical care pharmacist-led program in the management of PADIS by implementing CAM-ICU and ABCDEF bundle into daily practice. Critical care pharmacists can advance patient care by implementing an evidence-based and multidisciplinary approach. The goal of the program is to enhance bundle compliance and improve patient outcomes.

Education/Training

401 | Improving global health pharmacy rotations using SUGAR (Simulation Use for Global Away Rotation)

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Service or Program: Simulation Use for Global Away Rotation (SUGAR) is on-line simulation training that helps health care professionals prepare for international global health rotations. SUGAR has been provided to medical residents at Mayo Clinic since 2014. Based on qualitative, positive feedback from the medical residents, the training was expanded to include pharmacy residents in 2016. The Pharmacy Director of Global Health and two physicians delivered the scenarios at the Mayo Clinic Simulation Center.

Justification/Documentation: Past pharmacy residents electing an international rotation had expressed concerns about lack of preparedness. This area of need prompted the incorporation of pharmacy residents into SUGAR training to better prepare them for the physical and emotional challenges as well as medication and equipment limitations associated with a resource-limited setting. A qualitative analysis was conducted to silicate feedback from the four pharmacy residents who have completed the training and one pharmacy resident who could not complete the training. The analysis indicated that SUGAR helped pharmacy residents prepare more appropriately for their rotation by providing education about which books to bring, supplying realistic expectations, promoting flexibility, and educating about cost hindrance of medication usage and language barriers. The one resident who wasn't able to utilize SUGAR felt uncomfortable and unprepared for the rotation. This was similar to feedback from past pharmacy residents prior to utilization of SUGAR.

Adaptability: SUGAR is free simulation training that can be utilized by any institution with a simulation center that provides international rotations as part of pharmacy curriculum. Pharmacists with international health experience that are precepting international rotations are qualified to use SUGAR. Institutions across the country will find implementation of this education straightforward through usage of SUGAR.

Significance: Offering simulation training using SUGAR to pharmacy residents can improve the adaptability, flexibility, and preparedness of pharmacy residents prior to their international rotation.

402 | Asia Pacific antimicrobial stewardship preceptorship program developed and implemented by a medical center in Taiwan

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Service or Program: A one-year antimicrobial stewardship preceptorship program was developed by Chang Gung Memorial Hospital (CGMH), a 3700-bed medical center in Taiwan. It was implemented in 2018 and delegates (ie, infectious disease physicians, nurses, medical technologists, pharmacists, and information system specialists) from several hospitals in the Philippines and Vietnam participated. The project aimed to provide professional antimicrobial stewardship (AMS) training and to equip the participants with expertise and leadership necessary for establishing and/or improving antimicrobial use. It involved pre-training teleconferences, one-week multi-disciplinary AMS workshop at CGMH, and finally CGMH project facilitators conducted site visits.

Justification/Documentation: CGMH spares no effort in combating antimicrobial resistance. It has been implementing Antimicrobial Stewardship Programs (ASP), as recommended by the Center for Disease Control and Prevention for over a decade. In 2004, CGMH developed a pilot healthcare information system (HIS)-based online prospective auditing antimicrobial stewardship program assessing the appropriateness of antimicrobial prescriptions. To date, its ASP team has already accumulated more than ten years of experience in promoting the responsible use of antimicrobials and is looking forward to provide support and practical recommendations for hospital staff both locally and abroad, especially in resource-constrained settings.

Adaptability: Success in effective implementation of ASP in hospital settings is dependent on defined leadership, a coordinated

multidisciplinary team, and most importantly a robust health data infrastructure. This innovative project is easily adaptable, as long as there is support by the senior hospital management.

Significance: This Asia Pacific AMS preceptorship program positions pharmacists to optimize the treatment of infections and reduce adverse events associated with antimicrobial use. The participating pharmacists are not only provided with training in infectious diseases, but are also equipped with skills to design, implement, and continuously improve ASP initiatives. Improving the quality of antimicrobial prescribing and thereby improving patient clinical outcomes may be more efficient through the aid of adequately trained pharmacists.

403 | Implementation of a continuing education series to promote interprofessional collaboration and evidence based practice in the United Arab Emirates

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Service or Program: The Ras Al Khaimah Medical and Health Sciences University-International Symposium (RAKMHSU-IS) series was established in 2017 to provide continuing education for faculty and students from various colleges of pharmacy, medicine, and nursing throughout the United Arab Emirates (UAE). An interprofessional team with different healthcare models and educational backgrounds from Australia, the United States (US), India, and the UAE designed the innovative programming. Lectures and active learning strategies were employed to promote evidence-based decision making, gaining perspective of each professional on the team, and providing updates on clinical guidelines. The audience was encouraged to participate in case-based discussions and share experiences to foster best practices in the clinical management of chronic disease states. The overall goal of RAKMHSU-IS was to promote an interprofessional approach to patient care, which includes the pharmacist.

Justification/Documentation: Despite the evolving healthcare reforms and education models in the UAE, there are limited national professional organizations that provide continuing education to advance evidence-informed decision making. Currently the UAE utilizes guidelines from other countries and interprofessional collaboration is not common practice. Thus far, the RAKMHSU-IS has certified 114 participants, including educators and students from the US, Australia, India, and UAE. Representatives from 7 colleges of pharmacy worldwide and 6 health systems have contributed to content development. Overall there has been a 30% increase in participant attendance from 2017 to 2019.

Adaptability: The RAKMHSU-IS interprofessional design and interactive case-based activities can be implemented at other academic institutions and hospitals. Participants can tailor and share their knowledge and skills with other practicing healthcare professionals/trainees as a means to advance clinical practice.

Significance: RAKMHUS-IS conveniently allows for practicing professionals to stay updated and succeed in their clinical practice, while fostering lifelong learning and networking. The event's unique structure emphasizes the significance of interprofessional patient care and advancements in clinical pharmacy worldwide.

404 | Development of direct patient education material to reduce inappropriate gabapentin prescriptions among older adults

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Service or Program: Patient education material was created to heighten patient awareness in recognizing and preventing harm from inappropriate medication use and to catalyze collaborative care for reducing inappropriate prescriptions of gabapentin in adults 65 years or older to reduce adverse effects.

Justification/Documentation: EMPOWER (Eliminating Medications through Patient Ownership of End Results) brochures for gabapentin were created to prevent inappropriate use. Patient education material included information concerning withdrawal, adverse effects, tapering schedule, alternatives for pain management and how use of gabapentin changes with age. Feedback from physicians, patients, and pharmacists were incorporated into various drafts. The prototype achieved its purpose when shown to veterans from the Boston VA Healthcare System who illustrated an improvement in quality of life and functioning after medication review, tapering and deprescribing of gabapentin.

Adaptability: The brochure is adapted to ensure understanding by older adults at the VA Healthcare System where it will be eventually distributed by providers and pharmacists to patients prescribed gabapentin. Prior to developing drafts of the brochure literature, guidelines, and case reports were reviewed concerning gabapentin use in older adults to ensure accuracy. Former EMPOWER brochures were implemented into the Boston VA Healthcare System, and therefore the brochure for gabapentin will be successfully implemented as well.

Significance: he development of plain language patient information pamphlets about gabapentin opens conversations about deprescribing among physicians, pharmacists, other healthcare professionals and patients. Gabapentin use, especially as patients get older, can cause more harm than good. Patients may need to de-escalate therapy due to physical changes in the patient or improvement in the disease may indicate that the medication is no longer warranted. Deprescribing should be considered due to the risk of adverse effects which increases with the use of many medications and with age. Educating

patients about their medications provides them with an opportunity to be more involved in their healthcare.

405 | Utilizing nominal group technique for planning and implementing professional development program for clinical pharmacists in Qatar

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Service or Program: Utilizing the nominal group technique to measure educational needs and create an annual framework for continuous professional development for clinical pharmacists in a secondary care hospital in Qatar.
Justification/Documentation: Prior to the implementation of this initiative, continuing educational activities within a clinical pharmacy team were based on presenter's preferences and a structured systematic needs assessment for clinical pharmacists was lacking. Nominal group technique (NGT) is a decision-making tool that incorporates a unique combination of qualitative and quantitative data collection through structured group meeting.
First, 15 clinical pharmacists with varying practice specialties were asked to list top three educational needs individually. Subsequently, all members were asked to vote and rank their top 3 priorities from the compiled list of 45 topics. The top three gaps identified were: statistical analysis, Pharmacokinetices and Fluids/Total Parenteral Nutrition management. Other topics included: project management, quality improvement, thyroid disorders and shock syndromes. Working groups of clinical pharmacists were formed based on background expertise and interest. Each group was requested to create SMART learning objectives and correlate each with an assessment method.
Adaptability: This initiative utilizes NGT model to identify gaps and develop a program that meets local context and needs. As such, it is adaptable to any practice settings.
Significance: Unlike the traditional brainstorming, Delphi technique and focus groups, NGT allows participants to express their ideas equally which leads to higher number of ideas per group. The strategy identified the needs, strengths and weaknesses of a clinical pharmacy team and utilized the power of having varied, complementary knowledge, skills and experiences among different team members to improve team's productivity and dynamics and personal growth of its members.

406 | Effectiveness on counseling training program for ambulatory care pharmacist toward bowel preparation before colonoscopy

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Service or Program: A thematic medication consultation training program of bowel preparation was implemented in a medical center of Taiwan. The objective of this program was to improve pharmacist's consultation skill and knowledge for bowel preparation. This program contained four parts: differentiating dilution and administration tips of different purgatives, reviewing concomitant medication, low residue diet before colonoscopy, and adequate water supplement.
Every trainee was guided by senior consultant pharmacists along 160 hours of training period. Pre- and post-training mini-clinical evaluation exercise (mini-CEX), containing 19 items with full scores 38, were employed to evaluate effectiveness of the program. Satisfaction surveys were documented by trainees after training.
Justification/Documentation: Most pharmacists are responsible to dispense in Taiwan. However, pharmaceutical counseling remains an important competency for pharmacists. Since high-quality bowel preparation is essential for successful colonoscopy, and the rate of adequate bowel preparation is low, education before colonoscopy becomes a major facet for ambulatory pharmacists.
Twelve pharmacists were trained since March 2016. The mean score of mini-CEX significantly rose from 17.25 to 30.625 ($P < 0.0001$). "How to dilute and when to take the purgative", which was the critical part of counseling with full score: 14, had been improved most (mean score: 7.58 to 12, $P < 0.0001$). All trainees agreed the program is helpful, and suggested more relevant training program including education of anticoagulants (50%) and glucose-lowering agents (49%).
Adaptability: Further thematic training program could be established and implemented in our clinical setting. Other ambulatory care pharmacists would be able to implement a similar program and evaluate the consultation quality by mini-CEX.
Significance: A thematic medication consultation training program allows pharmacists to become more confident when communicating with patients, and more proficient at health education. Besides, with the enhancement of consultation skill and knowledge for ambulatory care pharmacists, the quality of bowel preparation prior to colonoscopy would be also improved for patients.

407 | Problem-Based Learning (PBL): An educational strategy for the advancement of clinical pharmacy and team-based care in Italy

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Service or Program: Problem-Based Learning (PBL) is a non-traditional pedagogical method utilized at Duquesne University School of Pharmacy to provide students the opportunity to think critically, develop clinical knowledge, and work as a team. During two study abroad experiences in Italy, a group of pharmacy students and faculty from Duquesne University implemented a PBL activity for pharmacy

students at the University of Bologna and University of Perugia. After the PBL process was introduced, the students from the United States and Italy collaborated in small teams on a patient case to devise a care plan with evidence-based recommendations.

Justification/Documentation: In the United States, the curriculum has evolved to focus on patient-centered care by implementing courses like PBL. Currently, the pharmacy school curriculum in Italy does not offer courses specific to clinical problem-solving and team-based practice. If implemented in Italy, this model can provide an important element to help expand the pharmacist's role on the healthcare team and enhance patient-centered care. A cross-sectional survey performed in 2018 and 2019 evaluated 67 Italian participants' perceptions of PBL and its impact on their education and training. Students and faculty from both universities saw the value in applying the information learned in PBL to their current or future practices (4.48 ± 0.785) and enjoyed collaborating with a team to improve patient care (4.66 ± 0.789) on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Adaptability: This PBL approach to patient cases could be similarly adopted in Italy and other international schools of pharmacy. Since patient cases can be designed at varying complexity, pharmacy faculty can regularly utilize this model throughout the curriculum to prepare students for clinical practice.

Significance: Introducing this innovative PBL model into the pharmacy school curriculums in Italy can equip students with essential clinical problem-solving and team-based decision-making skills to effectively help expand the pharmacist's role in Italy.

408 | Accreditation of an international pharmacy residency program: Qatar's experience

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Service or Program: Hamad Medical Corporation (HMC) postgraduate year one (PGY1) pharmacy residency program is the first American Society of Health-System Pharmacists (ASHP) accredited program in Qatar and among few accredited programs outside United States (US). HMC is the leading provider of secondary and tertiary healthcare in Qatar and the only hospital system outside the US to achieve JCI Academic Medical Center accreditation for all its hospitals.

Justification/Documentation: Developing a pharmacy residency program and attaining ASHP accreditation was one of HMC strategic goals and considered as a need for advancing postgraduate pharmacy training in Qatar. A team of executive director of pharmacy, residency program director (RPD), residency program coordinators and pharmacists representing HMC hospitals was appointed as the residency advisory committee (RAC) to lead the program establishment and development. The program applied a rigorous process to ensure compliance with 2014 ASHP accreditation standards. The first recruitment was in 2015 summer; two residents started a twelve months residency program with ASHP accreditation candidate status. The ASHP surveyors were hosted on October 2016, and survey report was received on Jan 2017 and did not include any areas of noncompliance to the accreditations' standards. HMC program's survey response report covered areas of partial compliance findings and incorporated consultative recommendations that have been both worked up through various HMC committees and working groups. The official accreditation was received in April 2017 for three years (2017-2020).

Adaptability: HMC PGY1 pharmacy residency program successfully achieved ASHP accreditation in two years period and served as an exemplary program in the Middle East region. The program is considering plans for developing various PGY2 programs and achieving their accreditation.

Significance: Such international accreditation assures that the advanced residency training will provide our pharmacists the knowledge, skills, and experience they need to excel in their career, which will further enhance the quality of patients care.

409 | Translating the Pharm.D. to the established MS Clinical Pharmacy Degree to meet international pharmacists' clinical needs

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Service or Program: The University of Colorado (CU) created the online MS Clinical Pharmacy (MSCP) to meet the needs of international pharmacists aiming to develop clinical expertise beyond their baseline pharmacy degree.

Justification/Documentation: Outside North America, pharmacists are often educated with a BS (4-5 years) or Master's (MPharm; 5 yrs) of Pharmacy. Pharmacists with these entry-level degrees can pursue specialized education to develop clinical expertise to meet the profession's call for patient-centered pharmacy care. While the US established the Doctor of Pharmacy (Pharm.D.) to meet that need, other countries offer specialized Masters degrees.

With 20+ years' experience providing online post-graduate Doctor of Pharmacy (Pharm.D.) education, including an ACPE-accredited International Trained Pharm.D. (ITPD) pathway, CU is in a unique position to offer a MSCP to international pharmacists. The MSCP program is an online, flexible program that provides a robust professional foundation, through coursework that develops clinical expertise, such as pharmacotherapy courses, foundational and advanced applied clinical pharmacy practice courses (eg, evidence-based medicine and clinical decision-making), and a mentor-guided, demonstration of entrustable professional activities (EPAs) portfolio. Individualized pharmacy career paths are supported by several electives and completion of a practice-based capstone thesis project. All courses, excepting the thesis project, were created for the school's ACPE-accredited ITPD pathway, assuring quality.

Adaptability: The CU MSCP program is applicable to international pharmacists as it has established expertise in educating toward patient-centered pharmacy care. It allows for translation of this new expertise to the learners' local environment through the EPA portfolio, and capstone thesis project, which is designed to meet a local need, and if available, under the co-guidance of a local mentor.

Significance: CU's MSCP program is an important step toward recognizing that US expertise in preparing patient-centered clinical pharmacy practice practitioners can be applied in new ways to meet our international colleagues' educational needs and norms.

410 | Evaluation of educational methods and retention using a "train-the-trainer" model in rural Peru

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Service or Program: Communidades Unidas (CU) Peru is an interprofessional, student-run, non-profit organization that has been operating since 2009 and has been a 501c3 since 2011. The vision of the organization is to ensure there are leaders in healthcare in every community throughout the Loreto region of Amazonian Peru by using a "train-the-trainer" approach. Students conduct twice yearly trainings with approximately 100 community health workers (CHWs) in attendance at each session. Topics covered during trainings are decided by community priorities as well as epidemiological data for the area.

Justification/Documentation: Previous evaluation of the effectiveness of the program by administration and scoring of pre- and post-tests of CHWs has shown that mean post-test scores are higher from the mean pre-test scores. Post-tests from prior training years have begun to be administered the following session to evaluate retention of information provided.

Adaptability: CHWs are a cost-effective approach to help alleviate health inequities when there is a lack of resources available to adequately treat rural and low-income communities. However, in many cases these CHWs only have a basic level of education, leading to lack of trust from the community, as well as in their own decision making. With these factors considered, the "train-the-trainer" model being used by CU Peru could be applicable to other areas of the world where the same CHW structure is used.

Significance: The CU Peru program is a student-run interprofessional organization that allows for both professional and personal growth and development. The organization has had long-standing partnerships with the Ministry of Health as well as Peruvian medical student organization, Sociedad Cientifica De Estudiantes De Medicina De La Amazona Peruana, which has allowed for long-term success. With close to ten years of experience and sustained attendance at training events, the organization continues to grow with hopes to extend its reach further into the Amazon.

Hematology/Anticoagulation

411 | Implementation of a pharmacist-led anticoagulation education and follow-up service at a tertiary hospital in China and its outcomes in patients with nonvalvular atrial fibrillation

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Service or Program: The pharmacist-led education and follow-up service (PEFS) was established at a tertiary hospital in Zhuhai, China in 2014. Adult inpatients who were newly started on warfarin with intended duration of ≥3 months were provided with a standardized, one-on-one education session upon discharge. Telephone follow-ups were conducted at 30 and 90 days post-discharge, during which pharmacists assessed adherence to warfarin and INR monitoring and provided counseling accordingly.

Justification/Documentation: Due to its low cost, warfarin remained widely prescribed for stroke prevention in patients with nonvalvular atrial fibrillation (NVAF) in China. Despite increasing prevalence of atrial fibrillation, warfarin underuse and inappropriate INR monitoring were often observed in clinical practice. From 2014-2017, a randomized controlled trial was conducted to compare the impact of the PEFS and usual care (UC) on anticoagulation control, measured as the percentages of time within target INR range (TTR) and time within expanded target range (TER). In the subgroup analysis of 85 NVAF patients (41 in PEFS group vs 44 in UC group), the differences in TTR (29.7% vs 28.7%; $P = 0.618$) and TER (53.6% vs 40.7%; $P = 0.087$) were not statistically significant within 180 days post-discharge, whereas the proportion of patients spending ≥50% of TER was higher in the PEFS group (58.5% vs 36.4%; $P = 0.041$). Within 30 days post-discharge, the PEFS group spent significantly more TER than the UC group (58.0% vs 40.4%; $P = 0.040$).

Adaptability: The PEFS was implemented by a team of four pharmacists receiving standardized training in anticoagulation management. Pharmacists were not allowed to adjust warfarin doses or order INR tests. This service model can be easily adapted by other hospitals in China or other countries.

Significance: The PEFS improved INR control in Chinese NVAF patients newly initiated on warfarin, particularly within 30 days post-

discharge. Even with limited scope of clinical practice, pharmacists can play an important role in optimizing anticoagulation management.

Medication Safety

412 | Developing and implementing the foundational blocks of Clinical Pharmacy across 49 South African private hospitals

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Service or Program: This paper describes the approach taken to commence a clinical pharmacy services program within a South African private hospital group, amidst a challenging economic and healthcare environment. The underlining purpose of a Clinical Pharmacy program, to mitigate drug related harm to patients,[1] was introduced. This led to the development and implementation of a Medication Safety program to impact medication safety with medication processes across prescribing, dispensing, administering and monitoring, and at the patient' bedside. The Medication Safety program was implemented across 49 hospitals. The hospitals' program leadership applied mostly pharmacist led, nurse led or co-leadership approach.

Justification/Documentation: The Medication Safety program formed the foundational block of an in-progress Clinical Pharmacy program, creating a sustainable and collaborative culture of safety within the hospital group. The Medication Safety program was developed from a review of international clinical pharmacy practises that addressed system and individual patient medication risks. The level of implementation of the program was measured over a 4 year period between Oct 2014 and Sept 2018, across hospitals, via bi-annual assessment processes of predetermined criteria. The current status of the Group's Medication Safety program showed an average compliance of 82.3% to safe practices relating to the program, across 49 hospitals.

Adaptability: The domains of the Medication Safety program included Medication Management, Incident management, High Alert practices, Medication Communication and Safe practices across the medicine management pathway. The pre-implementation phase of the program included awareness of medication risk and development of medication safety tools. Thereafter a step-wise implementation process phase was commenced that included:

- Medication safety hospital leadership structure development,
- Targeted system safe practises that included auditing and improvement assessments of ward and pharmacy processes, and
- Targeted individualized patient medication safety reviews.

Significance: Implementation of a medication safety program contributed towards highlighting and justifying the importance of advancing clinical pharmacy within the hospital group.

Other

413 | Overcoming regulatory hurdles to allow international pharmacists and students to engage at clinical pharmacy practice sites

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Service or Program: The St. Louis College of Pharmacy (STLCOP) Office of International Programs (OIP) has developed mutually beneficial exchanges of faculty members and students with several international pharmacy partners. International partners visiting the U.S. are interested in learning about pharmacy education, practice, and desire shadowing at clinical pharmacy practice sites. Because licensure issues make it difficult to host international partners at these sites, STLCOP has worked with the Missouri Board of Pharmacy (Board) to develop procedures to overcome these challenges.

Justification/Documentation: The Board requires a pharmacist or pharmacy technician license to spend time in a pharmacy. One of the Board requirements for licensure is a Social Security Number (SSN), which international visitors lack. The Board values these experiences for our students and visitors; working to find accommodations so international visitors can have learning experiences that promote the advancement of clinical pharmacy practice abroad.

Adaptability: The Board will allow international pharmacists and student pharmacists to apply for a pharmacy technician license. The Board accepts a passport number in lieu of a SSN and waives the background check requirement. Once the application is submitted, they are eligible for pharmacy shadowing. STLCOP helps with fingerprinting, drug screenings, notary services, immunization records, and liability insurance prior to pharmacy shadowing so international visitors are allowed to engage at pharmacy settings soon after arriving. Barriers still exist, as some institutions lack the policies to allow access to international visitors (eg, Veterans Affairs).

Significance: The exchange of learners/educators between international partners should be reciprocal and mutually beneficial. One of

the most desired experiences for international partners is clinical pharmacy practice site shadowing. Their main objective is to learn new, innovative and novel approaches to enhancing patient care and returning to their home institution to implement these practices. These regulatory obstacles must be overcome to allow international visitors to further clinical pharmacy abroad.

Psychiatry

414 | Development of a virtual pharmacy simulation programme for enhancing student's drug therapy assessment skills

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Service or Program: To cultivate pharmacy student's ability to conduct holistic patient and drug therapy assessment, the School of Pharmacy of the Chinese University of Hong Kong developed a web-based, interactive pharmacy virtual simulation program. The program consists of six animated case scenarios and two virtual reality videos featuring various stages of depressive and bipolar patient management. The details of the case scenarios were first developed by a clinical pharmacist and a teaching staff of the University. The information technology department of the University assisted on creating animated characters and the virtual reality videos based on the case scenarios. The developed program is provided to year 3 pharmacy students as a self-learning activity in a therapeutics course of psychiatric disorders.
Justification/Documentation: Asking the right questions to obtain relevant information is crucial for pharmacist to properly assess therapy with knowledge and holistic mindset. This process needs to be repeatedly practiced and reinforced with real-life scenarios. As feedback from students on inadequate exposure to real-life case scenarios has been received, this programme fills the gap by providing practice with interactive cases and simulated responses. Surveys have been conducted to assess students' perception on whether program has met its objectives.
Adaptability: The programme created could be used for student's self-practicing for OSCE (Objective Structured Clinical Examination) exam, the patient assessment and counseling domain. As the programme is web-based, there is a high accessibility. More cases of other disease modules can also be added.
Significance: The interactive programme allowed students to practice interviewing patients with specific questions and providing therapy recommendations. Student's observational skills for clinical signs could also be enhanced with the videos. Based on preliminary student feedback, student appreciated the knowledge application in therapy assessment. The programme also assisted students' learning of important counselling techniques by providing the simulated patient feedback.

Women's Health

415 | New models of care to increase access and support decision-making about contraception option in Qatar

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Service or Program: ACOG recommends the initiation of immediate postpartum contraception before leaving hospital. A new inpatient counseling service led by two ob/gyn clinical pharmacists is established in the postnatal ward to address the need for immediate knowledge on contraception options before patients discharge.
Justification/Documentation: This service was initiated to improve the awareness about hormonal contraception to women post delivery within the postnatal ward at Al Wakra Hospital within Qatar. A survey conducted comparing the patients seen in OPD family planning clinic after discharge over a span of 6 months was 258 patients. Whereas, the number of patients seen at our in-patient counseling service over a 6 months was 714 patients, indicating that this service captures a greater proportion of patients for providing education and knowledge about contraceptive options at the best time and the best place (prior discharge).
Adaptability: The service is started in February 2017, nowadays a total of 2185 patients were counseled in this service. The average time of each session was 16 minutes. A cross sectional survey evaluating patient's satisfaction was voluntarily completed by 100 patients. Based on this survey, 97-100% of the patients agreed that the clinical pharmacists clearly explained all birth control options including possible side effects, missed doses, drug interactions and guided them in choosing a suitable contraceptive method.
Significance: This service is opened a new role of clinical pharmacist in women health and gives an opportunity for a good counselling by increasing interaction between patient and clinical pharmacist as well in promoting adherence and continuation of contraception. This service is the first initiative in GCC, it might also potentially reduce the number of hospital outpatient visits, save effort and time for both the healthcare professional and patient, which may all result in cost savings for the hospital.

EVOLUTION OF SPECIALIZED CLINICAL PHARMACY (PRACTICE, RESEARCH, OR EDUCATION)

Ambulatory Care

416 | Evolution of clinical pharmacy specialist role in ambulatory care: From medication reviews to disease state management before/after bariatric surgery, and creation of a multi-disciplinary care team and continuously improved shared-medical appointments

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Background: AACE/TOS/ASMBS's 2013 Clinical Practice Guidelines for Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient recommends medical history and adjustment of medications for optimal preoperative and postoperative care. Pharmacists are ideally suited for this role. One pharmacy consult service for bariatric surgery was published previously, however was limited to inpatient care. We describe herein the evolution of Clinical Pharmacy Specialists' (CPS) role in ambulatory care bariatric services at the Phoenix Veterans Affairs (VA) Hospital.

Historical Milestones: In 2014, CPS involvement with bariatric surgery was limited to evaluating medication formulations ("crushability"/size commentary) and medication education. In 2015, after identifying metabolic changes related to medications/disease states around bariatric surgery, CPS provided medication/disease state management and ordered medication adjustments, micronutrient supplementation, labs and follow-up screenings. Note templates created helped standardize care and nutrient supplementation dispensed at the Phoenix VA was updated to ASMBS recommendations. A multidisciplinary shared medical appointment (SMA) team to streamline care was created: Dietitian, Medical Psychologist and CPS.

Significance of Achievements: The CPS role evolved from medication formulation review to active disease state management as a mid-level provider and key member of the multidisciplinary bariatric advisory team.

Impact on Patient Care: Patients received intensive medication education and management starting pre-surgery and continued post-surgery for de-escalation of medications as clinically indicated to minimize medication-related adverse events. SMA patients identified improved knowledge, preparedness around surgery and overall satisfaction.

Future Implications: With Veterans considering surgery from non-VA sites through the Mission Act, CPS medication optimization will be vital for safety and continuity of care. ASMBS identified a lack of standardized outcomes reporting after bariatric surgery and subsequent challenges in comparing/defining success among studies. CPS actively manage recommended outcomes (hypertension, diabetes, lipids, acid reflux), thus ensuring availability for future reporting to help fill this current literature gap.

417 | The evolution of primary care pharmacy services at San Francisco Health Network: The expansion story

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Background: San Francisco Health Network (SFHN) is an FQHC that consists of ambulatory care clinics, mental health facilities, Zuckerberg San Francisco General, and Laguna Honda Hospital. Primary Care treats 90,000 publicly insured or uninsured individuals across 14 health centers. Fourteen primary care pharmacists provide comprehensive medication management under an inclusive collaborative practice agreement that allows them to prescribe medications, order labs, and make referrals in all adult primary care clinics.

Clinical pharmacy within SFHN started with disease-specific clinics such as anticoagulation, neurology, hypertension, and HIV at ZSFG hospital in the 1990's. Shortly thereafter, 3 positions were funded by the pharmacy department to provide medication management at our community primary care clinics. The immense impact of our services to patients provided by our initial pharmacists led to the addition of 5 clinical pharmacists funded entirely by Primary Care.

The robust pharmacist practice at SFHN has be propelled by three drivers: a strong provider voice, pharmacist flexibility to meet the needs of the health system, and circumstantial opportunities that allowed services to spread to all primary care clinics. Currently in our capitated payment, team-based model, the pharmacists in primary care thrive without billing by understanding and flexing to fill the care gaps that exist.

Impact on Patient Care: Primary care clinical pharmacists see over 9,000 patients yearly in face-to-face visits, and help providers to be more informed about pharmaceutical decisions and formulary.

Future Implications: The practice expansion has been very successful without the need to collect outcomes data. As the health system moves to a more data-friendly electronic medical record in 2019, the ability to collect and analyze data such as outcomes and interventions will provide more concrete evidence of the strength of this practice and identify ways it can be improved.

418 | Pharmacists: Making a difference one tooth at a time in a dental medicine clinic

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Background: The provision of clinical pharmacy services in a dental clinic is a unique concept that supports interprofessional education and enhances patient care. The collaborative efforts of clinical pharmacists, dental faculty, and both pharmacy and dental students creates a unique learning environment which benefits all parties involved and improves patient care.

Historical Milestone: Pharmacy services were established at an academic student-driven dental clinic within a large institutional multispecialty clinic. The pharmacists and pharmacy students, who are completing their ambulatory care rotation, screened dental patients utilizing an established protocol to stratify risks for potential dental interactions with the patients' medication(s) and/or medical condition(s).

Significance of Achievements: The pharmacy team screened about 11 patients and provided approximately 8 consults per day to high risk dental patients. One component of the consult was reconciling all medications including over-the-counter (OTC) and/or herbal products.

Impact on Patient Care: Through a 6 month retrospective chart review of 267 patients, 38 patients were found to have been taking additional medication(s) which were not identified by the dental student when conducting the medication history, but obtained by the pharmacy team. Medications included but limited to fish oil, ibuprofen, and acetaminophen which can potentially impact dental care and dental medication selection.

Implications for the Future: One goal of the pharmacy team is to educate both pharmacy and dental students of these interactions to enhance patient safety. Since providing pharmacy services in a dental clinic was an innovative service, the impact of student learning and patient outcomes was limited. The pharmacists continue to investigate and evaluate the utilization of the pharmacy recommendations in dental patient care as well as in experiential student education.

419 | Impact of an ambulatory care pharmacist on naloxone prescription rates and compliance with Assembly Bill 2760 in a federally qualified healthcare center in California

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Background: In 2017 there were 2,196 opioid-related overdose deaths in California (CA), the majority (70%) of which involved prescription opioids. In September 2018, CA Governor Brown signed Assembly Bill 2760 which, effective January 1, 2019, required prescribers to offer high-risk patients a naloxone prescription and overdose prevention education when prescribing opioids. To increase the naloxone prescription penetration rate for federally qualified healthcare center (FQHC) patients identified as high-risk and meeting AB-2760 criteria, the clinical pharmacist implemented a telephone-based naloxone prescribing protocol and provided opioid overdose prevention education.

Historical Milestones: All California-licensed pharmacists may prescribe naloxone pursuant to the pharmacists completing a minimum of 2 hours of naloxone continuing education and following the CA statewide naloxone protocol.

Significance of Achievements: Naloxone prescriptions in high-risk patients on concurrent chronic opioids and benzodiazepines increased from 30.1% to 83.5% post implementation of the clinical pharmacist telephone-based protocol. Primary care providers (PCPs) were notified after each intervention. When patients declined naloxone (16.5% either declined or deferred prescription until they saw their PCP) prescribers were encouraged to further discuss with the patient during following appointment knowing that patients are likely to accept a naloxone prescription when offered in-person by their PCP.

Impact on Patient Care: An ambulatory care pharmacist-led naloxone project helped increase patient safety, knowledge, and understanding of appropriate use of naloxone.

Implications for the Future: Ambulatory care pharmacists are key members of the primary care team and can have a significant impact on patient outcomes. Further research is needed to support the integration of more clinical pharmacists into primary care teams at FQHCs.

420 | Overview of Kaiser Permanente Colorado Ambulatory Care Clinical Pharmacy Specialty Services

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Introduction/Background: Ambulatory Clinical Pharmacy Specialty Services (CPSS) at Kaiser Permanente Colorado (KPCO) has evolved since beginning in 1990. Clinical Pharmacy Specialists (CPS) are located in the medical office, practicing within multidisciplinary teams. CPS provide direct and indirect patient care, population management strategies, clinician education, medication use outcomes, and participate in local and national organizations.

Historical Milestones or Accomplishments: With the ongoing challenges facing healthcare, CPSS resources have been consolidated across KPCO Clinical Pharmacy Services to align with demands. Currently, eight different specialty areas are supported by fifteen full time equivalent CPS at KPCO.

Significance of Achievements:

- Collaborated in the development of national Kaiser Permanente disease treatment guidelines.
- Created/led KPCO inter-departmental and inter-disciplinary work groups to establish best practices across multiple specialty areas.
- Established a CPSS infrastructure to support emerging high cost medications.
- Designed unique elective learning experiences for schools of pharmacy and KPCO's PGY2 Ambulatory Care pharmacy residency program.

Impact on Patient Care/Patient Outcomes:

- Behavioral Health: Increased psychiatry transitions of care drug related intervention rates to 43%.

- Cardiology: Achieved a > 80% adherence for TSH and ALT amiodarone lab monitoring and incorporating medication management for abnormal results.
- Dermatology, Gastroenterology, Rheumatology: Implemented biologic utilization management strategies to save approximately $1 million.
- Neurology: Increased utilization of highly-effective disease modifying therapies to 63% in multiple sclerosis.
- Oncology: Implemented Medicare off-label chemotherapy compendia review infrastructure, resulting in $3.6 million in cost savings in 2018.
- Palliative Care: Utilized education to achieve a 3x increase in provider medical record documentation for opioid conversions.

Implications for the Future:

- Identify innovative and sustainable CPSS patient intervention models to deliver safe, quality and affordable care for KPCO patients amidst a volatile healthcare market.
- Engage in clinical activities at the top of CPS scope.
- Capture outcomes to demonstrate ongoing value.

Cardiovascular

421 | Embedding clinical pharmacy services within a private cardiology practice

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Introduction: Pharmacist involvement in team-based community care practices is growing, however, embedding clinical pharmacists into private practices continues to be a challenge. Barriers in this setting include lack of financial justification or reimbursement, and the lack of provider status and opportunity for direct billing for pharmacists. The following is an example of a successful model of embedding clinical pharmacy services within a private cardiology practice.

Historical Milestones/Accomplishments:

In 2015, a clinical pharmacist faculty member introduced pharmacy services to a large, private cardiology practice. Initially involvement included attending weekly structural heart clinic and proactively contacting high-volume callers for medication questions. Within a year, a consult referral system and task in the eMAR was created, and the pharmacist began seeing patients and billing for services. After a year, the pharmacist and APPE students began providing medication reconciliation and discharge education for patients in a 14 bed acute care clinic at the practice. In 2017, a PCSK9 inhibitor pharmacist clinic was developed, for which over 275 patients have been consulted. In July 2019, our first PGY2 cardiology resident began and the 46th pharmacy student began their rotation at the clinic.

Impact on Patient Care/ Patient Outcomes: Introducing clinical pharmacy services to this large private practice has advanced the profession into an atypical setting. Providers have realized the supportive role of a clinical pharmacist and utilize on a regular basis. Patients have benefited from improved medication adherence, teaching, outreach, safety and overall patient care.

Implications for the Future: The role of the clinical pharmacist and pharmacy services will continue to grow within this particular practice setting. The team will continue to be utilized in developing new clinics and protocols with the goal of optimizing cardiac patient care. Hopefully in the future, more clinical pharmacists can join the team-based approach within private practice settings.

Education/Training

422 | Creation of a synergistic and sustainable collaborative focused on critical care education and scholarship: The evolutionary story of the University of Georgia Critical Care Collaborative (UGAC3)

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Introduction/Background: Clinical faculty members must balance scholarly productivity with competing obligations including professional service, patient care, education, and mentorship. Creation of collaborative groups could enhance productivity, increase work satisfaction, and mitigate burnout.

Historical Milestones or Accomplishments: UGAC3 was formed in 2017 across four campuses and has produced 4 peer-reviewed publications, 2 grant awards, 1 joint speaking engagement, 18 abstract presentations, and 4 research awards. Multiple innovative classroom techniques have been developed for didactic and skill-based learning. Additionally, more than 20 learners have been mentored.

Significance of Achievements: UGAC3 has encountered obstacles common to collaborative efforts related to communication, logistics of multi-site research, accountability, and marketing. Utilization of a tool to identify member strengths and personality aided in early cohesion and synergy. Regularly scheduled meetings and annual retreats helped leverage these obstacles into stronger infrastructure that continues to foster success.

Impact on Patient Care/Patient Outcomes: Strategic placement of retreats for idea formulation and design allow for integration of pharmacy learners into research. Completion of research templates ensures a thorough, methodical approach to projects and serves as a platform for idea sharing. A cloud-based sharing drive simplifies

communication and helps with group organization. Creation of and frequent revisiting of one- and five-year goals provides accountability and encouragement. Utilizing a data collection dictionary ensures uniformity of data across multiple sites. Leveraging multi-site memorandums of understanding streamlines institutional review board approvals. The dedication of UGAC3 to mentoring learners and contributing to peer-reviewed literature will pay exponential dividends to patient care in the future.

Implications for the Future: UGAC3 can serve as a framework for academic and practice-based groups to enhance pharmacy practice, research, and education. A core group of individuals with diverse skill-sets working towards a common vision is vital. Development of a strong infrastructure early in the process is imperative to sustained success.

Emergency Medicine

423 | Evolution of emergency medicine pharmacy practice

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Background: Emergency medicine (EM) is a complex and unique practice area that encompasses several specialty disciplines and diverse patient populations. EM pharmacists were described in the 1970s, but rapid growth occurred since the early 2000s following recognition of the emergency department (ED) as high-risk for medication errors. Practice has evolved from distributive roles to an expansive, interdisciplinary, bedside pharmacotherapy service.

Historical Milestones: The ACCP EMED PRN and ASHP Section Advisory Group on Emergency Care and Connect Group were established (mid-2000s). The Agency of Healthcare Research and Quality funded the project, "Emergency Department Pharmacist as a Safety Measure in Emergency Medicine" (2005). ASHP published a Statement on Pharmacy Services to the Emergency Department (2009) and Guidelines on Emergency Medicine Pharmacist Services (2011). The American College of Emergency Physicians (2015) and American College of Medical Toxicology (2017) published statements of support for EM pharmacists as critical members of the EM team. This year a petition will be submitted to the Board of Pharmacy Specialties to recognize EM Pharmacy.

Achievements: Dedicated pharmacist coverage in hospital EDs has increased from 3.4% to about 22% (2006-2015).

Impact on Patient Outcomes: A national survey of pharmacists practicing in the ED found most roles focused on bedside clinical activities, emergency response, and order processing, but also medication histories, teaching, administrative, and scholarly endeavors (2015). EM pharmacists have impacted myocardial infarction, stroke, sepsis, opioid and antimicrobial stewardship, rapid sequence intubation, transitions of care, dose optimization, and vaccination related patient outcomes. They have reduced medication errors and potential adverse events and have positive financial impact.

Impactions for the Future: Practice continues to evolve as EM pharmacist integration into the team expands. Practicing EM pharmacists are participating and leading initiatives in the ED and organization-wide. It is expected for unique roles that improve patient outcomes to continue to emerge.

424 | Evolution of emergency medicine pharmacy research

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Introduction/Background: Emergency medicine (EM) pharmacy is a relatively new specialty with much growth since the early 2000s. Many publications early on described EM pharmacy roles and clinical research focused on outcomes related to these roles, staff satisfaction, medication safety, and cost avoidance. Since EM practice encompasses several specialties and patient populations, the body of literature, in content, is diverse.

Historical Milestones or Accomplishments: There have been large national survey studies that have evaluated national EM pharmacy practice roles (2015), EM pharmacy educational opportunities for trainees (2015), and involvement in trauma resuscitation (2009, 2019). EM pharmacists have increased medication error interception and overall reduction in medication errors through consultative activities at the bedside described in two large, multicenter studies (2010, 2012).

Significance of Achievements: EM pharmacists have received industry sponsored and foundation research grants, participated in the ACCP Research and Practice Network, ACCP Focused Investigator Training program, ACCP EMED PRN Research Committee activities, led and participated in studies through Discovery, the Critical Care Research Network, and other EM pharmacy related multicenter research and received research publication awards.

Impact on Patient Care/Patient Outcomes: There are several publications that describe the EM pharmacist role in improving disease-state

specific outcomes measures (myocardial infarction, stroke, sepsis, rapid sequence intubation, dose optimization, and vaccination), compliance with organizational and national guidelines and practice algorithms, antimicrobial and opioid stewardship outcomes, medication use evaluations, and reducing ED and hospital readmissions.

Impactions for the Future: We recently evaluated the feasibility of EM pharmacists to contribute to multicenter EM research. We expect that EM pharmacist involvement with clinical research and patient outcomes will continue to expand and the ACCP EMED PRN Research Committee will begin to build the framework for a research network.

425 | Evolution of emergency medicine pharmacy training

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Introduction: Emergency medicine (EM) as a medical specialty was established in 1973 and the first resident started in 1970. Few EM pharmacy residency programs existed before the mid-2000s and in 2007 there were three accredited programs. As EM as a pharmacy specialty expanded, resident and student training opportunities followed.

Historical Milestones: There are 67 accredited PGY2 EM pharmacy residency programs (76 positions). New competency areas, goals, and objectives to guide PGY2 EM training were published in 2018. In 2007, recognizing training opportunities did not meet the demand, ASHP developed the Patient Care Impact Program. An EM pharmacist and physician mentored pharmacists through development of EM pharmacy services at their institution. This program ran until 2013 and had over 80 participants. In 2014, a national survey found 21% and 83% of colleges/schools of pharmacy offer EM-focused introductory and advanced experiences, respectively, but only 15% have EM-related didactic curriculum. Of PGY1 pharmacy residency programs, 74% offered an EM rotation. Recently, ASHP launched the Emergency Medicine Certificate Program to provide pharmacists foundational knowledge/skills to optimize emergency department (ED) patient care.

Significance of Achievements: It is best practices for pharmacists to be members of the EM team. Due to the 24/7 nature of the ED and over 4300 EDs in the United States, training opportunities do not meet the demand; although there has been significant progress.

Impact on Patient Outcomes: Trained pharmacists can perform expanded clinical pharmacy services that have been associated with positive patient outcomes.

Impactions for the Future: There has been a steady growth in EM PGY2 training and it is anticipated that this will continue. A petition for recognition of EM Pharmacy by the Board of Pharmacy Specialties will be submitted this year that would provide a pathway for credentialing of EM pharmacists.

Endocrinology

426 | The evolution of pharmacists as diabetes Specialists

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Introduction: Over 30 million Americans are affected by diabetes, and incidence rates continue to rise. Pharmacists recognized the need to help people with diabetes (PWD) and increased their involvement and expertise in diabetes management by pursing certification and leading innovative practice models.

Historical Milestones: In 1986, the Certified Diabetes Educator (CDE®) credential was established: 1483 pharmacists hold the CDE® and many have established innovative practices in diabetes self-management education and support (DSMES). As the scope of diabetes education continued to expand, the BC-ADM® was established in 2001. Currently, 1240 health care professionals, including 310 pharmacists, hold this credential.

Significance: Collaborative practice agreements allow pharmacists prescribing authority. BC-ADM certification validates the pharmacist's ability to adjust medications, treat and monitor acute and chronic complications, counsel on lifestyle modifications, address psychosocial issues, and participate in research and mentoring. Examples of innovative pharmacist run services include continuous glucose monitoring (CGM) shared medical appointments, individual appointments for complex metabolic management, and a pharmacist run diabetes center of excellence.

Impact on Patient Care: A Pharmacist led CGM shared medical appointment program demonstrated a 0.8% A1C reduction and 1.63/10 point improvement in diabetes self-efficacy in 171 participants. Compared to usual endocrinology care, a pharmacist intervention improved A1C by 0.49%. A pharmacist managed gender-specific clinic provided advanced metabolic care for women and transgender Veterans: A1C improved by 2.3% post-intervention. A pharmacist run diabetes center of excellence yielded average sustained reductions of A1C = 1.1%, BMI = 1 kg/m2, and systolic BP = 5 mmHg in over 1500 patients.

Implications for the Future: Pharmacists serve an essential role on the health care team and continue to create innovative services to help PWD. Pharmacists are encouraged to obtain diabetes certifications and lobby for provider status or expansion of collaborative practice agreements.

Gastroenterology

427 | Impact of a pharmacist on under-served patients access to hepatitis C treatment

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The World Health Organization set the goal of treating 80% of hepatitis C patients by 2030. This raised the problem of access; patients access to a gastroenterology provider in New Mexico in 2018 averaged three months. With the confusion in the prior authorization process, specialty pharmacy process, changes in medication regimens, and needed baseline labs further delayed access to needed hepatitis C treatment. With an increasingly younger population being diagnosed with hepatitis C access to care, treatment completions, and show rates were dwindling. Therefore, a pharmacist was added to the gastroenterology team to manage a hepatitis C treatment team.

Prior to the pharmacist starting at the clinic between the dates of January 2018 - December 2018 the number of Medicaid patients who were initiated on treatment for hepatitis C equated to 450. After the institution of the pharmacist between the dates of January 2019 - August 2019 the number of patients seen and treated via measure of a dropped claim equated to 431. At the current rate by December of 2019 the number of patients seen will equate to 658. Implementation of the pharmacist is estimated to lead to increased access to treatment by at least 200 Medicaid members.

The impact of a pharmacist has had a significant impact on access to Hepatitis treatment for the New Mexico Medicaid patient. The pharmacist's knowledge of medication, pharmacy processes, prior authorization requirements has freed up follow-up appointments to treat more patients. In addition to this the hepatitis C project has freed up time for other gastroenterology providers to conduct procedures and see patients with multiple issues. In the future as the project is streamlined all patients with a hep C diagnosis will be added to the pharmacists panel.

Geriatrics

428 | Improving medication use nationwide with a telehealth medication therapy management program

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Background: Since the 1960s, the efforts of innovative pharmacists in collaboration with various organizations have advanced the role of pharmacists in the ambulatory care setting. However, a lack of widely available reimbursement mechanisms has restricted its growth. The Medicare Modernization Act offered the first opportunity for reimbursement for Medication Therapy Management (MTM) nationally, as a service offered by pharmacists. These services were soon offered telephonically to address their outsized need among older adults. The Institute of Therapeutic Innovations and Outcomes (ITIO) opened the Medication Management Program (MMP) in 2014 at The Ohio State University College of Pharmacy (OSU-COP) to offer telehealth medication management services.

Historical Milestones: The program was launched in 2014 with one pharmacist, technician, and student; it has grown to 24 pharmacists, 23 technicians, 140 students and 4 staff members. Cumulatively, ITIO-MMP has employed over 650 students, provided more than 450,000 CMRs and generated $18 million in revenue since its inception. The program has been recognized by OSU for excellence in outreach and engagement and for its quality of completed research at national meetings.

Significance of Achievements: The ITIO-MMP is one of the largest employers of student pharmacists in the state of Ohio. Prospective student pharmacists gain valuable experience early in their pharmacy careers in communication, patient care, and evidence-based medicine.

Impact on Patient Care: The collaboration between the ITIO-MMP and SinfoníaRx has resulted in completion of 4.68 million innovative, telehealth medication interventions in 2018, reaching patients nationwide despite geographic, physical and socioeconomic constraints.

Implications for the Future: Legislation, research, and the efforts of pioneering pharmacists continue to advance the services offered through MTM. The evolution of MTM services is poised to merge the automated monitoring of prescription claims with dedicated alert systems and optimize medication use through electronic intervention by pharmacists.

Health Services Research

429 | Three year implementation of an academic detailing program across a VA network

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Background: Academic detailing (AD) is an educational outreach service used to promote the use of evidence-based treatments. Clinicians with the most opportunity for prescribing change are identified as priority providers. Clinical pharmacists function as academic detailers in the Veterans Health Administration (VHA) because they are considered medication experts, are residency trained, and have prescribing privileges.

Historical Milestones/Accomplishments: In 2016, we began with a team of six AD pharmacists and a part-time informatics pharmacist. In our inaugural year, outreach focused on appropriate use of benzodiazepines (BZD). In year two, campaign topics expanded to include upper respiratory tract infections, urinary tract infections, opioid safety, and heart failure (HF). After year three, our program had demonstrated such positive impact that we expanded to nine AD pharmacists and two part-time informatics pharmacists. Outreach visits have expanded from an average of 66 visits/detailer/quarter to 123 visits/detailer/quarter.

Significance of Achievements: As a startup service, substantiating impact within the VHA was paramount. Demonstrating significant impact on prescribing across VHA has allowed us to expand our program, increase outreach, and further influence prescribing trends and Veteran outcomes.

Impact on Patient Care/Patient Outcomes: 155 providers were detailed during our BZD campaign, leading to a 23% reduction in BZD use and a 54% reduction in BZD initiations. 293 outreach visits for HF significantly increased the proportion of patients receiving at least 50% of optimal doses of guideline-directed medication therapy. Recently, 150 outreach visits for acute pain led to reductions in opioid prescribing and opioid prescriptions greater than 5 days.

Implications for the Future: Our program will continue efforts to impact prescribing trends for BZDs, opioids, and HF. We plan to begin detailing on chronic obstructive pulmonary disease and tobacco use disorder. Finally, incorporation of e-detailing (virtual detailing) has potential to further increase the impact our program has on prescribing trends.

430 | Clinical pharmacy evolution: The Hepler's snowball in North Cyprus

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Background: A more responsible approach of pharmaceutical care practice was what Hepler and Strand called for and since then pharmacy practice continued to evolve to a more patient centered practice. In Turkey and North Cyprus (NC), the implementation of Clinical Pharmacy Services (CPS) in hospitals is currently gaining attention to rationalize drug use as the pharmacist specialization program was started for this purpose in 2017.

Historical Milestones: Inspired by Hepler and Strand's and ACCP position papers; the first implementation of CPS in NC was on 2013 with the introduction of a clinical pharmacist into a pulmonary clinic. Following year, the services were further extended into cardiology and internal medicine clinics along studies evaluating rational drug use in hospitals. Efforts were mounted with opening of the first drug information and clinical pharmacy center in a tertiary hospital in 2015, with 12 clinical pharmacists.

Significance of achievements: Since 2013, 50 different research projects were carried of which more than 50% are published, 1535 people were served during these studies, while 1694 patients' yearly benefit from services that sustained. More than 600 pharmacy students of different schools in NC underwent clinical pharmacy experiential practices in the developed sites of practice. Meanwhile 40 postgraduate students have gained their PhD or MSc of Clinical Pharmacy.

Impact on patient care: Rational drug use investigations in NC has shown a great extent of irrationality in prescribing antibiotics, acid-suppression medications, and anticoagulants, optimization of therapy was needed in geriatric, respiratory, cardiology, pediatrics, intensive care patients and community pharmacies. Pharmacist interventions in NC has significantly prevented or resolved DRPs, improved QoL, BP, HbA1C, satisfaction, promoted weight loss and adherence in different settings.

Implication for the future: Testing the cost-effectiveness hypothesis of CPS in the Turkish and North Cyprus context is mandatory to sustain and further develop these services.

HIV/AIDS

431 | Exploration of telemedicine in the classroom setting

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Introduction/Background: Since 2013, UIC College of Pharmacy has offered the elective opportunity, “Exploration of Telemedicine” to its' students, with goals of providing education and hands on clinical experiences working with incarcerated patients currently receiving HIV/Hepatitis C care via telemedicine. The course consists of online modules and discussion as well as opportunities to observe telehealth clinical activities in real time. The interprofessional team that manages this service consists of infectious disease physicians and pharmacists

as well as nurses and caseworkers; on average, 15 patients from 26 Illinois correctional facilities are scheduled daily for comprehensive medication and health management. Adequate exposure and training in this discipline is essential for pharmacists so that patient care can be optimized with the expanding use of technology.

Historical Milestones or Accomplishments: This course has pioneered online elective training for pharmacy students, and provides them with the knowledge to better understand and use telehealth in their future practice.

Significance of Achievements: Preparing our future pharmacists to be proficient with technological healthcare tools will be essential in ensuring the delivery of adequate patient care.

Impact on Patient Care/Patient Outcomes: While telemedicine services are becoming widely accepted as comparable to in patient visits, healthcare delivered in this fashion has been shown to be beneficial for remote and underserved patient populations. Clinical management via telehealth can improve adherence and patient quality of life. Our group demonstrated improved virologic suppression using telemedicine in patients living with HIV/AIDS when compared to traditional face-to-face management.

Implications for the Future: More research is warranted on the clinical outcomes that result from healthcare delivered via telemedicine services and comparison to outcomes of standard in-person care.

Infectious Diseases

432 | Outpatient ID pharmacists: OPAT and beyond

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Introduction/Background: Since the 1970s, outpatient parenteral antimicrobial therapy (OPAT) has been a key component in the management of patients with serious infections. Though published clinical and economic benefits of OPAT are evident, associated adverse drug events (ADEs) and hospital readmission are reported as high as 30% and 26%, respectively. Many medical institutions provide OPAT clinical oversight through infectious diseases physicians or advanced practice providers (APPs). In 2016, our large tertiary academic medical center engaged ID trained pharmacists to assume this role. The OPAT pharmacist team operates under a Collaborative Practice Agreement with the Infectious Diseases division to independently manage abnormal monitoring labs, address symptomatic intolerances, prescribe antimicrobials, outline supportive cares, and order minor tests/procedures.

Historical Milestones or Accomplishments: The OPAT pharmacist currently averages 200 patient care touches monthly. Practice expansion after inception now includes: late culture review, provision of medication management services for patients with non-tuberculosis mycobacterial infection, monitoring of high risk oral antimicrobials, therapeutic drug monitoring, clinical research, education, and leadership. An OPAT Quality FMEA revealed only 2 out of 70 potential OPAT failures at the pharmacist level. Currently, the OPAT pharmacist is leading cutting edge practice advancements such as telemedicine.

Significance of Achievements: The OPAT pharmacist team expanded ID pharmacy practice, solidifying a beneficial clinical role within ID. OPAT pharmacists demonstrate mastery of functional tasks typically outside pharmacists' legal scope, add value in direct patient care, and offset workload from physicians and APPs.

Impact on Patient Care/Patient Outcomes: Data on our OPAT patients treated for Staphylococcal infections (where the OPAT pharmacist role was present for the latter half the study period) showed high overall treatment completion (137/148, 92.6%) and low 30-day readmissions due to OPAT (5/148, 3.4%).

Implications for the Future: Expansion of pharmacy services to include OPAT pharmacists should be considered widely for implementation at other institutions.

433 | Evolution of infectious diseases (ID) clinical pharmacy: Highlight on ID residency and fellowship at the Detroit Medical Center (DMC) and the Anti-Infective Research Laboratory (ARL) at Wayne State University (WSU)

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Background: Detroit Medical Center (DMC) and the Anti-Infective Research Laboratory (ARL) have been pivotal in training infectious diseases (ID) leaders for decades.

Historical Milestones or Accomplishments: Detroit Receiving Hospital (DRH), within the DMC and one of the first Postgraduate Year Two ID residency programs established in 1996, has trained 20 residents. The ARL, housed initially at DRH and now on the medical campus of Wayne State University (WSU) at the DMC and one of the first ACCP approved ID fellowship programs established in 1985, has trained >45 fellows and received >20 fellowship awards.

Significance of Achievements: With four residency program directors, latest being Dr. Ryan Mynatt, fellowship program director, Dr. Michael Rybak, the leadership of Dr. Jason Pogue, and ID preceptors Dr(s). Leah Molloy and Jing Zhao, the DMC and the ARL have published >500 ID peer-reviewed articles, with ~50% having residents/fellows as primary authors.

Impact on Patient Care/Patient Outcomes: DRH has been progressive in ID pharmacy, having one of the first full-time ID pharmacy practitioners rounding with the ID consultation service in the U.S.,

early advocacy of antimicrobial management/stewardship programs (service implementation: 1987), and developing a pharmacy training program for an antibiotic pharmacokinetic consultation service with advancements in aminoglycoside/vancomycin therapy including one of the first adopters of area under the curve vancomycin monitoring. The pharmacokinetic/pharmacodynamic and health outcomes research generated within the ARL have impacted several international clinical practice guidelines, of which Dr(s). Michael Rybak and Jason Pogue have sat on at least four international guideline committees. ID residents/fellows precept students/residents and are involved with teaching ID modules at WSU.

Implications for the Future: The DMC and the ARL have created a collaborative clinical and scholarly pharmacy training system where residents/fellows work with mentors to advance the practice/research/education of ID clinicians in years past and in years to come.

434 | Pharmacist-led Hepatitis C clinic model

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Introduction: The Veterans Health Administration is the largest provider of care for Hepatitis C infected individuals, and in January 2015, approximately 140,000 veterans were known to be awaiting treatment. With the approval of oral direct-acting antiretroviral therapy for HCV and the achievement of cure a reality, VA providers were eager to address the needs of HCV-infected veterans.

Milestones: The William Jennings Bryan Dorn VA Medical Center Columbia, SC had over 1,600 patients awaiting treatment and implemented a novel pharmacist-led HCV clinic model resulting in 1,111 patient receiving treatment over 18-months. The pharmacist-run clinic expanded capacity by repurposing a cardiac mobile medical unit as a HCV clinic. The mobile unit allowed the pharmacist to travel to rural locations to evaluate, prescribe, dispense and monitor HCV treatment for veterans with access issues. In 2017, this pharmacist was the top prescriber of HCV therapy in VA, with a resultant cost savings of $121,469.64 for the 18-month period.

Significance: At a single, multi-site VAMC based in Columbia, SC, the proportion of patients treated increased from 2% to 78% in 18 months due to an innovative pharmacist-run HCV clinic, including a mobile medical unit, and consequently became the highest treating VHA facility in the country.

Impact: Access issues were resolved by utilizing a pharmacist-run clinic model. Unmet needs were addressed by repurposing a mobile medical unit to reach rural veterans with transportation challenges. An SVR rate of >98% was achieved for those completing treatment in this clinic, decreasing risks for long-term complications such as cirrhosis and hepatocellular carcinoma.

Implications: A pharmacist provider functioning independently under a scope of practice is an efficient and cost-effective way to treat HCV. This model may prove effective across other pharmacotherapy-driven disease states. Also, expanding this model to include a mobile medical unit allows rural veterans to appropriate care.

435 | Antimicrobial stewardship: From infancy to center of excellence

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Introduction/Background: In 1997, the Society of Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) released guidelines on the prevention of antimicrobial resistance in hospitals, suggesting that all hospitals establish a system for monitoring bacterial resistance and antibiotic usage. University of Kentucky HealthCare (UKHC) took action, developing an antimicrobial "management" program and a multidisciplinary antimicrobial subcommittee of the Pharmacy and Therapeutics Committee. The early focus was to decrease antimicrobial resistance and cost.

Historical Milestones/Accomplishments: Our Antimicrobial Stewardship Program has been recognized by several national organizations. We won the American Society of Hospital Pharmacists (ASHP) Best Practice Award (2004), the Society of Infectious Diseases Pharmacists (SIDP) Outstanding Practice Award (2005), and recently was designated an IDSA Antimicrobial Center of Excellence (2019). Over time, the program became an integral component of patient care at UKHC, resulting in an expansion from one pharmacist and one physician to six pharmacists and three physicians.

Significance of Achievement: UKHC has been a leader in antimicrobial stewardship for over 21 years through delivering high-quality care consistently and serving as a standard for executing novel antimicrobial stewardship principles in preserving antibiotics, preventing resistance, and protecting lives.

Impact on Patient Care/Patient Outcomes: The Antimicrobial Stewardship Team has made a significant impact on patient care by a) maximizing appropriate antimicrobial therapy with rapid diagnostic technology, b) improving treatment outcomes through diseases state stewardship, c) decreasing acute kidney injury in patients on vancomycin through area under the curve monitoring, and d) providing treatment options for patients with multi-drug resistant organisms.

Implication for the Future: Our next step is the expansion of stewardship leadership and programs to additional settings such as ambulatory and long-term care facilities throughout the Commonwealth of Kentucky.

436 | **Establishment and execution of a practice based research network: The Southeastern Research Group Endeavor (SERGE-45) experience**

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Introduction/Background: Practice based research networks (PBRNs) facilitate large scale research and are most successful when members share a common interest or practice area. PBRN functionality and efficiency may be dependent on several factors including member motivation, perceived professional benefit and size of the PBRN. The Southeastern Research Group Endeavor (SERGE-45), an interdisciplinary PBRN with a focus in clinical infectious diseases, was established in 2011.

Historical Milestones/Accomplishments and Impact: The SERGE-45 network is currently at its peak membership, comprised of 73 pharmacists and physicians from 12 states in the Southeast US. One primary goal of the SERGE-45 network is to facilitate research among clinical pharmacists in non-academic settings. Only 14% of the membership are full-time academics and nearly 50% of the institutions are community hospitals. There are 5 peer-reviewed publications, numerous peer-reviewed abstracts and several ongoing projects specifically attributed to the SERGE-45 network. In 2017, the SERGE-45 network established a social media presence on the Twitter platform. Articles have been published in high impact journals and cited at a high rate. Many clinical pharmacists have had the opportunity to grow as scholars through participating in multi-center studies. Several regional and national presentations regarding SERGE-45 development and implementation have been delivered. SERGE-45 co-founders have served as consultants to assist other groups in creating critical care and ambulatory care PBRNs of similar makeup.

Mobilizing SERGE-45 network members has facilitated published research answering clinical questions that impact daily patient care decisions. Additionally, an annual publication of top papers in antimicrobial stewardship interventions serves as a key reference for stewardship programs and trainees.

Implications for the Future: The SERGE-45 network will continue to provide opportunities for multi-center research to clinical pharmacist and physician members. Mentoring of junior investigators and the establishment of an independent website will be a focus moving forward.

Neurology

437 | **The Evolution of rescue therapy for the treatment of seizure emergencies**

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Some patients with drug resistant-epilepsy have seizure clusters, which can progress to prolonged seizures or status epilepticus. When patients or caregivers can identify such episodes, they could administer a therapy that interrupts seizure progression. In the 1980s, a team of clinical pharmacists, nurses, and epileptologists identified an unmet need for out-of-hospital management of seizure clusters. They designed an off-label therapy with rectally administered diazepam that triggered a new approach to treating seizure emergencies, now known as rescue therapy.

Following reports on the off-label use of rectal diazepam, an industry-academic collaboration began development of a commercial rectal diazepam product in 1987. They obtained FDA orphan product designation in 1991 and completed an NIH-funded Phase III trial in 1996. The FDA approved diazepam rectal gel, Diastat®, in 1997.

Diastat® approval launched a new approach to managing seizure emergencies. Given the objections to the use of rectal diazepam, clinicians began exploring off-label use of benzodiazepines by other routes. At the same time, industry and academic groups undertook formal development of rescue therapies. This led to the recent approval of an intranasal midazolam product, Nayzilam®, and an NDA for an intranasal diazepam formulation is under review. Further, investigational intrapulmonary, intramuscular, buccal, and subcutaneous benzodiazepine products are in development.

Rescue therapy has advanced the management of epilepsy, improved patient/family quality of life, and reduced health care costs. However, several barriers to effective use of rescue therapy remain. A 2014 Epilepsy Foundation survey found that only 30% of patients had a seizure emergency plan.

The number of rescue therapies is expanding. Non-rectal routes of administration offer convenience and may lead to faster seizure cessation resulting in fewer emergency department visits and improved quality of life. Further improvements in drug delivery coupled with seizure prediction technology hold the promise of fundamentally changing our approach to treating epilepsy.

438 | **Pharmacist integration and contribution into clinical trials utilizing NIDA cannabis extract**

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Background: Although cannabis continues to be classified as a schedule 1 drug by the federal government, there is a growing interest in conducting robust clinical research trials to investigate efficacy and safety of cannabis or its components in various disease states. Currently, the only cannabis plant products approved for investigational use is either Epidiolex or is sourced by the National Institute of Drug Abuse (NIDA).

Historical Milestones/Accomplishments: The NIDA cannabis supply is both limited by the crop yield each year and the product formulations, concentration and ratio of cannabinoids. Following the Epidiolex package insert as a guide, clinical research pharmacists at the University of Colorado Anschutz Medical Campus successfully compounded the NIDA crude plant extract into an oral solution with the desired ratio of 30 CBD:1 THC for use in a clinic trial.

Significance of Achievements: Preparation of the crude plant extract into an oral solution for administration provides flexibility in dosage concentration, ratio of cannabinoids, and formulation that may be more representative of products used by the public. This process provides specialized pharmacists involved in clinical trials with resources to compound the crude plant extract product for use in other clinical research trials.

Impact on Patient Care/Patient Outcomes: By increasing diversity of formulations and strengths of investigational cannabis products that both meet federal requirements and more similarly mimic what is seen in the real-world use, researchers can begin to bridge the gap in knowledge.

Implications for the Future: There is a need for robust clinical trials to answer the growing amount of questions the medical community has with regards to the clinical benefits and risks of using cannabis or its components medicinally. By utilizing pharmacists compounding knowledge and expertise to formulate cannabis products for use in research trials we can continue to evaluate its place in medicine.

Oncology

439 | Evolution of oncology clinical pharmacy

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Introduction/Background: Oncology pharmacists have advanced training and expertise enabling them to provide evidence-based care to cancer patients throughout their disease. The oncology pharmacist can assess appropriateness and provide input on treatment decisions and make recommendations on suitable supportive and palliative care regimens. Additionally, oncology pharmacists can play an active role in cancer prevention and screening.

Historical Milestones or Accomplishments: Specialty training in oncology pharmacy has been available since the 1980s through residency or fellowship programs. In the 1990s, a small group of oncology pharmacists proposed board certification. This was based on the premise that as a member of the cancer care team, oncology pharmacists possess specialized knowledge, ensure optimal drug therapy, and bring a unique contribution to the patient care team. The Board of Pharmacy Specialties acknowledged oncology pharmacy as a specialty in 1998. In 2004, the Hematology/Oncology Pharmacy Association (HOPA) was formed.

Significance of Achievements: The role of oncology pharmacists has dramatically changed transitioning from the central responsibility of dispensing medications to providing direct patient care in a variety of settings. Some of these settings are unique, such as investigational drug services, practice management, disease-state specific clinical roles, and specialty pharmacy. Currently, over 2750 pharmacist have obtained their BCOP and HOPA has over 3000 members.

Impact on Patient Care/Patient Outcomes: The value of the oncology pharmacist has been documented in 1) clinical care by reducing medication errors and improving supportive care, monitoring and documentation; 2) patient education by improving medication adherence and learning outcomes; 3) implementation of informatics by identifying medication errors and aiding with clinical decision support tools used in precision medicine, and 4) economic benefits related to cost savings, process improvement, and revenue generation.

Implications for the Future: With a shortage of oncology physicians expected by 2020, oncology pharmacists are well poised to function as physician extenders.

Other

440 | The process optimization and quality control of hundreds of Chinese medicine dispensing granules

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Introduction: Nowadays, compound granules are becoming increasingly popular worldwide, especially in Japan, Korea, Taiwan and Hongkong. The popularity is largely due to its better quality control and easier administration over the traditional decoction. Most of the compound granules are produced based on Traditional Chinese Medicines (TCMs). One famous example is the Japanese Kampo, most of which are produced in the form of compound granules.

Accomplishments: In some regions of China, it is termed as Chinese medicine dispensing granule. As the market expanded in the past two decades, the quality of the compound granules remains inconsist. The government has issued a guideline for the quality control and quality

standard of TCM dispensing ganules (draft for comment) in 2016. Our research focuses on the process optimization and quality control of hundreds of Chinese medicines.

Significance of Achievements: The study has made enterprise standards of 680 kinds of traditional Chinese medicines, which has been submitted to the local government for records and also provides scientific basis for clinical use in hundreds of medical institutions in Zhejiang province.

Impact on Patient Care: It is easy to carry and take immediately after mixing granules with water. The granules could be preserved for three years. It is more popular and convenient to young people and professionals.

Implications for the Future: Uniform industry standard to restrain and promote the development of TCM dispensing granules will be released. Our study provides the usage in Zhejiang province to support the future implications of TCM dispensing granules throughout the country.

The study is incorporated into the TCM Science and Technology Program Management of Zhejiang province, supported by Tai Lake Elite Programme in Hu zhou city.

441 | The Emerging Role of Pharmacists in Population Health Management

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Background: *Population health management (PHM)* is the management of patient health outcomes and the distribution of those outcomes within a specified group. PHM may include a multitude of disciplines working in unison to improve health outcomes, individual patient experiences, and mitigate healthcare costs. Pharmacist serve as uniquely qualified providers in delivering outcome-focused activities for PHM.

Accomplishments: The pharmacist's role has evolved from primarily dispensing to delivering specialized clinical services and a key member in the healthcare team. The value of pharmacists in the provision of clinical services has been well documented over time, and has been foundational for their inclusion in PHM programs. To date, pharmacists serve as key contributors to various initiatives by population-based management programs within hospital systems, accountable care organizations, health plans, prescription benefits managers, and physician offices.

Significance of Achievements: Due to significant achievements in practice, pharmacists are now vital in PHM roles and work to optimize effective medication management. They help to achieve clinical and financial performance metrics through a collection of diverse activities such as medication and disease management, medication reconciliation, patient education, adherence management, and post discharge follow-up.

Impact on Patient Care/Patient Outcomes: PHM models of care that have incorporated pharmacists have shown to improve the health of the population, reduce per capita healthcare costs, and improve the patient's experience of care. Pharmacist's initiatives at Kaiser Permanente's PHM program yielded a 24% reduction in high-cost drug expenses. Patients managed by pharmacists as part of Geisinger Healths' robust PHM program experienced 18% fewer emergency department (ED) visits and 18% fewer hospitalizations per year. Other programs have had similar success.

Implications for the Future: The inclusion of pharmacists in PHM programs positively impact population outcomes. PHM models create an opening to transform pharmacy care delivery and may increase future practice opportunities.

442 | The Impact of a 15-year Sustained Partnership in Global Health

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Introduction/Background: In 2004, the Purdue Kenya Program (PKP) joined AMPATH in western Kenya with the goal of introducing contextualized care services, training providers, and establishing research infrastructure. By collaborating with local partners, the PKP has become a leader in Global Health through its creation of innovative education, practice and research programs.

Historical Milestones or Accomplishments: The PKP grew from a program primarily focused on creating HIV-focused supply chain rotations for North American students to a holistic care program which provides Kenyans (KE) and North Americans (NA) with undergraduate and postgraduate clinical pharmacy training. PKP's educational program has grown to include 5 educational programs which address various levels of practice in pharmacy including: 1) a Global Health APPE (NA) (n = 315), 2) PGY2 in Global Health Pharmacy (NA) (n = 12), 3) 6-month internship (KE) (n = 80), 4) Postgraduate clinical training program (KE) (n = 19) and 5) Master's in Clinical Pharmacy (KE) (n = 11).

The PKP's research program has successfully raised 7.8 million USD in grant funding and published >70 peer reviewed manuscripts.

Significance of Achievements: The PKP has driven the practice in Kenya from being product-focused to patient-focused, which has led to the creation of the first Department of Clinical Pharmacy at a public sector hospital in Kenya and accreditation of its programs by the Kenyan government.

Impact on Patient Care/Patient Outcomes: The pharmaceutical care programs grew from 1 program in 2004 to 17 clinical programs by 2019, with a growth of clinically trained local pharmacy practitioners from 1 to 22 persons. Programs have been developed in the following areas: internal medicine, diabetes, cardiology, anticoagulation, oncology, supply chain and pharmacovigilance for a catchment population of 8 million persons.

Implications for the Future: The integrated approach of the PKP serves as a model for global health pharmacy programs to maximize success in care, education, and research.

443 | Emergence of the transitions of care pharmacist

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Introduction: National Transition of Care (TOC) Coalition estimates 60% of medication errors occur during TOC leading to hospital readmissions and economic burden. To address this issue, CMS initiated the Hospital Readmission Reduction Program (HRRP); where hospitals with excessive readmission rates for defined diagnoses receive payment reductions. Hospital implementation of services to reduce readmissions led to TOC pharmacist positions.

Historical Milestones: Through HRRP, pharmacists' roles expanded through development and implementation of various pharmacist-led TOC programs to assist with improving quality of care transitions. TOC programs may include pharmacist visits, interprofessional collaboration and meds-to-beds programs.

Significant Achievements: CMS incentivized providers for Transitional Care Management Services (TCM) by providing reimbursement for post-discharge follow-up activities. Although TCM must be billed by physicians, pharmacists support TCM by conducting non-face-to-face services and face-to-face visits. Thus, providing an opportunity for pharmacists to form collaborative agreements with physicians. Pharmacist TCM activities include medication reconciliation, discharge coordination/counseling and post-discharge follow-up services.

Impact on Patient Care: TOC pharmacists' services led to decreased medication errors, reduction in 30-day readmissions, improved HCAHPS score, and positive financial impact for institutions. Successful TOC initiatives include Medication REACH where pharmacist-led interventions decreased readmissions by 50%, likewise, Project RED resulted in decreased 30-day readmissions (30.6% to 12%). Lastly, 45% of Project PRIMED interventions prevented medication errors of category D or higher (cost avoidance $1.1 million).

Future Implications: Broad outcomes like readmission rates are affected by many factors outside of pharmacy influence. Future outcomes should focus on clinical outcomes, cost savings and revenue generated from pharmacist-provided services. Studies should validate tools that supports TOC to enhance medication management, handoffs, and clinical outcomes while seeking to reduce costs of care for patients. As the healthcare system moves towards value-based measures, and changes in primary care reimbursement structure, pharmacists play an integral role in optimizing patient outcomes during TOC.

Pediatrics

444 | Pharmacist contribution to Vermont Oxford network impacting antibiotic stewardship on the smallest patients

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Introduction/Background: Vermont Oxford Network (VON) is an international group of health care providers who provide research, quality improvement, and benchmark improvement for infants in over 1,200 hospitals. From 2016 through 2018, VON focused on antibiotic stewardship giving the clinical pharmacist the ability to collaborate in multi-disciplinary research to make an international impact.

Accomplishments: Due to the pharmacist involvement with antibiotic stewardship, VON increased its pharmacist membership and attendance at the annual quality conference. During the quality conference, the clinical pharmacist was able to present three posters on antibiotic stewardship and was asked to be an expert in round table discussion two years in a row. The round table experts were chosen by VON leadership.

Significance of Achievements Akron Children's Hospital- St. Elizabeth neonatal intensive care unit experienced a significant decrease in antibiotic days/1,000 patients. The focus on pharmacist involvement at a neonatal international conference brought to light the advantage of having a pharmacist on the multi-disciplinary team.

Impact on Patient Care/Patient Outcomes: Percentage of antimicrobial days per 1,000 patient days derived from the electronic medical record decreased from 45% in December 2015 to 5% in April 2018. Balancing measure showed antimicrobial allocated pharmacy revenue decreased from $47,803 in December 2015 to $3,405.51 in April 2018. Presentation to hospital leadership focused on the decrease in

allocated pharmacy dollars as a benefit to the hospital and community.

Implications for the Future: The impact of the pharmacist has now been seen on an international level amongst a group of neonatal nurses and providers. Increased use of the pharmacist knowledge base will be requested at the annual quality conference.

Peri-Operative Care

445 | The Evolution of Perioperative Clinical Pharmacy from the Lens of the Perioperative Care (PERI) PRN

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Background: The Perioperative Care PRN aims to foster collaborative practice, education, and research related to pharmacotherapy for patients within the surgical care continuum. The PERI PRN, founded in 2014, is a network of perioperative clinical pharmacy practitioners who have combined efforts to create and disseminate interventions with significant patient care impact. Since then, multiple efforts related to the dissemination of key clinical pharmacy interventions in this setting have been underway.

Significance of Achievements: Education related to perioperative care has been presented via annual focus sessions and webinars since its inception. The first opinion paper authored by PERI PRN members was published in early 2019 after the presentation of key concepts at the PERI PRN focus session in 2017. Collaborative application for grant-funded research has also been pursued with the help of members of the Enhanced Recovery After Surgery (ERAS) Society.

Impact on Patient Care: Numerous clinical pharmacist interventions within the perioperative setting, especially in the context of systems changes, have been documented extensively in the literature resulting in significant improvements in the frequency and severity of postoperative complications. Examples of these interventions include, but are not limited to, multi-modal pain control, antimicrobial stewardship, appropriate use of hemostatic agents, and transitions of care.

Implications for the Future: Perioperative clinical pharmacy remains a relatively under-recognized role with great potential to improve patient outcomes considering the number of patients who undergo surgical procedures and the increasing patient and payer complexities. Expanding education, practice, and research in this area of clinical pharmacy is a frontier that will lead to progress not only within the profession but also within patient care in the surgical setting.

Rheumatology

446 | Kaiser permanente Colorado ambulatory clinical pharmacy specialty services in rheumatology

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Introduction/Background:

A Rheumatology Clinical Pharmacist Specialist (CPS) was identified as a needed resource due to the utilization of high-cost medications, specifically biologics, at Kaiser Permanente Colorado (KPCO). The Rheumatology CPS engages in various roles supporting patients, pharmacy, rheumatologists and nursing teams through consultative and population health management strategies. The Rheumatology CPS supports the optimization of treat-to-target disease/medication management, delivery of cost-effective care, maintenance of medication safety, and leverages systems to increase efficiency, while championing high quality care and providing education to patients and healthcare providers.

Historical Milestones of Accomplishments:

- Co-developed and co-chaired KPCO's Autoimmune Multi-Disciplinary Committee (AMC) achieving 2018/19 goals of developing consensus recommendations and workflows for immunizations, medication laboratory monitoring, and perioperative medication management for immunocompromised patients receiving high-risk medications.
- Collaborated with research, nursing, and rheumatologist leads to implement patient interactive voice response (IVR) outreaches to improve the timeliness of laboratory monitoring completion for high-risk medications.
- Strategized and implemented adalimumab and etanercept utilization management dose de-escalation initiative for eligible patients.
- Facilitated the conversion of an infliximab reference-product to infliximab biosimilar.

Significance of Achievements:

- The AMC supported the development of electronic health record pneumonia immunization and medication adherence alerts for immunocompromised patients.
- The IVR intervention decreased the percentage of patients due/overdue for medication laboratory monitoring from 24.3% to 17.5%.

- Demonstrated an approximately $800,000 cost savings associated with etanercept and adalimumab dose de-escalation and infliximab biosimilar conversion.

Impact of Patient Care/Patient Outcomes:

- The IVR program has streamlined prescription refill workflows as patients have laboratory monitoring completed on time.
- Conversion and dose de-escalation efforts have maintained control of disease activity.

Implications for the Future:

- Improve immunization and medication adherence rates.
- Develop quality and safety initiatives supporting glucocorticoid-induced osteoporosis and hydroxychloroquine eye screening.

Substance Abuse/Toxicology

447 | Implementation of a medication take back program in a community health system

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Introduction: Safe medication disposal options are important to ensure patient safety in the community and limit the environmental implications of medications in the aquatic ecosystem. In the face of the ongoing opioid epidemic, access to convenient disposal options for controlled substances is imperative. Over 70 percent of new opioid users acquire medications from a family or friend's medicine cabinet. In 2014, the DEA enacted the final rule on the disposal of controlled substances, expanding the list of authorized entities that can serve as collection sites to include pharmacies. This expanded regulation paved the way for health care providers to get involved in the establishment of new medication take back locations.

Historical Milestones: Historically, law enforcement buildings have been the cornerstone for medication take back locations. In 2019, Edward-Elmhurst Health began offering medication disposal receptacles in the lobbies of its 2 community hospitals.

Significance of Achievements: Successful implementation of a medication take-back program provides healthcare institutions with another method to combat the misuse of controlled substances. Education about the location of the receptacles and the convenience of that location is useful to disseminate to patients at the same time that they are receiving prescriptions for controlled substances upon discharge from the hospital.

Impact on Patient Outcomes: Over a 24-week period, 254 pounds of unused medications were collected.

Implications for the Future: The success of the medication take-back program highlights a continued need for convenient access to safe disposal methods by patients in the community who have unused medications. Expansion of the safe medication disposal program, through the addition of single use disposal packages, is a consideration for the future.

Transplant/Immunology

448 | Transplantation Immunosuppressive Pharmacology Research Program at University at Buffalo: Team science

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Introduction: Maintenance immunosuppressive regimens including a calcineurin inhibitor, mycophenolic acid (MPA) ± glucocorticoid have exhibited notable intra and interpatient pharmacokinetic(PK) and pharmacodynamic(PD) variability in renal transplant recipients. Limited studies had examined the PK/PD of glucocorticoids in immunosuppressive regimens post-renal transplant by the late 1980s.

Historical Milestones: During my fellowship at the University at Buffalo (UB), I focused on glucocorticoid PK/PD. During training and as a junior faculty, I designed and conducted clinical PK/PD investigations of glucocorticoids in renal transplant recipients and elderly subjects in collaboration with an academic nephrologist and endocrinologist to address these knowledge gaps. The program was among the first to document the interpatient and intrapatient PK/PD variability of methylprednisolone and adverse effects during fixed dosing regimens post-transplant. This research also established glucocorticoid PK/PD differences between Blacks and Whites, sex and adult ages with racial links to post-transplant diabetes. This program expanded into the UB Transplantation Immunosuppressive Pharmacology Research Program (TIPRP) incorporating a multidisciplinary research team including biostatisticians, nephrologists, immunologists, geneticists and modelers. This research continues PK/PD with pharmacogenomic investigations of race, sex and age influences on calcineurin inhibitors, MPA and the relationship to immunosuppressive adverse effects through investigator initiated grants from pharmaceutical industries and NIH.

Significance of Achievements: These observations were among the first to describe differences in immunosuppressive PK/PD between sex and race, which provided support to individualize dosing regimens post-transplant for sub-populations.

Impact on Patient Care: These reports provided clinical science foundations for further investigations into the race and sex influences on immunosuppressive pharmacology to guide advanced individualized dosing regimens.

Future Implications: This multi-disciplinary research program has implemented NIA-funded clinical pharmacology investigations into the influences of age, sex and race on common immunosuppressives to address the PK/PD knowledge gap and assist in individualization of

dosing regimens prescribed for the increased number of elderly renal transplant recipients.

CASE REPORTS

ADR/Drug Interactions

449 | Oxcarbazepine-induced cutaneous reaction in a female of Mexican ancestry: A case report

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Introduction: Oxcarbazepine (OXC) is an antiepileptic medication known to induce severe dermatologic hypersensitivity reactions in persons with the human leukocyte antigen (HLA)-B*1502 allele. This genetic variant is prominent enough in persons of Asian ancestry to warrant genetic screening prior to therapy initiation. However, in persons of non-Asiatic lineage, testing is often left to the discretion of the provider. Limited information regarding genetic composition of Mexican indigenous peoples may limit prescriber attentiveness.

Case: A 60-year-old female of native Mexican ancestry presented to a primary care clinic with a diffuse morbilliform rash, with redness and eruptions of papules/pustules concentrated on her neck, chest, back, and abdomen. The rash had progressed in severity over 1 week following the initiation of OXC for trigeminal neuralgia. The correlation between the reaction and OXC initiation was not recognized by the provider. The patient returned to clinic three weeks after the initial clinic visit with the rash worsening severity. A clinical pharmacist prompted the discontinuation OXC due to suspicion of an adverse drug reaction. Corticosteroid therapy was tapered over two weeks and rash resolved within 1 month.

Discussion: The association of OXC with the cutaneous eruption was classified as "probable" based on the Naranjo Scale. Literature relating Mexican ancestry to geographic location has demonstrated that indigenous Mexicans share genotypic similarities with Native American, European, and West African peoples. While financial resources were not available in clinic to perform genetic testing, it may be likely that the genetic status of this patient lent itself to greater potential for cutaneous reactions with OXC.

Conclusion: As regional genotypes disperse globally, it is imperative that clinicians are cognizant of risks regarding genetically-implicated adverse drug reactions. As information is limited for certain ethnicities, it is essential that providers to diligently monitor all populations for reactions characteristic to specific medications.

450 | Case report: Successful treatment of suspected kratom-induced serotonin syndrome

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Introduction: Kratom is an herbal supplement that has emerged as self-treatment for anxiety and depression. Mitragynine, an active alkaloid in kratom, acts as a serotonin agonist. We report a case of serotonin syndrome likely induced by kratom in combination with prescription psychotropics.

Case: A 63 year-old male presented with symptoms of diaphoresis, flushing, aphasia, confusion, dysarthria, right facial droop and oral temperature of 103.2°F, lactate 2.7 mg/dL, and creatine phosphokinase of 1507 IU/L. Initial differential diagnoses included acute ischemic stroke and bacterial meningitis. Despite treatment with alteplase and broad-spectrum antibiotics, symptoms persisted and subsequent physical exam noted hyperreflexia, clonus, tremors, as well as a temperature of 106°F. Home medications included a chronic regimen for depression with bupropion, buspirone, desvenlafaxine, trazodone, and ziprasidone; patient also revealed recent use of kratom. High clinical suspicion for serotonin syndrome lead to discontinuation of psychotropic medications and initiation of cyproheptadine, acetaminophen, and lorazepam. Approximately 8 hours after administration of cyproheptadine, aphasia, facial droop, and confusion improved. Treatment with cyproheptadine continued for a total of 10 days. Bupropion was restarted during hospitalization with additional psychotropic medications restarted upon discharge, except desvenlafaxine. Patient was counseled to discontinue use of kratom.

Discussion: Use of serotonergic agents and risk of serotonin syndrome is well known. Here, we present a case of possible serotonin syndrome (Naranjo Scale 4) that developed following use of kratom by a patient taking multiple serotonergic-acting agents. Mitragynine exhibits agonism at the 5HT2A receptor subtype, and pharmacokinetic data suggests that components of kratom inhibit multiple CYP isozymes, both of which may have potentiated the serotonergic effects of this patient's medications.

Conclusion: Kratom is currently unregulated by the FDA and harmful effects have been identified. Because substances contained in kratom exhibit pharmacologic activity similar to prescription psychotropic medications and may interact, clinicians must be aware of potential development of serotonin syndrome.

451 | Hypersensitive reaction to infliximab-abda (biosimilar to infliximab): Case report

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Introduction: Infliximab administration has been associated with infusion reactions e.g. anaphylaxis, dyspnea, and hypotension. Several biosimilars including infliximab-abda have been approved for similar indications as infliximab, and their use will likely increase in coming years. There are no prior published reports of hypersensitive reactions secondary to infliximab-abda.

Case: A 37-year-old white male presented to the emergency department (ED) from gastroenterology (GI) clinic with shortness of breath, urticaria, and tongue swelling 40 minutes after beginning an infusion of infliximab-abda. There were no other systemic symptoms. The patient has a past medical history significant for ileocolonic fistulizing Crohn's disease, depression, and gastroesophageal reflux disease. He was chronically taking budesonide, azathioprine, omeprazole, and sertraline. Upon arrival to the ED, his vitals were stable. All labs had no significant abnormalities except for a slightly below normal hemoglobin of 12.9 which is characteristic of the patient's baseline. Tongue swelling worsened and the patient was intubated for airway protection. He received supportive care treatment for angioedema with IV dexamethasone, IV diphenhydramine, and IV famotidine. He was extubated approximately 43 hours later and observed overnight in the medical intensive care unit after extubation. He was transferred to the floor the next day for further care.

Discussion: Infliximab biosimilars, including infliximab-abda, carry the same warnings regarding infusion reactions as the original infliximab molecule, however, this is the first case report on the adverse event of angioedema after treatment with a new infliximab biosimilar. The Naranjo Probability Scale indicated a probable reaction with a score of 6. The case was reported to the United States Food and Drug Administration's (FDA) MedWatch Program.

Conclusion: Providers should be aware of infusion reactions with infliximab biosimilars as early detection is critical for appropriate therapeutic intervention to prevent life-threatening situations. Implementation of pre-medications protocols should likely be considered for use of infliximab biosimilars.

452 | A case report of mesalamine-induced myocarditis

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Introduction: Mesalamine is a 5-aminosalicylic acid derivative approved for the treatment of inflammatory bowel disease. Rarely, cases of myocarditis and pericarditis has been reported with mesalamine and other 5-aminosalicylic acid derivatives. This report describes a case of probable mesalamine-induced myocarditis.

Case: A 24-year-old Caucasian female presented to the hospital with a chief compliant of chest pain for two days. Pertinent vitals on admission included a temperature of 102.6 degrees Fahrenheit and heart rate of 115 bpm. Past medical history included ulcerative colitis diagnosed 3 weeks prior. She denied recent sick contacts. Laboratory studies on arrival revealed leukocytosis (21,000 cells/mm^3), elevated erythrocyte sedimentation rate (83 mm/h), and elevated troponin of 3.18 ng/mL. An echocardiogram revealed a left ventricular ejection fraction (LVEF) of 40% with multiple wall motion abnormalities. The electrocardiogram on admission was significant only for sinus tachycardia. A diagnosis of myocarditis was made. Infectious diseases was consulted and several viral serologies were obtained which all returned negative. Home medications included mesalamine 2400 mg twice daily and prednisone 35 mg daily which were started 3 weeks prior. Mesalamine was discontinued on admission and prednisone was transitioned to methylprednisolone IV. A repeat echocardiogram on hospital day four revealed a normal LVEF of 55-60% and no wall motion abnormalities. Discharge medications included metoprolol tartrate 25 mg twice daily and prednisone 40 mg daily. Mesalamine was discontinued.

Discussion: Although rare, mesalamine should be considered as a cause in a patient with myocarditis. In this patient, the temporal relationship of mesalamine initiation and the extensive negative viral serologies make this case unique and further supports mesalamine as a cause of myocarditis. The Naranjo Adverse Drug Reaction Probability Scale indicated a probable reaction with a score of 7.

Conclusion: 5-aminosalicylic acid derivatives should be considered a potential cause in a patient presenting with myocarditis. Prompt discontinuation and evaluation of other etiologies should be considered.

453 | Neutropenic enterocolitis secondary to sulfasalazine in a woman with psoriatic arthritis: A case report

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Introduction: Neutropenic enterocolitis (NE) also known as typhlitis is a serious condition that has been described in immunosuppressed hosts including patients with leukemia, HIV and in patients on

chemotherapy. We present the first case of female on sulfasalazine for psoriatic arthritis, otherwise healthy, that was diagnosed with neutropenic enterocolitis involving the cecum and rectum. This adds up to the cases of NE diagnosed in non-oncologic conditions.

Case: A 65 year old female with history of psoriatic arthritis on sulfasalazine, presented to the ED after an episode of syncope. She was complaining of a fever and mild generalized abdominal pain. Physical exam was remarkable for peri-umbilical tenderness. Severe neutropenia and acute kidney injury were found on blood work. CT scan of abdomen showed evidence of colitis involving the cecum, ascending colon and rectum which in light of neutropenia, was consistent with NE. Infectious causes were ruled out. Intravenous fluids and broad spectrum antibiotics were initiated and sulfasalazine was discontinued. Patient was subsequently afebrile and was out of neutropenia by day 3 without the need for GM-CSF. By day 5, patient was pain free and was discharged.

Discussion: Even though NE is primarily described in the setting of malignancies and chemotherapy, one should keep in mind that this entity can occur in people on any immunosuppressive therapy. Early discontinuation of sulfasalazine and conservative management were essential in the treatment of NE in this case. Whether neutropenia precipitates colitis, or the latter causes agranulocytosis by bone marrow suppression through cytokines remains to be proved.

Conclusion: The diagnosis of medication-related adverse reactions remains a big challenge for clinicians and therefore requires a high index of suspicion. Resolution of the symptoms can simply occur with the discontinuation of the offending drug and often does not require extensive workup or treatments that might cause harm to the patient's health.

Ambulatory Care

454 | Desvenlafaxine-associated hyperglycemia: A case report and literature review

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Introduction: Desvenlafaxine is a potent selective serotonin and norepinephrine reuptake inhibitor used to treat depression and anxiety. Several antidepressants are associated with drug-induced hyperglycemia but currently there are no reports for desvenlafaxine.

Case: A 59-year-old female with type II diabetes being treated with metformin, insulin glargine, and dulaglutide presented to the clinic with an average fasting blood glucose (FBG) and 2-hour post-prandial blood glucose (PPBG) of 88 mg/dL (range: 62-109) and 165 mg/dL (range: 111-205), respectively. Additionally, she was being treated for depression and anxiety with venlafaxine; however, at this visit was switched to desvenlafaxine due to poor symptom control. One month after switching to desvenlafaxine, her average FBG and 2-hour PPBG increased by 30 mg/dL and 75 mg/dL, respectively. The patient reported adherence to medications and no changes in diet, exercise, weight or medications were made during this time. Over the course of three months, the diabetes medication regimen was intensified to maintain glucose control due to patient refusing alternative antidepressant therapy.

Discussion: Antidepressants have been associated with glucose dysregulation. A PubMed and MedWatch search was conducted and no reports of desvenlafaxine-induced hyperglycemia were found. The Naranjo algorithm resulted in a score of five indicating probable cause for the adverse drug reaction. Desvenlafaxine associated hyperglycemia supports current literature that antidepressants can cause glucose dysregulation. However, literature also demonstrates improved glycemic control in treated versus untreated depression. Practitioners should weigh risks and benefits when making treatment decisions.

Conclusion: The presented case provides support for probable desvenlafaxine induced hyperglycemia which is the first report of its kind. Antidepressants have shown glucose dysregulation and it is important to monitor blood glucose soon after initiation. If altered glucose levels are noted, all potential causative agents should be evaluated and risks and benefits weighed to guide therapy.

Cardiovascular

455 | Concomitant therapy with dronedarone significantly increases apixaban drug concentrations: A case series

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Introduction: In the ARSTOTLE atrial fibrillation trial median peak and trough apixaban levels were 123 and 79 ng/mL and 171 and 103 ng/mL, for the 2.5-mg and 5-mg BID cohorts, respectively. The US prescribing information does not recommend apixaban dose adjustments when co-administered with dronedarone. The 2018 European guide for DOAC use grades the dronedarone-apixaban interaction as “yellow”, “consider dose adjustment or different NOAC if 2 or more yellow factors are present”. Of note, when discussing ketoconazole, a strong P-gp and CYP3A4 inhibitor that increases apixaban Cmax and AUC, by about 70% and 100%, respectively, the US recommendation is a 50% apixaban dose reduction, while the European guide grades the interaction as “red”, “contraindicated/not recommended”.

Case: Both of our atrial fibrillation-flutter patients treated with dronedarone and apixaban had levels drawn because of this potential drug-drug interaction (Table).

PT	AGE (yrs)	DOSE (mg)	WEIGHT (lbs)	BMI	CREATININE (mg/dl)	CrCl (mL/min)	LEVEL TIMING (hrs)	APIXABAN LEVEL (ng/mL)
1	64	5-BID	247	31.7	1.2	**98.5**	**11.5**	**196.2**
		2.5-BID	247	31.7	1.2	**98.5**	**13**	**88.3**
2	73	5-BID	171	29.3	1.2	**60**	**2**	**352.5**
		5-BID	171	29.3	1.2	**60**	**13**	**154.7**

Levels were **significantly above** the median ARISTOTLE levels resulting in a dose reduction in both patients.

Discussion: Data from clinical trials has shown that apixaban exposure may vary significantly among individual patients taking the same dose. Pharmacokinetic data is not available for the apixaban-dronedarone interaction, but effects on apixaban levels can be anticipated based on dronedarone's strong P-gp and moderate CYP3A4 inhibition.

Conclusion: Our cases suggest that apixaban overexposure occurs commonly in patients treated concomitantly with apixaban and dronedarone. This has reinforced our approach to monitor apixaban levels in these patients.

Critical Care

456 | Major bleeding secondary to heparin thromboprophylaxis in neurocritically ill underweight patients: A case series

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Introduction: Professional guidelines recommend pharmacological thromboprophylaxis in neurocritically ill patients who are high-risk for venous thromboembolisms (VTE). Monitoring and dosing recommendations for underweight patients do not exist; however, this population may be at higher risk for complications. We present three cases of major hemorrhage in underweight patients secondary to unfractionated heparin (UFH) prophylaxis to demonstrate the need for further monitoring.

Case: A 76-year-old underweight (44 kg) female with past medical history of recent intracranial hemorrhage was transferred from inpatient rehabilitation with worsening aphasia. Imaging revealed acute on chronic subdural hematoma. On admission, aPTT and anti-Xa factors were elevated secondary to UFH prophylaxis at the rehabilitation center. After UFH discontinuation, aPTT levels normalized within 24 hours and the patient was discharged safely. A 56-year-old underweight (33 kg) female recovering from subarachnoid hemorrhage was transferred from inpatient rehabilitation following cardiac arrest. Labs revealed a hemoglobin drop of 4 g/dL within 6 hours and prolonged aPTT secondary to UFH prophylaxis. Imaging revealed large rectus sheath hematoma and the patient expired secondary to hemorrhagic complications. A 29-year-old underweight (29 kg) male with history of rhabdomyosarcoma of the brain was transferred to the ICU for management of a brain abscess. Following craniotomy, patient was placed on UFH. He later developed bleeding at his tracheostomy site with prolonged aPTT and imaging revealed intraventricular hemorrhage. He expired shortly afterwards.

Discussion: Recent studies indicate that underweight individuals do not receive reduced-dose UFH in the ICU setting. All three patients in this series received UFH at high weight-based doses (>300 units/kg/day) and all had acute neurologic abnormalities. These factors could potentially serve as signals for pharmacists to initiate laboratory monitoring or recommend dose reduction.

Conclusion: Neurocritically ill underweight patients may require pharmacodynamic monitoring and reduced UFH doses for thromboprophylaxis. Larger studies can assist in elucidating risk factors for bleeding.

457 | A case report of suspected dexmedetomidine-induced fever in the surgical intensive care unit

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Introduction: Fever from dexmedetomidine exposure in critically ill adults is infrequently reported in the literature and may lead to invasive, costly interventions, including infectious work-up and medical management, especially with increasing global dexmedetomidine use. We describe a case of dexmedetomidine-associated fever concordant with previous reports, which should serve as a catalyst for further research.

Case: A 64-year-old woman with a history of alcoholic cirrhosis was admitted to the surgical ICU for hepatic encephalopathy, complicated by respiratory failure requiring intubation, septic shock, aspiration pneumonia, pancreatitis, acute kidney injury, and GI bleed. Dexmedetomidine was started at 0.1 mcg/kg/hr for agitation, and up-

titrated to a maximum of 0.9 mcg/kg/hr by Day 3. The patient was initially afebrile, but her temperature steadily rose to a maximum of 38.9°C by day 2. New cultures were unrevealing, and she received external cooling measures. She remained persistently febrile on dexmedetomidine, without other evidence of infection. Drug fever was suspected, and dexmedetomidine was stopped on day 4, with fever resolution within a few hours. A possible dexmedetomidine-induced fever was documented in her chart.

Discussion: Similar to our case report, dexmedetomidine-induced fevers are usually persistent, resistant to medical management, and occur and resolve rapidly. They may be dose-dependent and recur upon re-challenge. Lack of recognition may lead to prolonged use of antimicrobials/antimicrobial resistance, increased imaging, cultures or line changes, and increased length of stay and nosocomial infections. Our team recognized the possibility of drug fever and provided minimal infectious work-up (new cultures were ordered) and supportive interventions (external cooling). There may be an association between dexmedetomidine use and prevalence and severity of fever. Further research would help to characterize mechanisms, precipitating factors, association with patient harm and resource utilization, and inform clinical decision making.

Conclusion: Dexmedetomidine-induced fever is a clinical possibility, and prompt recognition and discontinuation may prevent increased interventions and resource utilization.

458 | Administration of andexanet alfa for gastrointestinal hemorrhage in Jehovah's Witnesses patient

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Introduction: Life-threatening hemorrhage in patients receiving factor Xa inhibitors was previously treated with prothrombin complex concentrate, transfusions, or other supportive care. Andexanet alfa, approved 2018, is a non-factor containing reversal agent for rivaroxaban and apixaban.

Case: A 77 year-old male with congestive heart failure, hyperlipidemia, hypertension, systemic lupus erythematosus, and end-stage renal disease on hemodialysis presented with hemoglobin of 6.5 g/dL (baseline hemoglobin 11 g/dL) secondary to gastrointestinal hemorrhage. Apixaban was initiated 1 week prior to the admission for newly diagnosed atrial fibrillation. The patient was pale, tachycardic, and had a blood pressure of 135/58 mmHg. Fluids and proton pump inhibitors were initiated immediately; however, repeat hemoglobin after 6 hours was 5.2 g/dL, and blood pressure declined to 98/49 mmHg. The patient was a Jehovah's witness and refused to receive blood transfusions despite the life-threatening hemorrhage. Alternatives to andexanet alfa, recombinant factor VIIa and 4-factor prothrombin complex concentrate were declined by the physician and patient respectively. Andexanet alfa 400 mg bolus and 480 mg infusion were administered to reverse apixaban. Esophagoduodenoscopy showed many gastric polyps and small duodenum arteriovenous malformation, which was successfully treated with endoscopic clipping. Patient achieved hemostasis maintained stable hemodynamics, and, was transferred out of the intensive care unit on day 3 of hospitalization.

Discussion: Utilization of andexanet alfa for this case is potentially controversial. It is difficult to determine if the gastrointestinal hemorrhage alone represented life-threatening hemorrhage clinically or if the inability to administer blood products created a life threatening hemorrhage. One potential alternative to andexanet alfa, for institutions without the product, is recombinant factor VIIa.

Conclusion: A potential indication for use of andexenet alfa is a patient who will not consent to blood products with life-threatening hemorrhage with rivaroxaban or apixaban.

459 | A case report of extravasation injury from nicardipine and levetiracetam following administration of systemic alteplase

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Introduction: When health care providers evaluate extravasation injury following IV site infiltration, only medications directly administered at the site of infiltration are assessed. Implications of concomitant systemic therapies should be considered.

Case: An 88 year old male presented from an outside facility with seizure like episode followed by incomprehensible speech. Medical history included hypertension, diabetes, coronary artery disease and leg amputation, with no history of stroke or seizure. Ultrasound guided placement of bilateral antecubital fossa catheters was obtained by a physician. Alteplase was administered through the left antecubital fossa for presumed ischemic stroke with no contradictions to therapy. Blood pressure elevated and nicardipine was initiated through the right antecubital fossa for 37 minutes and discontinued. Levetiracetam was subsequently administered in the right IV line for prevention of additional seizure activity. The patient complained of pain at the right IV site and the line was removed. The next morning the ICU nurse documented the prior right IV site area to be hard, warm, edematous, and painful to touch. Within 72 hours the site began to develop injury requiring burn surgery consultation. Physical exam noted 1% TBSA injury, multiple skin tears, large hematoma, and intact blistering. The blister was lanced and wound care follow up was performed. A subsequent inpatient admission within 30 days for unrelated complications did not document any debilitating injury or complications to the right arm.

Discussion: Despite limited guidance on management of extravasation injuries, the potential mechanisms of injury in this case include the acidic pH of nicardipine, osmolality of levetiracetam, and bleeding from administration of alteplase. Prompt identification and

management of extravasation injury following alteplase infusion is critical in order to minimize complications.

Conclusion: Contaminant systemic therapies, such as alteplase, may pose additional extravasation injury risk during medication infiltration.

460 | Angiotensin II use in patients with septic shock and chronic liver dysfunction: A case series

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Introduction: Angiotensin II (AT2) is a novel vasopressor approved for the treatment of septic shock (SS) based on the ATHOS-3 trial which showed a significant increase of mean arterial pressure (MAP) response at 3 hours compared to placebo. Patients in the AT2 group experienced venous thromboembolism (VTE) at a higher rate than placebo. Patients with liver failure were excluded from ATHOS-3 and thus rates of VTE with AT2 in liver disease are unknown.

Case: Six patients with liver failure were treated with AT2 for SS. Of these only one was initiated on VTE prophylaxis during treatment with AT2. The primary reason for holding prophylaxis was thrombocytopenia. Use of AT2 resulted in a median increase in MAP of 9.5 mmHg and a decrease in pressor requirements of 0.12 mcg/kg/min of norepinephrine equivalents. Only three patients experienced MAP increases of 10 mmHg or greater and four had decreased vasopressor requirements. One patient did develop a VTE six days after the discontinuation of AT2. This patient was not initiated on VTE prophylaxis. Overall mortality was 100 percent.

Discussion: There is a dearth of literature regarding populations excluded from ATHOS-3, including those with liver failure. Compared to the ATHOS-3 population with 69.9% efficacy, this group only experienced 50% efficacy of a MAP increase at 3 hours and a decrease in vasopressor requirements only occurred in 66% of patients. In a patient population who are at an increased risk of VTE, the inability to initiate VTE prophylaxis also poses a concern and resulted in one patient experiencing this adverse event.

Conclusion: Risks versus benefits of AT2 should be weighed closely due to the limited efficacy and increased risk of VTE in patients experiencing septic shock with liver failure. Future studies should include patient populations not studied by ATHOS-3 to provide a pragmatic experience to guide use in these populations.

461 | Case report of adjunctive dexmedetomidine for control of methamphetamine-induced hypertension

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Introduction: Management of cardiovascular complications from methamphetamine toxicity begins with reduction in catecholamine release using intravenous (IV) benzodiazepines. Severe hypertension warrants addition of nitroprusside. Hypertension refractory to aggressive treatment is relatively uncommon but can pose a barrier to discharging such patients from the intensive care unit (ICU). Cumulative doses of benzodiazepines can lead to increased length of stay and ICU-related complications. Dexmedetomidine, an alpha-2 receptor agonist, has been used in a variety of toxicities involving sympathetic overdrive. However, evidence supporting our off-label use of dexmedetomidine in the ICU is insufficient.

Case: A 40-year old male with a history of IV drug abuse was admitted from the emergency department (ED) to the ICU with acute methamphetamine toxicity and hypertensive emergency. Urine toxicology screen was positive for methamphetamines and cannabinoids. Blood alcohol was undetectable. The patient received several repeat bolus doses of 0.5-2 mg IV lorazepam in the ED. An infusion of lorazepam 2 mg/h was initiated upon arrival to the ICU. His blood pressure rebounded after attempted dose reductions. Nitroprusside at a fixed-dose of 0.2 mcg/kg/min was added on day 2, and stopped on day 3. Dexmedetomidine 0.2-0.7 mcg/kg/h was started on day 3. With the initiation of dexmedetomidine, the change in lorazepam requirements occurred at 1 h with a 1 mg/h dose reduction and both agents were successfully weaned off after 9 h. Cumulative lorazepam dose was 49 mg over 3 days. The total length of ICU stay was 5 days. No adverse outcomes were documented.

Discussion: Our case demonstrates dexmedetomidine was safe and effective in reducing blood pressure and weaning off benzodiazepines in acute methamphetamine toxicity. Cases reports in the literature describe dexmedetomidine use for agitation in the ED. Limitations include retrospective observational study. Prospective controlled trials in the ICU are warranted.

Conclusion: Dexmedetomidine appears to be successful as adjunct for methamphetamine-induced hypertension.

Emergency Medicine

462 | A therapeutic approach utilizing double bolus dose thrombolytic therapy in cardiac arrest secondary to massive pulmonary embolism: A case report

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Introduction: Despite massive pulmonary embolism (PE) accounting for 8-13% of unexplained cardiac arrests, the current literature does not demonstrate survival benefit from the administration of thrombolytics in undifferentiated cardiac arrest. We describe a patient case

showing survival benefit and preserved neurologic outcomes after receiving double bolus dose thrombolytic therapy in the setting of a suspected, massive PE.

Case: A 54 year-old male presented to the emergency department (ED) complaining of nausea, vomiting and dyspnea. The patient's vital signs included: blood pressure 81/68 mmHg, respiratory rate 30, and pulse 108. The patient's oxygen saturation was 82%, and he appeared diaphoretic and ashen. Arterial blood gas included: pH 6.95, PCO_2 51, PO_2 67, HCO_3 11. Bedside ultrasound identified an under-filled left ventricle, dilated right-sided chambers and D-sign. These findings yielded a high suspicion for massive PE, and the decision was made to administer intravenous (IV) thrombolytic therapy. During alteplase preparation, the patient became pulseless and the ACLS algorithm was initiated. Alteplase 50 mg was administered as a bolus and return of spontaneous circulation (ROSC) was achieved within two minutes. The remaining 50 mg of alteplase was started as an IV infusion over 60 minutes. Nine minutes post-ROSC the patient became pulseless again, and the remaining alteplase infusion was administered as a second IV bolus, and ROSC was obtained.

Discussion: Currently, the optimal dosing of thrombolytics for the treatment of cardiac arrest secondary to massive PE is unknown. A recent case report described a successful outcome with a second 50 mg bolus dose of alteplase in an arresting patient with persistent hemodynamic compromise. Extrapolating from the available literature, our patient was successfully treated with double bolus dose thrombolytic therapy, further supporting this unique treatment modality.

Conclusion: It is reasonable to administer a second thrombolytic bolus dose to patients who rearrest or remain in prolonged active cardiac arrest.

Family Medicine

463 | Case report of Wernicke's encephalopathy causing secondary adrenal Insufficiency following Sleeve Gastrectomy

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Introduction: Wernicke's encephalopathy (WE) is an acute neuropsychiatric syndrome resulting from thiamine deficiency and is a potential complication following bariatric surgery. Here we report a confirmed case of WE following sleeve gastrectomy with resulting secondary adrenal insufficiency, likely due to WE induced neuronal damage.

Case: A 56-year-old male with a past medical history of morbid obesity, s/p sleeve gastrectomy, hypertension, and coronary artery disease presented with dizziness, visual disturbance and sudden-onset headache for two weeks. The patient attested to nonadherence with vitamin therapy following bariatric surgery five months prior. He was diagnosed with WE, based on history, symptoms and MRI findings. He was initiated on thiamine treatment of 500 mg IV TID. The patient was persistently hypotensive on admission despite holding home antihypertensives and was found to have positive orthostatics. Tests revealed a low AM cortisol (3.1 mcg/dL) and low ACTH (4.6 pg/mL) and an appropriate response to cosyntropin stimulation at 30 and 60 minutes. He was diagnosed with secondary adrenal insufficiency and initiated on oral hydrocortisone 20 mg at 6 am and 10 mg at 6 pm. Significant improvement in neurological symptoms were noted 3 days following treatment with thiamine and hydrocortisone and the patient was discharged 17 days following admission on thiamine 100 mg po daily and hydrocortisone 20 mg po BID.

Discussion: Wernicke's encephalopathy following Roux-en-Y gastric bypass is well reported, but there is a paucity of reports following sleeve gastrectomy. This case demonstrates the importance of adherence with vitamin supplementation, and the potential risks for secondary adrenal insufficiency in severe WE.

Conclusion: Clinicians should be aware of the risks of Wernicke's encephalopathy and the potential for secondary adrenal insufficiency in patients s/p sleeve gastrectomy.

464 | Case report of granulomatosis with polyangiitis following tick bite

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Introduction: Granulomatosis with polyangiitis (GPA) is a rare idiopathic, inflammatory disease characterized by vasculitis and granulomas in multiple organ systems. As one of the only cases in literature that describes worsening of vasculitis following a tick bite, this case highlights the importance of this correlation.

Case: 57 y/o male with a past medical history significant for bilateral eye redness/dryness and photophobia for one year was admitted to the hospital for symptoms concerning for systemic vasculitis versus sepsis. Eight weeks prior to admission the patient sustained tick bites in Pennsylvania and subsequently developed significant fatigue, polyarthralgias, bilateral hearing loss, worsening photophobia and neuropathic pain and received treatment for a tick born illness with 21 days of doxycycline. Noted to have biapical mass like lung densities concerning for sarcoidosis, and an eye exam revealed scleritis, he was referred to pulmonology for further work up. Despite completing the doxycycline course his symptoms worsened and his primary care provider diagnosed him with bilateral ruptured tympanic membranes and prescribed a 14 day course of amoxicillin. Pertinent findings while

inpatient are as follows: RMSF IGG +, ESR and CRP significantly elevated, cANCA and antiproteinase 3 antibodies +, 1.8 cm nasopharyngeal mass on MRI and bronchoscopy revealed necrotizing granulomas. The patient was diagnosed with GPA and initiated on high dose IV methylprednisolone followed by 60 mg oral prednisone, with rheumatology follow up and plans for rituximab IV. Ophthalmic prednisone, brimonidine and timolol eye drops were initiated inpatient and continued upon discharge to treat uveitis/scleritis.

Discussion: There are limited data on rickettsial infection triggering an exacerbation of a previously mild vasculitis. Multi-organ symptoms following rickettsial infections may warrant evaluation for vasculitis.

Conclusion: Further research is warranted on the connection between tick born illnesses and their relationship to systemic vasculitis.

Gastroenterology

465 | Successful treatment of steroid-refractory ulcerative colitis using an accelerated infliximab induction regimen: A case report

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Introduction: Conventional infliximab dosing for steroid-refractory ulcerative colitis (UC) has demonstrated efficacy using a three-dose induction regimen of 5 mg/kg at day 0, 2 weeks, and 6 weeks. However, some patients may fail infliximab and still require a colectomy within 5 years. Studies have shown an intensified infliximab induction regimen may reduce colectomy rates after acute episodes of severe UC, although the optimal regimen has yet to be elucidated. We present a case in which a patient with acute severe UC avoided colectomy using an accelerated infliximab regimen over three days.

Case: A 28-year-old female with a history of UC refractory to mesalamine and adalimumab presented with hematochezia, weight loss, and anemia with a hemoglobin of 5 g/dL. Despite treatment with intravenous methylprednisolone daily she was under consideration for colectomy. Intravenous infliximab 10 mg/kg was administered on day 5 and 8 of hospitalization. The patient showed improvement in her symptoms with an increase in hemoglobin from 8.0 g/dL hospital day 5 to 11.3 g/dL on hospital day 11 without further transfusions or interventional procedures. She was discharged hospital day 11 without any complications.

Discussion: Published literature comparing the benefits of accelerated versus conventional infliximab regimens are conflicting, suggesting that accelerated infliximab regimens may only be beneficial for a subgroup of patients. While selection criteria differ, many have proposed using a CRP/albumin ratio > 1 to determine who may benefit from an intensified infliximab induction regimen, which our patient met. Since discharge, our patient has maintained disease remission on infliximab 10 mg/kg every 6 weeks.

Conclusion: An accelerated infliximab dosing regimen over 3 days can be considered when conventional therapies fail for acute severe UC. Prospective trials are needed to identify which patient populations would benefit from an accelerated infliximab regimen for this disease.

Geriatrics

466 | Late onset dystonia with low dose olanzapine in an older adult: A Case Report

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Introduction: Drug induced dystonic reactions typically occur with conventional neuroleptics soon after initiation or dose increase. Although rare, dystonias can occur with second-generation antipsychotics within hours to weeks of exposure to the offending agent. Our patient developed dystonia after 2 years of olanzapine use.

Case: 71 year-old female with moderate dementia presented with altered mental status and fever. Her physical exam was notable for a clenched jaw, stiff neck, tremors and facial droop. Admission labs, CT head and brain MRI were unremarkable. Home medication included olanzapine 5 mg daily for 2 years for behavioral symptoms. Olanzapine was discontinued and she received one dose of IV diphenhydramine 25 mg. Over the next two days, symptoms improved however, she became delirious. She received 2 doses of lorazepam IV for her behavioral agitation and dystonic symptoms. On day 8, the patient developed intermittent tremors, mouth clenching and rigidity which self-resolved. The dystonia resolved 11 days after admission. The patient was discharged without antipsychotics.

Discussion: To our knowledge this is the first case describing dystonia after chronic use of low dose olanzapine. EPS induced by olanzapine is rare and usually dose related. Her symptoms resolved but recurred intermittently during the hospitalization. This case illustrates the difficulty of using anticholinergics to treat dystonias in older adults, which can precipitate delirium. Use of the Naranjo Adverse Drug Reaction Probability scale (7) demonstrated a probable relationship between olanzapine and dystonias. Choosing an alternative antipsychotic with less EPS risk is challenging as she had previous trials with quetiapine and risperidone. Clozapine was deemed an unfavorable alternative as laboratory monitoring would be burdensome.

Conclusion: Although uncommon, olanzapine induced dystonias can develop anytime during therapy. Families must balance the desire for mood stabilization with antipsychotics side effects.

Hematology/Anticoagulation

467 | The use of apixaban in Paget-Schroetter syndrome: A case report

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Introduction: Paget-Schroetter syndrome (PSS) is characterized by compression and thrombosis of the subclavian vein. PSS is rare and typically develops in young, healthy, males subjected to repetitive overhead motions. Treatment of PSS differs from other types of deep vein thrombosis (DVT), as anticoagulation alone is not preferred. Although not specific to PSS, current guidelines for the treatment of venous thromboembolism (VTE) recommend direct oral anticoagulants, such as apixaban, as first line therapy. Robust data are lacking on the use of apixaban in upper extremity deep vein thrombosis (UEDVT), particularly in pediatric patients with PSS.
Case: A 17-year old, male, baseball player, presented with swelling and "tightness" of the left arm. Ultrasound revealed an occlusive thrombus of the left subclavian vein with further imaging confirming PSS. Anticoagulation was initiated with intravenous heparin and warfarin. On day 2, the patient was discharged with apixaban 10 mg twice daily for 7 days, followed by 5 mg twice daily. One week later, he underwent catheter-directed thrombectomy; followed by thoracic outlet decompression with resection of the first rib. Apixaban continued after the procedure.
Discussion: Despite apixaban's FDA-approval for the treatment of VTE, supporting evidence did not include patients with UEDVT. The use of apixaban in PSS is described in one case report involving a 30-year old female with a new UEDVT during 3-month follow-up. Questions surrounding the use of apixaban for UEDVT treatment in adults is currently being evaluated. This case uniquely describes the use of apixaban in a pediatric patient with PSS. Dosing and duration of anticoagulation used is consistent with adult VTE literature.
Conclusion: A pediatric patient with PSS was successfully treated with apixaban in conjunction with surgical management. Continued research is needed to support the use of apixaban in pediatric patients with UEDVT, including PSS.

Infectious Diseases

468 | Case reports of vasomotor symptoms associated with prolonged courses of ceftriaxone

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Introduction: Ceftriaxone is a commonly used antimicrobial for infections that require extended courses of treatment. These case reports describe a potentially under-reported adverse effect in patients who received prolonged courses of ceftriaxone.
Case: Patient 1 was a 53 year-old female diagnosed with a perihepatic abscess who received ceftriaxone for the last 4 weeks of an 8 week antimicrobial course. During a clinic visit she mentioned having 1-2 "hot flashes and sweats" a day. She did not take her temperature when these events occurred and had a normal temperature in clinic. She was also receiving oral metronidazole. She reported having a total hysterectomy several years prior. She finished her course of ceftriaxone and 5 days later, in medical record notes, she confirmed that her hot flashes and sweats had tapered off.
Patient 2 was a 68 year-old female treated with vancomycin (infused in the morning) and ceftriaxone (infused in the evening) for meningitis and cervical spine infection. During a clinic visit she mentioned night sweats. She did not take her temperature when these events occurred, and had a normal temperature in clinic. She was changed to ertapenem and noted during her follow-up visit that the night sweats stopped after the second day of ertapenem. No other medication changes were made at that time.
Discussion: In tertiary sources, ceftriaxone-associated diaphoresis is listed as a very uncommon occurrence, with rates less than 1%. There are also no published case reports on ceftriaxone-associated diaphoresis or vasomotor symptoms. For both patient cases the Naranjo adverse drug reaction score was 6, which indicates a probable association. In both cases, removal of ceftriaxone decreased the vasomotor symptoms that the patients were experiencing.
Conclusion: Patients who experience new vasomotor symptoms while on ceftriaxone should be evaluated for a possible association, and consideration of alternative agents.

469 | Micafungin resistance to *Candida albicans* in a non-immunocompromised host: A case report

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Introduction: Echinocandins have reliable activity against *Candida albicans* and are recommended as initial therapy for candidemia in nonneutropenic patients. We present a non-immunocompromised patient who developed micafungin resistance to *C. albicans*, while maintaining susceptibility to azole antifungals. This resistance is an unexpected finding, and we present theories which may explain its development in this patient. Our case highlights the need for further investigation of appropriate micafungin dosing in select patients.
Case: We report a 62-year-old critically-ill obese Caucasian male weighing 144 kg who presented for a scheduled left heart catheterization. After experiencing cardiac complications prompting an emergent coronary artery bypass graft, the patient became febrile on post-

operative day 1. Vancomycin and piperacillin-tazobactam were started for suspicion of a bacterial infection, and micafungin 100 mg IV daily was started on post-operative day 10. Blood cultures drawn on post-operative day 21 were positive for budding yeast, despite micafungin treatment. The yeast was identified as *C. albicans*, and susceptibility testing showed sensitivity to fluconazole but resistance to micafungin.

Discussion: We speculate that this obese patient (BMI = 48 kg/m^2) developed micafungin resistance due to a suboptimal dosing regimen, leading to reduced systemic exposure. Although we did not obtain confirmatory blood concentrations, this theory is supported by growing literature suggesting that standard 100 mg daily micafungin leads to inadequate concentrations in obese patients. We hypothesize that obese patients who receive the standard micafungin 100 mg daily will have reduced systemic exposure, which may lead to worse outcomes, compared to non-obese patients receiving this same dose.

Conclusion: This obese patient developed fungemia caused by echinocandin-resistant *C. albicans* after appropriate empiric treatment with micafungin. Increasing evidence suggests that standard micafungin doses do not achieve adequate systemic concentrations in obese patients. Therefore, we suspect that this patient received a sub-therapeutic micafungin dose that may have resulted in *Candida albicans* resistance.

470 | Emergence of brucellosis in South Georgia, U.S.: A case series

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Introduction: While uncommon in the U.S., approximately 100 cases of brucellosis are reported each year according to the Centers for Disease Control and Prevention. Brucellosis remains underreported due to difficulties in diagnosis. This case series aims to describe the epidemiology and clinical manifestations of brucellosis case in South Georgia.

Case: Five patients who were diagnosed with brucellosis from regional hospitals between 2016 and 2018 were included. All patients were male whose ages ranged from 31 to 76 years presented with an undifferentiated febrile illness. In each case, brucellosis was diagnosed by isolating *Brucella suis* from blood cultures. Contact with wild pigs while hunting and exposure at a slaughterhouse were the likely modes of transmission for three patients. Complications included transaminitis, splenic abscesses and infarcts, as well as suspected implantable cardioverter-defibrillator infection. Most commonly, doxycycline was administered with gentamicin while inpatient. One patient experienced an acute kidney injury due to gentamicin. All were discharged on doxycycline-containing regimens for an extended duration.

Discussion: Brucellosis remains as an underdiagnosed illness due to nonspecific clinical presentation. As a result, it is crucial for clinicians to obtain a detailed medical history in order to identify potential risk factors. While most cases of brucellosis result from consuming contaminated dairy products, the majority of patients in our case series acquired *B. suis* through direct contact with infected pigs. Raising awareness of brucellosis in areas with prevalent wild animal exposure or occupational risk is critical to reduce the incidence of brucellosis.

Conclusion: Brucellosis is often a consideration in the differential diagnosis of patients of all age groups presenting with an undifferentiated febrile illness in returning travelers from endemic countries. Nevertheless, as this case series illustrates, brucellosis is an emerging infectious disease in the Southeast U.S. among those with a history of wild animal exposure or as an occupational risk.

471 | High-dose daptomycin in ESRD as part of triple antibiotic therapy in a patient with persistent methicillin-resistant Staphylococcus aureus (MRSA) bacteremia: Case report

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Introduction: Infectious Disease Society of America (IDSA) MRSA guidelines recommend vancomycin or daptomycin as fist-line treatment. Clinicians are faced with a therapeutic dilemma when faced with persistent bacteremia. There has been limited evidence evaluating high-dose daptomycin in MRSA infections, and less evidence in patients on dialysis. Additionally, there has been little to no literature regarding triple therapy consisting of gentamicin, ceftaroline, and daptomycin.

Case: A 51-year old male presented to the ED for bilateral lower extremity weakness. Pertinent past medical history included ESRD on hemodialysis (HD), lung nodules, and recanalization of occluded brachiocephalic vein with stent-graft and stent placement one month prior to admission. In the ED blood cultures were obtained which were positive for MRSA, and vancomycin was initiated. Sensitivities resulted on day 3 with a vancomycin MIC of 2 mcg/mL. Vancomycin was changed to standard-dose daptomycin (8/8/12 mg/kg after HD). Despite this, cultures remained positive. On day 6 linezolid was added for potential pulmonary source. On day 8 linezolid was changed to ceftaroline. On day 11 daptomycin was increased to high-dose (12 mg/kg post each HD). On day 14 gentamicin was added. Daily blood cultures were drawn, and the first negative culture resulted from day 15 while being treated with high-dose daptomycin, ceftaroline and gentamicin. Despite an exhaustive evaluation, no definitive source of infection was identified. CPK levels remained normal while on therapy.

Discussion: There is little literature on the safety and efficacy of daptomycin 12 mg/kg in ESRD on HD. This case demonstrates that high-dose daptomycin may be safe to use in dialysis patients. Additionally, it shows that ceftaroline, high-dose daptomycin, and gentamicin were effective in clearing a persistent bacteremia despite guideline directed and typical salvage therapy.

Conclusion: High-dose daptomycin, ceftaroline and gentamicin were safely and successfully used to clear a persistent MRSA bacteremia in a patient on dialysis.

472 | Case report: Prolonged vancomycin-induced immune thrombocytopenia in an orthopedic patient

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Introduction: Vancomycin-induced immune thrombocytopenia (VIIT) is rare. After vancomycin discontinuation, platelet counts return to over 150,000/μL within 7 days.[1] We describe a case of prolonged thrombocytopenia after shoulder arthroplasty with vancomycin impregnated antibiotic beads and cement.

Case: A 64-year-old male with an infected right shoulder arthroplasty was admitted for revision and explantation of the hardware and placement of a cement spacer/beads impregnated with tobramycin 2.4 g and vancomycin 4 g. Vancomycin IV was started postoperatively (creatinine clearance of 73 mL/min). Platelet count was 197/μL on day 0 and decreased to 37/μL on day 2 and vancomycin/enoxaparin was discontinued. Heparin induced thrombocytopenia was low probability. Day 3, platelet count dropped to 7/μL. Random vancomycin levels day 3 and 4 were 7.1 and 4.7 mcg/mL. A day 3 platelet transfusion failed and IVIG was given on day 3 and 4. Random vancomycin level on day 16 was <4.0 mcg/mL. Platelets increased to 121 K/μL by day 23. There were no episodes of bleeding or other complications. Drug-dependent platelet antibiotic returned positive for IgG supporting the diagnosis of VIIT.

Table 1. Timeline

Day	0	1	2	3	4	5	6	7	8	16	23
Platelet count / μL	197	192	37	7	13	41	70	78	81	58	121

Discussion: VIIT improves quickly with vancomycin discontinuation. Case reports have reported typical platelet recovery within 5-7 days with a mean of 7.2 days (4.0-17.0).[1,2] Persistent thrombocytopenia occurred in 3 patients with impaired renal function.[1] Our patient had normal renal function. Vancomycin impregnated antibiotic beads release vancomycin into the local joint and become undetectable within weeks to months.[3] This may have been the cause of the prolonged thrombocytopenia.

Conclusion: VIIT resolves when blood concentrations are undetectable. This case is unique as it shows how the placement of vancomycin cement and beads cause extended vancomycin exposure resulting in prolonged thrombocytopenia.

473 | Vancomycin-induced immune hemolytic anemia: A case report

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Introduction: Drug-induced immune hemolytic anemia (DIIHA) is a rare, potentially life-threatening complication of drug treatment characterized by abrupt hemolysis. Cephalosporins are commonly associated with DIIHA, yet associations with other antimicrobials are rare. Herein, we describe a case of vancomycin-induced DIIHA.

Case: A 65-year-old male with a history of left knee septic arthritis and osteomyelitis requiring a total knee replacement and revisions developed knee pain and fevers. He was on treatment with cefepime for *Enterobacter cloacae* prosthetic knee infection. On day 1, vancomycin was initiated empirically. On day 6, a hemoglobin of 7.1 g/dL prompted blood transfusion. Due to suspicion of cefepime causing hemolysis, therapy was modified to ertapenem. Vancomycin was discontinued on day 5. On day 12, a vancomycin spacer was placed and on day 14, patient required blood transfusion. Deep tissue cultures showed *Staphylococcus epidermidis* and vancomycin was reinitiated on day 15. The patient again developed reducing hemoglobin levels requiring 3 additional transfusions. Given ongoing anemia with no identified cause, vancomycin was discontinued on day 34 and the patient was treated with daptomycin. An extensive hematology evaluation revealed reticulocytosis and macrocytic erythrocytes consistent with a diagnosis of DIIHA. Agglutination studies demonstrated formation of an antibody to vancomycin.

Discussion: Identification of the cause of hemolytic anemia in complex cases involving surgery, infection, and multiple medications is challenging. As cefepime was initially suspected due to its association with DIIHA, further use of vancomycin resulted in recurrent hemolysis which demonstrated it as the causative agent along with anti-vancomycin antibody confirmation. Antibodies for vancomycin should be obtained in cases of DIIHA in the setting of vancomycin. This is the third reported case of DIIHA associated with anti-vancomycin.

Conclusion: Many antimicrobials have been associated with DIIHA. Vancomycin should be considered in the differential of causative agents in patients with hemolytic anemia without another clear cause.

Neurology

474 | A case of Stevens Johnson syndrome induced by lacosamide

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Introduction: Antiepileptic drugs (AEDs) are associated with several hypersensitivity reactions, reported in up to 16% of xchkpatients. These are usually mild and transient cutaneous reactions, although Stevens Johnson Syndrome (SJS) and toxic epidermal necrolysis (TEN) are reported. There is only one case report of SJS/TEN associated with lacosamide administration.

Case: This is a 75-year-old African American woman who initially presented for akathisia complicated by worsening altered mental status (AMS) due to an acute stroke. Hospital course was further complicated by status epilepticus (SE) for which she was initiated on levetiracetam and discharged on valproic acid (VPA) per neurology recommendations. She returned three weeks post-discharge with AMS, fever, and hypoglycemia, required intubation for airway protection, and was noted to be in refractory SE for which she was re-loaded on VPA and levetiracetam followed by lacosamide, topiramate, and a midazolam infusion for burst suppression. Two weeks later, she developed a blistering, sloughing rash and all AEDs were discontinued. After 10 days, she was again noted to be in SE for which VPA, levetiracetam, topiramate and a midazolam infusion were reinitiated. The rash remained stable throughout her remaining hospital course, and care was withdrawn 11 days later.

Discussion: SJS/TEN is a rare medication complication, and AED use is the most commonly reported cause. The vast majority of incidents are associated with AEDs containing an aromatic ring, with the exception of VPA. Lacosamide is a functionalized amino acid containing one aromatic ring and, although there is a warning for drug reaction with eosinophilia and systemic symptoms (DRESS), there has only been one published case report of SJS/TEN with lacosamide use. Due to timing, lack of eosinophilia, and reintroduction of VPA and levetiracetam without reaction, lacosamide is the most likely cause.

Conclusion: This is the second case report of possible SJS from lacosamide.

Other

475 | Case report of assessed co-morbidities and complications 2 years after bariatric surgery in veteran over 60 years old

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Introduction: Some surgeons follow age-limit of 60 years for bariatric surgery. This impacts VA patients who are typically older than the general population. In Susmallian et al's recent retrospective analysis of elderly patients post bariatric surgery at a single primary medical center with follow-up ranging 9 to 45 months, improvements in comorbidities at 1 year after surgery and an acceptable rate of complications supported use of bariatric surgery in older patients.

This case report is unique given Veteran age > 60 with co-morbidities [diabetes (DM), hypertension (HTN), lipids] and complications assessed further (2 years) from surgery date than previous study (1 year) focused on older adults, thus adding to currently available literature. As the Phoenix VA utilizes private surgery centers to perform bariatric surgery, it is important to verify safety and efficacy post-surgery as patients are co-managed between specialty and primary care in this unique and often medically-complicated population.

Case: Veteran was a 69 year-old obese male with a BMI of 46.71 at time of surgery after having failed lifestyle changes for weight loss. Comorbidities include hypertension, diabetes, and hyperlipidemia along with chronic pain limiting exercise ability. One year after roux-en-y surgery, HTN, DM, TChol/LDL, and BMI improved. At 2 years, both HTN and DM improved further while lipids stabilized and BMI increased slightly. No surgical complications occurred.

Discussion: This Veteran similarly noted benefits in co-morbidities to the prior meta-analysis, and further improvement between years 1 and 2 post surgery, however did not reach remission. It is theorized that the benefits in improved comorbidities will be confirmed at medium-duration follow-up (>3 years).

Conclusion: Veterans >60 years old with chronic pain may still note improvements in co-morbidities after Roux-en-Y surgery > year 1 post surgery with acceptable complication risks. Following >3 years post-surgery would provide insight beyond short-term follow-up.

Pain Management/Analgesia

476 | Topical ketamine with amitriptyline for phantom limb pain: A case report

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Introduction: Phantom limb pain (PLP) effects an estimated 60-80% of people after an amputation. In 2005, roughly 1.8 million Americans were living with an amputation, and that number was expected to double by 2050. Despite the increasing prevalence, few controlled trials have been completed examining pharmacologic treatment of PLP, and no consensus has been reached on which are most efficacious.

Case: In an 86-year-old African American female being treated for PLP, we investigated the efficacy of a combination topical cream containing 10% ketamine and 2% amitriptyline. After an above the knee

amputation in 2012 which resulted in severe PLP, she has trialed numerous pharmacologic and non-pharmacologic modalities with limited success. The cream was applied to the stump four times daily for one month. At baseline, her reported pain score using the Numeric Rating Scale (NRS) prior to treatment was 10 out of 10 (worst pain imaginable). For 15-30 minutes after each administration, she reported a decrease in her NRS from 10 to 8. Despite the quantitative decrease in NRS score, this patient did not perceive a functional benefit so discontinued use.

Discussion: The evidence in treating PLP exists mainly with oral antidepressants, anticonvulsants, opioids, and NMDA-receptor antagonists, of which this patient had tried and either found them ineffective or experienced an adverse effect. Because each of these classes have higher risk for systemic side effects when taken orally, localized treatment would be preferred if effective. The topical combination of ketamine and amitriptyline has previously demonstrated utility for treatment of neuropathic pain, but it did not provide benefit for this patient when used for PLP. It is possible that the concentrations trialed were not adequate to elicit a perceived benefit from use.

Conclusion: Topical ketamine with amitriptyline at concentrations of 10% and 2%, respectively, was not effective for the treatment of PLP in this patient.

Pediatrics

477 | Management of hyperuricemia due to hemolytic uremic syndrome with rasburicase: A case report

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Introduction: Hyperuricemia has been reported in the literature to develop in patients with hemolytic uremic syndrome (HUS). The presence and development of hyperuricemia can exacerbate acute kidney injury (AKI) in patients with HUS. Primary management of HUS is supportive care including dialysis, fluid management and blood transfusions. While rasburicase is used for hyperuricemia associated with malignancies, to date, there are limited published reports for the treatment of HUS. We report a case of administering rasburicase to a pediatric patient with hyperuricemia secondary to HUS.

Case: An 8-year old, 42 kilogram female patient, with no significant past medical history presented to the hospital with episodes of bloody diarrhea and severe gastrointestinal pain. During her admission, she tested positive for Shiga-1 toxin in her stool and developed hemolytic anemia, thrombocytopenia, and AKI and was diagnosed with HUS. From hospital day 6 to 9, she developed elevated serum uric acid (UA), 6.7 to 9.5 mg/dL, and further worsening her AKI, serum creatinine (SCr) 0.73 to 1.16 mg/dL. Due to minor improvement with allopurinol, UA 9.2 mg/dL, rasburicase 0.1 mg/kg intravenously was initiated on hospital day 11. The patient's UA level decreased to 1.7 mg/dL with renal function progressively improving. On hospital day 16, she was in good health and discharged home.

Discussion: Our case report describes the successful use of rasburicase for the treatment of hyperuricemia in a pediatric patient with AKI and HUS. Similar to previous pediatric case reports for non-malignancy hyperuricemia, allopurinol provided minimal benefit prompting use of rasburicase for the reduction of UA levels. Case reports noted rasburicase doses ranging from 0.1 to 0.18 mg/kg.

Conclusion: While more studies and experience are warranted, rasburicase can be utilized for the treatment of hyperuricemia in pediatric patients that have HUS and AKI unresponsive to fluid and allopurinol management.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

478 | A perplexing case report using apixaban anti-Xa levels in a morbidly obese patient with VTE who was NPO with enterocutaneous fistula

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Introduction: Apixaban specific anti-Xa levels are available as a way to monitor apixaban activity, however there is currently no consensus on therapeutic levels to guide therapy. Monitoring is suggested for high bleeding risk, overdose, perioperative periods, extremes of weight, or when adherence is questionable. Presented is an obscure but fundamental use of apixaban anti-Xa monitoring in questionable absorption in enterocutaneous (EC) fistula.

Case: A 57-year-old morbidly obese male (150 kg, BMI 42.5) presented to the emergency room in respiratory distress. Imaging revealed upper extremity DVT and PE. His history was significant for strangulated ventral hernia. He had five previous operations and an eventual high output EC fistula with an open abdomen. He was managed with wound collection device, TPN therapy, and NPO status. He was able to take some crushed PO medications, however the patient reported finding whole capsules in his collection device. He refused enoxaparin injections for VTE treatment. The decision was made to load with crushed apixaban 10 mg BID with anti-Xa monitoring. After two 10 mg doses, peak apixaban anti-Xa level was 146 ng/mL, PT 18 sec, PTT 35.5 sec, INR 1.5. The patient successfully completed the loading phase but declined to come in for follow up monitoring.

Discussion: Given the high mortality associated with PE, it is imperative to ensure adequate anticoagulation. Although no therapeutic range exists, his anti-Xa level fell within the reported ranges for on-therapy VTE treatment in the AMPLIFY study. This monitoring was an important factor in this patient with questionable absorption and further complicated by his morbid obesity which has not been adequately studied in clinical trials.

Conclusion: Presented is the first report of successfully utilizing apixaban anti-Xa levels for questionable absorption in a morbidly obese patient with EC fistula. Even in facilities where this assay is not readily available, providers should consider this for circumstantial cases.

479 | The use of continuous infusion Ceftolozane/tazobactam for resistant gram-negative bacterial infections: a case series

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Introduction: Ceftolozane/tazobactam (C/T), a novel antipseudomonal cephalosporin with a beta-lactamase inhibitor, is used in multi-drug resistant gram-negative infections. C/T was recently FDA approved for hospital-acquired and ventilator-associated bacterial pneumonia using a higher dose of 3 g every 8 hours. Continuous infusion (CI) C/T is an attractive concept, for aiding in transitions of care and maximizing pharmacodynamics of cephalosporins (T > MIC) including *Pseudomonas aeruginosa* isolates with MICs >4mcg/mL. We describe outcomes of a case series of four unique patients, representing six uses of CI C/T, three of which had therapeutic drug monitoring (TDM).

Case: Patient 1 is a 32-year-old woman with recurrent respiratory infections secondary to cystic fibrosis. Patient 2, a 69-year-old woman, and patient 3, a 73-year-old man, both suffer from recurrent infections at their left ventricular assist device driveline exit site. Patient 4 is a 23-year-old man with recurrent intra-abdominal infections in the setting of a ventriculoperitoneal shunt. Median daily CI C/T dose was 6 g, and duration of therapy ranged 6-91 days. All isolated pathogens were either ESBL *Escherichia coli*, *P. aeruginosa*, or both; MICs for susceptible organisms ranged 0.19-1.5mcg/mL. Among 3 patients receiving TDM, serum drug concentrations drawn prior to and periodically during CI C/T estimated an $AUC_{ceftolozane}$ ranging from 542.9mcgâ€¢(h/mL) to 966.5mcgâ€¢(h/mL). In all patients, CI C/T was used successfully with favorable outcomes.

Discussion: Currently, few published uses of CI C/T exist. Pharmacokinetic analysis of TDM confirmed ceftolozane concentrations remained 10 times above breakpoints for the entire dosing interval given as 6 g per day given via CI.

Conclusion: CI C/T was successfully utilized in the inpatient and outpatient setting and in the presence of deep-seated infections. TDM confirmed CI C/T achieved pharmacokinetic targets, suggesting an effective alternative dosing regimen applicable in the outpatient setting. Further study of CI C/T is warranted.

Psychiatry

480 | Whole-body edema with olanzapine/fluoxetine: A case report

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Introduction: Olanzapine/fluoxetine is a combination product, composed of a second generation antipsychotic (SGA) and a selective serotonin reuptake inhibitor, that has been shown to promote disease remission in persons with treatment resistant depression (TRD). However, tolerability of augmentation with SGA's may be limited due to common adverse effects, such as weight gain. Data exists pertaining to rare localized edematous reactions with use of SGA's, but diffuse whole-body edema has yet to be documented.

Case: A 47-year-old white female with TRD presented with a 5-day history of weight gain and swelling of her torso and extremities. Five days prior, she had initiated olanzapine/fluoxetine 6/50 mg daily following failure of fluoxetine 40 mg daily monotherapy. The patient was noted to have gained 3.6 kg since her last appointment; exhibited bilateral grade 3 pitting edema on her forearms, lower limbs, hands and feet; and grade 2 pitting edema on her chest. Vital signs and laboratory tests were unremarkable, ruling out cardiac, renal, or hepatic dysfunction, as well as possible electrolyte abnormalities. Olanzapine/fluoxetine was discontinued and the patient was prescribed a 3-day course of furosemide 20 mg daily. A follow-up visit 5-days later noted complete resolution of symptoms.

Discussion: The association of olanzapine/fluoxetine with whole-body edema was categorized as "probable" based on the Naranjo Scale. It is unlikely that metabolic mediated reactions, such as adipose accumulation, may have occurred in this short period of time. It is hypothesized that super-sensitivity of α-adrenergic receptors to olanzapine antagonism may result in vasodilation and edema in susceptible individuals. Dopamine antagonism has also been implicated in disruption of

natriuresis, epithelial fluid resorption, and alteration of the renin-angiotensin system, promoting edema.

Conclusion: Due to the temporal relationship of symptoms with initiation of olanzapine/fluoxetine, we recommend monitoring for edema with initiation and/or titration of therapy.

Substance Abuse/Toxicology

481 | Combining extracorporeal elimination with carbapenems in a patient with severe valproic acid toxicity. A case report

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Introduction: Valproic acid (VPA) toxicity causes wide range of neurological manifestations, spanning from mild lethargy to life-threatening cerebral edema. Extracorporeal treatment, mainly hemodialysis, enhances plasma clearance of VPA. Meanwhile, Carbapenems interact with VPA leading to reduction in its plasma concentration. Previous cases reported utilizing either one of these two modalities in VPA toxicity. In this case, we present the combined use of hemodialysis and carbapenem in severe VPA poisoning.

Case: 41 years old male brought to the emergency department after being found unresponsive in his room. He was in deep coma with Glasgow Coma Scale (GCS) 3/15. He was intubated and placed on mechanical ventilator. Physical examination revealed loss of all brainstem reflexes.

He was shifted to the medical intensive care unit. Blood test showed unquantifiable high serum VPA concentration > 4000 umol/L (Therapeutic Range: 350 - 690 umol/L). Hemodialysis was done and 1 gram ertapenem was administered. Later on day 1, patient started to breathe over the ventilator.

On day 2, patient underwent another session of hemodialysis and another dose of ertapenem was given. He became fully awake, with GCS 15/15 and valproate level came down to 1760 umol/L then later on day 2 to 800 umol/L. The patient was successfully extubated and history was taken which revealed that he took 300 tablets of 500 mg valproic acid (total 150 g) for suicidal attempt.

Discussion: Extracorporeal elimination has shown benefit in numerous case reports of clinically severe VPA toxicity. in one case report, meropenem reduced VPA plasma concentration and improved mental status. In the present case, Simultaneous use of hemodialysis and ertapenem led to rapid neurologic recovery and marked reduction of VPA plasma level.

Conclusion: Carbapenems may add additional benefit to extracorporeal elimination in patients with life threatening valproic acid toxicity. Further studies are needed to establish the role of carbapenem in VPA poisoning.

SYSTEMATIC REVIEWS/META-ANALYSIS

ADR/Drug Interactions

482 | The impact of drug interaction of carbapenem in patients receiving valproate: A systematic review and meta-analysis

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Background: Combination use of valproate and carbapenem may result in decreased valproate plasma concentrations and loss of anticonvulsant effect. However, it remains unclear if this drug interaction is related to seizure aggravation. We aim to evaluate the impact of drug interaction of carbapenem in patients receiving valproate. Outcomes evaluated were change of mean valproate plasma concentration between baseline (valproate alone) and during carbapenem treatment (valproate and carbapenem), and increased seizure frequency.

Methods: Relevant studies were identified from the PubMed, EMBASE and Cochrane Library through June 2019. Studies were considered eligible if they investigated the effect of concurrent use of carbapenem and valproate compared to valproate alone with clearly stated eligibility criteria. Change of mean valproate plasma concentration were pooled using random-effects model. Seizure frequency was analyzed using descriptive statistics and presented in median (range). We used the National Heart, Lung, and Blood Institute tools for quality assessment.

Results: Thirteen prospective and retrospective before-and-after studies (n = 659) were identified. Mean difference of valproate serum concentration between baseline (valproate alone) and during carbapenem treatment (valproate and carbapenem) of twelve studies were pooled, showing a dramatic decrease in valproate concentration (MD -44.25; 95% CI -48.25 to -40.24). Nine studies reported increased seizure frequency, which accounted for 27% (3.8%-75%). Four studies were rated as good quality.

Discussion: Substantial decrease in valproate plasma concentration following combination treatment of carbapenem and valproate may contribute to increased seizure frequency. Most studies available in answering this research question were retrospective, uncontrolled before-and-after studies, and were at risk of bias, the reporting quality of included studies further influenced our quality assessment process. Future studies focusing on clinical impact (i.e. seizure frequency, mortality rate) rather than just surrogate outcomes were needed to better answer this question.

Other: Source of funding: None. Conflict of interest: None. Registration number: PROSPERO CRD42019123846.

Ambulatory Care

483 | The usability, acceptability and functionality of smart oral multidose dispensing systems for medication adherence: A scoping review

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Background: Smart medications management aids are being developed to address poor adherence however, little is known about their integration into daily use by patients. A scoping review was conducted to investigate the usability and impact on adherence of smart oral multidose dispensing systems.
Methods: Arksey and O'Malley's framework for scoping review was used. We searched for relevant literature in PubMed, EMBASE, International Pharmaceutical Abstracts, and Scopus using subject headings and keywords related to medication adherence, smart technology and dispensing system. Observational and interventional studies in adults 18 years and over were included. Letters, editorials, and non-English articles published before 1960 were excluded. Two researchers screened the initial 150 articles, after which a single researcher screened the remaining citations.
Results: Of the 2638 citations, 1182 were duplicates, and 1371 were ineligible. Inter-rater reliability after the initial screen of 150 articles was high (kappa coefficient of 0.85). Of 85 articles included for full text review, 18 articles met eligibility criteria, including one case study, 11 cohort and six randomized trials. Of the studies that reported demographic data, in total, studies included 560 males and 619 females with an age range of 30-87.1 years. The average number of daily medications ranged from 1.7 to 14.9. Smart medication aids included smart blister packaging, automated dispensers and electronic medication trays. The number of medications dispensed by the smart devices was >1 (n = 1), one (n = 7), placebo (n = 1) and not reported(n = 9). Studies reported outcomes as medication adherence (n = 5), usability, acceptability and/or functionality (n = 4) and both parameters (n = 9).
Discussion: Although smart multidose medication dispensers appear to be usable, there is significant variability in the types of dispensing aids, patient populations and measurement of adherence, which impacts the generalizability of results.
Other: Future studies should be designed to address the usability and effectiveness of these products on medication adherence with larger samples and randomized trials.

Cardiovascular

484 | Impact of pharmacist interventions on reducing low-density lipoprotein cholesterol levels: A systematic review and meta-analysis

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Background: Cardiovascular disease (CVD) remains the leading cause of mortality in the world. Reducing low-density lipoprotein cholesterol (LDL-C) significantly reduces CVD risk. Our aim was to quantify the LDL-C reduction achieved by pharmacist interventions compared to usual care.
Methods: We performed a systematic literature search of MEDLINE, Embase, and the Cochrane Central Register of Controlled Trials through October 2018 to identify randomized controlled trials evaluating the impact of pharmacist interventions on LDL-C. Studies with <100 participants were excluded. The primary outcome was change in LDL-C. Secondary outcomes included total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triglycerides (TG). Data was pooled using a random-effects model with a Hartung-Knapp confidence interval adjustment and Paule-Mandel estimator. We evaluated statistical heterogeneity and publication bias using the I^2 and Cochrane *P*-value and Egger's weighted regression tests, respectively. Random effects meta-regression assessed impact of study duration and magnitude of lipid changes on outcomes.
Results: Twenty-five studies, including 22,095 participants, were included. LDL-C was 7.89 mg/dL lower in the pharmacist intervention group vs. usual care (95% CI -11.43 to -4.35; I^2 94%, $P < 0.01$). Greater reductions in LDL-C were observed in studies conducted outside the US compared to the US (-11.66 vs. -2.79 mg/dL, respectively; $P < 0.001$). Meta-regression showed no relationship between study duration and magnitude of LDL-C reduction ($P = 0.57$). Pharmacist interventions were also associated with greater reductions in TC and TG levels, and a modest increase in HDL-C. Risk of bias was low, although allocation concealment was frequently unclear. Publication bias was low ($P = 0.819$).
Discussion: Pharmacist interventions significantly reduce LDL-C compared to usual care. Limitations include the high degree of study heterogeneity and LDL-C was rarely the primary outcome for the included trials. Additional randomized controlled trials with an appropriate primary outcome to evaluate the effectiveness of pharmacist interventions on reducing LDL-C are warranted.

Other: Unfunded; unregistered.

485 | Efficacy of tafamidis in transthyretin amyloid cardiomyopathy: A systematic review

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Background: Transthyretin cardiomyopathy (ATTR-CM) is a rare, progressively fatal disease caused by the deposition of transthyretin amyloid fibrils in the myocardium. It can be hereditary because of mutations in the transthyretin gene or acquired with aging. Tafamidis is a selective transthyretin stabilizer, preventing tetramer dissociation and amyloidogenesis. The study aims to examine the efficacy of tafamidis compared with standard of care (SOC) on mortality and cardiovascular hospitalizations in patients with ATTR-CM.

Methods: A systematic literature search was performed through May 20th, 2019 using PubMed, EMBASE and clinicaltrials.gov with the following key terms: "tafamidis," "cardiomyopathy," and "transthyretin amyloidosis." The review was restricted to controlled trials published in English in ATTR-CM patients with mortality or cardiovascular hospitalizations reported. Studies on amyloid neuropathy were excluded. The Cochrane Risk of Bias Tool was used to assess bias risk.

Results: Two trials with a total of 505 patients were included. Tafamidis was significantly associated with lower mortality than SOC (odds ratio 0.53, 95% CI 0.36-0.78, I^2 = 0%). However, there was no difference in the percentage of cardiovascular hospitalized patients between tafamidis and SOC (odds ratio 0.71, 95% CI 0.49-1.02, I^2 = 0%). Of note, the study conducted by Falk *et al* was an open-label nonrandomized study, therefore carrying higher risk of biases.

Discussion: Despite the small number of trials and participants included in the study, our results showed that tafamidis was significantly associated with reductions in mortality. No difference was identified between tafamidis and SOC for the percentage of cardiovascular hospitalized patients, however, it should be noted that, in the ATTR-ACT study, a significant reduction in the rate of cardiovascular hospitalizations was reported to be associated with tafamidis, indicating a benefit of tafamidis in reducing cardiovascular hospitalizations compared with SOC. In conclusion, the findings of our study support tafamidis as an effective therapy for ATTR-CM.

Other: Authors have no disclosures.

486 | The safety and efficacy of dual vs. triple antithrombotic therapy in patients with atrial fibrillation and acute coronary syndrome: A systematic review and meta-analysis

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Background: Appropriate antithrombotic therapy for patients with atrial fibrillation who had acute coronary syndrome (ACS) or undergone percutaneous coronary intervention (PCI) is debatable. This meta-analysis was conducted to assess and compare the safety and efficacy of the dual antithrombotic therapy (DAT: oral anticoagulant + P2Y12 inhibitor) to the triple antithrombotic therapy (TAT: oral anticoagulant + aspirin + P2Y12 inhibitor) in patients with atrial fibrillation who had ACS or undergone PCI.

Methods: EMBASE and MEDLINE were searched through May 2019 for studies evaluating the use of DAT versus TAT in patients with atrial fibrillation who had ACS or undergone PCI. Search terms included atrial fibrillation, triple anticoagulation, acute coronary syndrome and percutaneous coronary intervention. Search was limited to peer reviewed, randomized-controlled trials (RCTs) that were conducted in humans and published in English. The Mantel-Haenszel random-effects model risk ratio (RR) and corresponding 95% CIs were calculated using the metan routine in Stata (version 14.2) to estimate the pooled treatment effects. Heterogeneity was assessed by the I^2 statistics.

Results: Five studies met the inclusion criteria. When compared to the TAT, the DAT showed a significant reduction in Thrombolysis In Myocardial Infraction (TIMI) major bleeding (RR = 0.64, 95% CI = 0.49-0.83, I^2 = 0%) and intracranial bleeding (RR = 0.42, 95% CI = 0.22-0.78, I^2 = 0%). There were no significant differences between the TAT and the DAT in all-cause mortality (RR = 0.93, 95% CI: 0.71-1.21), death from cardiovascular causes (RR = 1.00, 95%CI: 0.76-1.32), myocardial infraction (RR = 1.00, 95%CI: 0.80-1.25), and stent thrombosis (RR = 0.94, 95%CI: 0.57-1.54).

Discussion: Compared to the TAT, DAT was associated with a better safety profile without compromising the efficacy of the antithrombotic therapy. Therefore, the findings of this study support the use of DAT over TAT in patients with atrial fibrillation who had ACS or undergone PCI.

Other: The authors received no financial support for the research.

Education/Training

487 | A systematic review of interprofessional education in the health professions

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Background: In 2007, the World Health Organization Programme on Interprofessional Education and Collaborative Practice was launched to emphasize interprofessional education (IPE) and identify mechanisms that facilitate successful interprofessional collaborations. To better understand how different disciplines incorporate IPE, a systematic review was conducted to: 1) identify which disciplines are leading IPE initiatives, and 2) determine which research methodologies are informing the IPE literature.

Methods: Studies were included if they were: 1) conducted in the United States; 2) described in a peer-reviewed research article; 3) published between 2007-2018; and 4) an IPE opportunity (i.e. students engaged with students from another discipline). Selected databases included PubMed/Medline, Embase, and ERIC, and the search occurred in October 2018. Articles were screened systematically using an abstract review, full-text review, and audit. Each article was reviewed by two individuals, who each extracted information from the articles about author discipline, study design, and analytic methods. Conflicts were resolved by an independent reviewer.

Results: After removing duplicates, 1,518 abstracts were screened. This was narrowed to 680 articles for the full text review, for a final sample of 361 articles. Of these articles, 146/361 (40.44%) had a pharmacist, specifically, 68/146 (46.58%) had a pharmacist as first author and 48/146 (32.88%) had a pharmacist as last/senior author. Additionally, pharmacists mostly collaborated with nursing professionals (n = 73/146, 50.00%), followed by medical practitioners (n = 69/146, 47.26%). For research methodology, articles with pharmacist authors most commonly used non-randomized study designs (n = 104/146, 71.23%) and quantitative methods (n = 75/146, 51.37%).

Discussion: Within the IPE literature, pharmacists are publishing most often with nursing and medical professionals, suggesting an opportunity to develop IPE relationships with other disciplines. In addition, the majority of IPE studies with pharmacist authors were non-randomized and quantitative, indicating possibilities for further IPE research by asking research questions that involve differing methodologies.

Other: There was no financial support or conflicts of interest identified.

Endocrinology

488 | Systematic review of pharmacotherapy for pediatric patients with type 2 diabetes mellitus beyond metformin and insulin

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Background: Currently, when treating type 2 diabetes mellitus (T2DM) in youth, metformin is first-line and if monotherapy fails, insulin is added. However, a cross-sectional view of U.S. youth with T2DM revealed that of those on insulin, the longer insulin was used, the higher the A1c levels. About half were on insulin and those on it for more than 2 years had mean A1cs of 9.6%. Therefore, insulin treatment leaves many at risk for complications. This systematic review was conducted to summarize the available clinical trials on pharmacotherapy for pediatric patients beyond metformin and insulin.

Methods: International Pharmaceutical Abstracts, EMBASE, Medline, and the Cochrane Library were searched through May 14, 2019. Search terms included: "type 2 diabetes mellitus" and "adolescent," "child," or "pediatrics". Studies included were clinical trials evaluating pharmacotherapy besides metformin or insulin. Selection bias was minimized by predefining inclusion criteria.

Results: Eleven studies met inclusion. There were 3 trials of over 100 patients evaluating safety and efficacy, 1 dose-determination study, and 7 pharmacokinetic/pharmacodynamic studies. Medications evaluated included DPP-4 inhibitors (3 studies), GLP-1 agonists (3 studies), SGLT2 inhibitors (2 studies), thiazolidinediones (2 studies) and glimepiride (1 study). All patients studied were obese, the mean ages ranged from 13.7 to 15, and the majority were female. The treatments tried were tolerated well with similar pharmacodynamics as in adults.

Discussion: Pharmacotherapeutic studies in youth with T2DM are limited. Glimepiride monotherapy, rosiglitazone as an adjunct to metformin, and liraglutide as an adjunct to metformin were the 3 medications with the most evidence for benefit. Glimepiride and rosiglitazone both cause weight gain, which worsens insulin resistance. Liraglutide assists with weight loss and although it is an injectable, it is the most evidence-based option to add to metformin in this population.

Other: No funding or registration were applicable for this study. Dr. Mukherjee was a preceptor for a Sanofi-Genzyme fellow.

Gastroenterology

489 | Efficacy of capsaicin for the treatment of cannabinoid hyperemesis syndrome: A systematic review

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Background: Cannabinoid hyperemesis syndrome (CHS) is a distinct clinical syndrome characterized by cyclic vomiting, abdominal pain and alleviation of symptoms via hot showers in patients who are chronic cannabinoid users. Capsaicin is now recommended as a first-line treatment approach for CHS despite limited clinical evidence regarding its use. The objective of this study is to systematically review the efficacy data for capsaicin in CHS.

Methods: A literature search using keywords related to cannabinoids, emesis, and capsaicin was performed in MEDLINE, CINAHL, and Embase from inception through March 31, 2019. Studies in which capsaicin was used for CHS and clinical outcomes were reported were eligible for inclusion. Published abstracts were also eligible for inclusion. Bias was assessed based on the study design employed.

Results: A total of 241 articles were screened, of which 5 full-text papers and 6 conference abstracts were included. Full-text case reports (n = 3) and case series (n = 2) found capsaicin to be effective in a total of 18 patients. Published abstracts were in the form of case reports (n = 1), case series (n = 3), and retrospective cohort studies (n = 2). Capsaicin use was described as beneficial in all case series and case reports; however, both retrospective cohort studies were unable to find a significant benefit for capsaicin on primary outcomes (emergency department length of stay).

Discussion: The current data for capsaicin efficacy in CHS is of low methodological quality. However, the limited data on alternative antiemetic therapies and the favorable risk-benefit profile of the medication make it a reasonable adjunctive treatment option. Prospective and comparative studies are needed to better assess the role of capsaicin in CHS.

Other: The authors received no funding for this study and have no conflicts of interest to disclose. This systematic review was unregistered.

Health Services Research

490 | Implementation strategies to improve statin utilization in individuals with hypercholesterolemia: A systematic review

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Background: Strong evidence exists that statins reduce cardiovascular events. Underutilization by physicians and non-adherence by patients, however, create significant care gaps. This systematic review addresses the research question, which implementation strategies promote prescribing by physicians and uptake of statin therapy among patients with hypercholesterolemia? Interventions of interest included implementation strategies that promote prescribing or the uptake of statin therapy. Key outcomes included LDL-cholesterol (LDL-C), statin prescribing, and statin adherence by patients.

Methods: This review was registered with PROSPERO (CRD42018114952). The PRISMA-P checklist guided the approach. A search of Ovid Medline, Embase, Scopus, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and Clinicaltrials.gov through October 2018 used the terms “statin” and “hypercholesterolemia”. Study designs, except qualitative studies and case reports, were included if they reported an outcome of interest. Risk of bias was assessed using the Cochrane Collaborations tool. Two investigators performed data extraction; discrepancies were resolved by a third. We categorized implementation strategies using the Expert Recommendations for Implementing Change and specified strategies according to actor, action, action target, temporality, dose, implementation outcome affected, and justification.

Results: We identified and screened 38,585 abstracts. We included 90/207 full-text articles in our analysis. A total of 24 strategies, from 22 countries, were studied and reported. The number of studies reporting outcomes were 71 (LDL-C), 50 (statin prescribing), and 22 (statin adherence).

Discussion: Although some implementation strategies appear to improve statin use in patients with hypercholesterolemia, not all strategy types have been studied. Strengths of this review include its comprehensiveness and methodology. Potential limitations include the inclusion of only English language studies and lack of raw data available for some studies, even after attempting to contact authors.

Other: This work supported by the National Heart, Lung, and Blood Institute of the National Institutes of Health under Award Number K12HL137942.

Infectious Diseases

491 | Dual allergies or cross-reactive?: A systematic review of hypersensitivity between penicillins and cefazolin

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Background: Cefazolin is a key beta-lactam antibiotic used for the prophylaxis and treatment of several bacterial infections. However, the 10% of patients reporting a penicillin allergy are unlikely to receive cefazolin because of cross-reactivity concerns, instead receiving more toxic and less effective alternatives such as clindamycin or

vancomycin. The purpose of this systematic review was to assess if penicillin allergic patients can safely receive cefazolin by evaluating the reaction rate between penicillins and cefazolin.

Methods: A systematic PubMed database search was performed from inception to April 2019. Variations of the following terms were searched: "hypersensitivity," "allergy," "allergic," "penicillin," "cefazolin," cephazoline." Included studies described the outcome of penicillin or cefazolin skin testing or subsequent systemic exposure in patients with a suspected or proven hypersensitivity to either penicillins (penicillin, amoxicillin, or ampicillin) or cefazolin.

Results: Of 249 unique citations remained 28 studies covering 651 patients which met inclusion criteria: 6 prospective studies, 4 retrospective studies, 5 case series, and 13 case reports. The overall rate of reactions between penicillins and cefazolin was 1.4% (95% confidence interval, [CI], 0.7%-2.6%). Patients with a positive skin test to the first allergen had a 3.0% reaction rate (95% CI, 0.7%-8.9%), while patients with systemic exposure had a 10.5% reaction rate (95% CI, 7.1%-30.8%). Case studies reported 5 of the 9 total reaction patients.

Discussion: We observed a low overall reaction rate between penicillin and cefazolin of 1.4%. This may represent patients with two independent allergies, and not necessarily a cross-reactive relationship. Limitations of this study include the heterogeneous patient population and publication bias. Empiric administration of cefazolin in penicillin allergy (or vice versa) may be appropriate, especially when beta-lactam allergy testing is unavailable.

Other: Dr. Blumenthal reports licensed intellectual property with Persistent Systems. No other conflicts of interest, funding, or registration are applicable.

Neurology

492 | Treatment of anxiety in Parkinson's disease: A systematic literature review

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Background: Anxiety is common in Parkinson's Disease (PD). Due to the availability of new data from randomized controlled trials (RCTs), a systematic literature review was conducted to evaluate the efficacy and tolerability of interventions for management of anxiety symptoms in patients with PD.

Methods: Literature searches were performed in PubMed, Cochrane Central Register of Controlled Trials, and EMBASE (January 1947 to May 2019) with no language restrictions. Eligible studies were randomized and placebo- or comparator-controlled. Study methodology, patient- and treatment-level data were independently extracted and summarized using descriptive statistics. Quality assessment and level of evidence classification were based on, respectively, the Cochrane risk of bias tool and American Academy of Neurology metrics. Documentation of the inclusion and exclusion process is presented in the Preferred Reporting Items of Systematic Reviews and Meta-Analyses format.

Results: 188 potentially relevant articles were identified. Six RCTs (total n = 154 subjects) met inclusion criteria for data extraction and synthesis. Five of the RCTs (n = 134; Class IV) involved cognitive-behavioral therapy (CBT), and one (n = 20; Class III) involved pharmacotherapy (bromazepam). Four of the five CBT studies (n = 116) demonstrated no difference between CBT and treatment as usual (TAU) or waitlist. When reported, drop-outs from CBT groups were due to burden of frequency of therapy sessions (including travel distance). Approaches in TAU consisted of self-study education or exercise support without a CBT component. In the pharmacotherapy RCT, bromazepam significantly improved anxiety symptoms but sedation and dizziness were common. Quality assessment indicates the CBT results are associated with high risk of selection and performance biases.

Discussion: CBT is not more efficacious than treatment as usual or waitlist in improving anxiety symptoms in patients with PD. There is an insufficient level of evidence on pharmacotherapy to make recommendations.

Other: Authors declare no potential conflicts of interest. PROSPERO registration submitted and approval pending.

Nutrition

493 | Inpatient management of total parenteral nutrition in the setting of bacteremia and/or fungemia: A systematic review

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Background: Malnutrition is predominant amongst hospitalized patients and is associated with increased mortality and longer lengths of stay. Total parenteral nutrition (TPN) provides vital nutrient and electrolyte support to ill patients when other options are inadequate. Management and administration of TPN becomes challenging for patients with positive blood cultures. The purpose of this review is to examine the literature surrounding this issue.

Methods: A literature search utilizing the PubMed database was conducted through April 2019 using the following search terms: "total parenteral nutrition", "bacteremia", "fungemia" and "parenteral nutrition". Any article published in the English language between January 01, 2000 to April 30, 2019 in human subjects was included for review. TPN use in the pediatric population was excluded. All articles were

screened and assessed by the two investigators independently to reduce bias.

Results: The search yielded 200 articles; 14 articles were included for further review. Nine articles were retrospective studies, four articles cohort studies and one article was a randomized controlled trial. Ten articles referenced TPN being a significant risk factor for attaining bacteremia, fungemia and associated line infections. Whereas, only four articles described potential interventions for managing TPN when blood cultures were positive. These measures included discontinuing TPN use, adjusting TPN formulation and manipulating compounding techniques.

Discussion: Most studies in this review showed that patients on TPN have a higher association for developing a bloodstream related infection. However, a general consensus on how to appropriately and safely manage TPN in acutely ill patients with concurrent positive blood cultures is still lacking.

Other: There are no funding, conflicts of interest, or registrations to report for this study.

Pharmacoeconomics/Outcomes

494 | Medication adherence to rivaroxaban and dabigatran in patients with non-valvular atrial fibrillation: A meta-analysis

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Background: Adherence to direct oral anticoagulants (DOACs) is necessary to maximize the benefits of these agents. Several real-world studies have evaluated DOAC adherence in patients with non-valvular atrial fibrillation (NVAF); however these studies have not been systematically summarized. We performed a meta-analysis to compare adherence to rivaroxaban versus dabigatran therapy in United States (US) patients with NVAF in a real-world setting.

Methods: Medline and Scopus were searched from January 2010 to August 2018 using keywords and MeSH terms related to adherence and oral anticoagulants. We included real-world studies of US adults with NVAF comparing adherence to dabigatran and rivaroxaban. Studies evaluating adherence by a measure other than proportion of days covered (PDC) were excluded. The proportion of patients with a PDC≥80 (a commonly utilized definition of adherence) served as the primary outcome of interest. We conducted a meta-analysis of included studies using the Hartung-Knapp random-effects model to estimate risk ratios (RRs) with corresponding 95% confidence intervals (CIs). The I^2 statistic was used to assess the percentage of variability in the treatment estimate that is attributable to heterogeneity.

Results: We included 5 studies evaluating 80,230 patients (range: 2,667-22,571). Median follow-up across studies was 6 months (range: 3-12 months). The proportion of patients with a PDC≥80 ranged from 59.5% to 83.5% for rivaroxaban users and 57.3% to 78.3% for dabigatran users. Upon meta-analysis, rivaroxaban use was associated with increased adherence compared with dabigatran use (RR = 1.08 95%CI = 1.03-1.12; I^2 = 88%).

Discussion: Rivaroxaban was associated with increased adherence. Possible explanations for this include dosing frequency or patient tolerance. A limitation is that we were unable to assess the impact of adherence on outcomes for these agents. Nonetheless, the inclusion of real-world studies increases applicability.

Other: This study was not funded. ERW has received research funding from Pfizer Inc. AP and IR have nothing to disclose. Registration and registry name: none

495 | A systematic review of economic evaluations of clinical pharmacy services in the United States: 2011 to 2017

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Background: High-quality studies evaluating the cost-effectiveness of clinical pharmacy services (CPS) are needed to justify implementation and reimbursement. We evaluated the quality of economic evaluations of CPS in the US and described the services and their economic outcomes to inform decision makers.

Methods: We conducted a literature search of published studies in PubMed, Ovid, and Embase from January 2011 through December 2017. Manuscripts evaluating a CPS with patient-level economic outcomes and conducted in the US were included. Study quality and risk of bias were classified by study design characteristics. Economic evaluations were classified according to presence of a comparator, and cost and outcome measures included. The quality of full economic evaluations was assessed using the Quality of Health Economic Studies instrument (QHES). Descriptive statistics were used to summarize CPS characteristics.

Results: After screening, 113 studies were included. Type of service provided included general pharmacotherapy (42%), disease management (28%), and targeted drug program (18%). Settings included hospital (35%), ambulatory care (27%), and community pharmacy (17%). Study designs were considered low-quality (quasi-experimental with a historical control group or no control group) in 70% of cases, while 26% were medium-quality (quasi-experimental with a concurrent control group) and 4% high-quality (randomized experimental and multi-

group interrupted time series). Economic evaluations types were descriptive studies that measured cost and/or outcomes of a CPS (57%), comparative studies that measured cost or outcomes of a CPS and a comparator (37%), and full evaluations that measured cost and outcomes of a CPS and a comparator (6%). Among seven full evaluations, the mean (SD) QHES score was 83 (14.6) and four reported the CPS as being more effective at a lower cost.

Discussion: While the body of evidence was large, most studies used low-quality methods. Among full economic evaluations, study quality was relatively high and supported cost-effectiveness of CPS.

Other: No conflicts, funding, or registration.

Psychiatry

496 | The P300 amplitude in alcohol use disorder: A meta-analysis and meta-regression

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Background: The P300 Event Related Potential component is a marker of reduced capacity in alcohol use disorder (AUD) to engage attentional mechanisms and update memory representations. No meta-analysis to date has been completed comparing effect size estimates of auditory *vs*. visual stimuli in AUD. In addition, there is a lack of consensus on whether the P3b in women is reduced.

Methods: A comprehensive search in Web of Science, PubMed and PsychInfo was independently performed through March 1st, 2019 by the two authors using the following search criteria: ((“alcohol” OR “alcoholism”) AND (“P300” OR “P3a” OR “P3b”) AND (“Event Related Potentials”) AND (DOCUMENT TYPES: (Article)). Data analysis was completed using a refined variance estimator of the random effects model. Study authors assessed source-study heterogeneity using the χ2-based Q test with its associated *P* value. Potential publication bias was calculated using the Classical Tests by Begg and Egger.

Results: Sixteen studies were included in the final analysis. The range of study participants' age was from 30 to 62 years. Effect size estimates were large for both auditory (Hedges' g = 1.01) and visual (Hedges' g = 0.77) P300, but only marginally significant for the auditory P300 (P = 0.056). The moderator analysis did not show significant sex differences for either auditory (P = 0.97) or visual (P = 0.45) P3b.

Discussion: Although their effect sizes are large and comparable, based on the *P*-value of the random effects model, the visual P3b amplitude is more significant and stable than the auditory P3b amplitude. There were no P3b amplitude differences between men and women. This meta-analysis clarifies the nature of P300 in AUD. It provides effect size estimates for visual and auditory P300, thereby permitting a conclusion of future studies grounded on statistical results.

Other: This analysis was supported by UIC College of Pharmacy, Department of Pharmacy Practice.

Pulmonary

497 | Dual versus mono-bronchodilator therapy in COPD: A meta-analysis

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Background: This meta-analysis evaluates the efficacy of dual bronchodilator therapy with long acting beta-agonist (LABA) + long acting muscarinic antagonist (LAMA) compared to mono-bronchodilator therapy for Chronic Obstructive Pulmonary Disease (COPD).

Methods: A systematic literature search of PubMed, CINAHL, and Web of Science databases from inception through June 2019 was conducted to identify English-language, prospective randomized controlled trials (RCTs) that compared dual to monotherapy in adult patients with COPD. All selected trials confirmed COPD diagnosis via forced expiratory volume at one second (FEV_1). Studies involving short acting muscarinic antagonist or beta-agonists were excluded. Risk of bias was assessed using Jadad score. Overall analysis was performed using Review Manager 5.3. Treatment effect was determined with random-effects model by using the Mantel-Haenszel method and was reported as mean difference or Odds Ratio (OR) with 95% confidence interval (CI).

Results: Eighteen RCTs were included (n = 6,086; median Jadad score 5 out of 5) that compared dual (LAMA + LABA) to mono-bronchodilator. There was a greater improvement in FEV_1 with dual therapy compared to monotherapy (mean difference = 0.08 L, 95% CI 0.05-0.11). There was no difference in St. George Respiratory Questionnaire (SGRQ) scores with dual therapy compared to the monotherapy group (OR = -0.85, 95% CI -1.83-0.13). There were no differences in overall adverse effects (OR = 1.00, 95% CI 0.92-1.09), serious adverse effects (OR = 1.01, 95% CI 0.86-1.18), or cardiovascular events (OR = 0.88, 95% CI 0.58-1.34).

Discussion: Dual therapy improves FEV_1 and appears to be as safe as monotherapy without increasing the incidence of adverse effects, serious adverse effects, or cardiovascular events. Dual therapy does not improve SGRQ scores.

Other: This work was not funded and none of the authors have conflicts to declare.

Rheumatology

498 | Efficacy and safety outcomes of biosimilar-rituximab compared to originator-rituximab in rheumatoid arthritis and non-Hodgkin's lymphoma: A systematic review and meta-analysis

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Background: Rituximab is one of the most widely used biologics in autoimmune diseases and lymphoma. In line with the end of originator-rituximab's patent, several kinds of biosimilars have been marketed; thus, it is necessary to comprehensively evaluate the efficacy and safety of rituximab-biosimilars compared to originator in rheumatoid arthritis(RA) and non-Hodgkin's Lymphoma(NHL) by combining the available latest data.
Methods: PubMed, Embase, Cochrane Library, ClinicalTrials.gov, and Google Scholar were searched and head-to-head RCTs that directly compared the efficacy and safety of rituximab-biosimilars to originator were identified. American College of Rheumatology(ACR) response rates for RA and response rates for NHL were evaluated as the efficacy outcomes. For the safety outcomes, adverse events and anti-drug antibodies were assessed. Pharmacokinetic(PK) profile was evaluated as a secondary outcome. To assess the methodological quality of the clinical trial, the Cochrane Risk of Bias Assessment Instrument was applied.
Results: Eleven head-to-head RCTs with 3,163 patients were included (1,744 in RA and 1,419 in NHL). No significant differences were found in efficacy outcomes in either RA or NHL. In RA patients, the pooled RR of ACR 20 at weeks 24 and 48 were 0.99(P = 0.70, 95% CI = 0.92-1.06) and 1.04(P = 0.73, 95% CI = 0.83-1.31), respectively. In NHL patients, the pooled RR of the overall response at week 24 was 1.02(P = 0.31, 95% CI = 0.98-1.07). There were no significant differences in safety outcomes in either adverse events(RR 1.04, P = 0.30, 95% CI = 0.97-1.12) or anti-drug antibodies(RR 0.86, P = 0.20, 95% CI = 0.68-1.08). Discussion: This systematic review and meta-analysis demonstrated that the overall outcomes of rituximab-biosimilars were similar with those of originator-rituximab in patients with RA and NHL. The results of this study are expected to provide strong evidence for clinical decision, although further data from real-world setting is demanded.
Other: none

ENCORE PRESENTATIONS

ADR/Drug Interactions

499E | Acute on chronic Fanconi syndrome induced by tenofovir compounded by tacrolimus toxicity

Becky S. Linn, Pharm.D.[1]
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Presented at ASHP Summer Meeting, Denver, Colorado, June 2-6, 2018.

Ambulatory Care

501E | The Pharmacy Hypertension Management Service (PHMS): A physician-pharmacist collaborative management clinic in older adults

William Madden, Pharm.D.[1], Leah Kelemen, BA[1], Stacie Levine, MD[1], Katherine Thompson, MD[1], Deborah Burnet, MD[1], Valerie Press, MD[1], Lisa Vinci, MD[1], *Tia Kostas, MD*[2]
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Presented at American Geriatrics Society Annual Meeting, Portland, Oregon, May 2-4, 2019.

502E | Prescribing pattern of oral anticoagulants in patients with obesity

Kristina Falk, Pharm.D., Meghan McComb, Pharm.D., Nancy Shapiro, Pharm.D., Ellen M Uppuluri, Pharm.D.
Pharmacy Practice, University of Illinois at Chicago College of Pharmacy, Chicago, Illinois

Presented at the Anticoagulation Forum, Ft. Lauderdale, Florida, April 11, 2019.

503E | Primary care comprehensive medication reviews in cancer patients with comorbid conditions

Amy Thompson, Pharm.D., BCACP[1], Karen Farris, R.Ph., Ph.D.[2], Michelle Azar, Pharm.D. Candidate[3], Emily Mackler, Pharm.D.[4]

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Presented at the Hematology/Oncology Pharmacy Association Annual Conference, Fort Worth, TX, April 3-6, 2019.

504E | Team-based process for medication reconciliation & review in ambulatory care

Celia Lu, Pharm.D., BCACP[1], Christine Chim, Pharm.D., BCACP[2], Danielle Ezzo, Pharm.D., BCPS[1], Nissa Mazzola, Pharm.D., CDE[1], Rachel Kashan, M.A.[3], Daniel J. Coletti, PhD[4]
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Presented at the Society of General Internal Medicine Annual Meeting, Washington DC, May 8, 2019.

Cardiovascular

505E | Metoclopramide and ranitidine induced QTc prolongation

Bernard Lee, Pharm.D.[1], Katherine Landmesser, Pharm.D.[2]
[1]Pharmacy, BayCare Health System, St Petersburg, Florida; [2]Pharmacy, University of Kentucky, Lexington, Kentucky

Presented at the Pediatric Pharmacy Advocacy Group Annual Meeting, Oklahoma, Oklahoma, April 10-14, 2019.

506E | Severe hypercholesterolemia secondary to drug-induced cholestatic liver injury

Diana Vinh Venci, Pharm.D.[1], Kelly Bartsch, Pharm.D.[1], Erica Davidson, Pharm.D.[1], Abigail Rabatin, Pharm.D.[1], M Wesley Milks, MD[2]
[1]The Ohio State University Wexner Medical Center, Columbus, Ohio; [2]Department of Cardiology, The Ohio State University Wexner Medical Center, Gahanna, Ohio

Presented at the National Lipid Association Scientific Sessions, Miami, FL, May 16-19, 2019.

Critical Care

507E | Sequence of vasopressor discontinuation in patients with septic shock and effect on clinically relevant hypotension requiring intervention

Ruben Patel, Pharm.D., BCPS, BCCP[1], Soo Kang, Pharm.D., BCCCP[1], Mitesh Patel, Pharm.D., BCCCP[2], Mona Philips, RPh, MAS[1]
[1]Department of pharmacy, Clara Maass Medical Center, Belleville, New Jersey; [2]Clara Maass Medical Center, Belleville, New Jersey

Presented at the New Jersey Society of Health-System Pharmacists, Atlantic City, New Jersey, March 28-29, 2019.

508E | Impact of trauma pharmacists on the management of pain, agitation, and delirium after ICU discharge

Andrew Schwartz, Pharm.D.[1], Xi Liu-DeRyke, Pharm.D., FCCM[1], Amanda Giancarelli, Pharm.D., CNSC, BCCCP[2]
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509E | Optimization and validation of heparin nomograms at an academic medical center

Elizabeth Riegle, Pharm.D.[1], Amy Schultz, Pharm.D.[1], Patrick Dunn, Pharm.D.[1]
[1]Cabell Huntington Hospital, Huntington, West Virginia

Presented at the Great Lakes Pharmacy Resident Conference, West Lafayette, IN, May 23-26, 2019.

Education/Training

510E | Curation and praxis of active learning: Gagné's events of instruction for teaching blood pressure measurement

Jack Chen, Pharm.D.[1], Herman Johannesmeyer, Pharm.D.[2]
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Presented at the American Association of Colleges of Pharmacy Annual Meeting, Chicago, Illinois, July 13-17, 2019.

511E | **Evaluation of a pharmacists' patient care process-based patient presentation rubric in a general medicine elective course**

Jason Lancaster, Pharm.D., MEd[1], Margarita V. DiVall, Pharm.D., MEd, BCPS[1], Michael J. Gonyeau, BSPharm, Pharm.D., MEd, BCPS, FCCP[1], Mark A. Douglass, Pharm.D.[2], Adam B. Woolley, Pharm.D., BCPS[3], Stephanie Sibicky, Pharm.D., BCGP, BCPS[4], Alexa A Carlson, Pharm. D., BCPS[5]

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Presented at the American Association of Colleges of Pharmacy Annual Meeting, Chicago, Ilinois July, 2019.

512E | **Faculty preceptors' strategies for evaluating and teaching clinical reasoning skills in the advanced pharmacy practice experience (APPE) setting**

Ginelle A. Bryant, Pharm.D., BCPS[1], Eliza Dy-Boarman, Pharm.D., BCPS[2], Morgan Herring, Pharm.D., BCPS[3]

[1]*College of Pharmacy and Health Sciences, Drake University, Des Moines, Iowa;* [2]*Department of Clinical Sciences, Drake University College of Pharmacy and Health Sciences, Des Moines, Iowa;* [3]*Department of Pharmacy Practice and Science / Division of Applied Clinical Sciences, The University of Iowa College of Pharmacy, Iowa City, Iowa*

Presented at the Iowa Pharmacy Association Annual Meeting, Cedar Rapids, Iowa, June 21, 2019.

513E | **Effects of mindfulness meditation on mindfulness, mental well-being and perceived stress**

Terri Poirier, Pharm.D., MPH[1], Irene Zollars, Pharm.D., MBA[2], Junvie Pailden, PhD[3]

[1]*School of Pharmacy, Southern Illinois University Edwardsville, Edwardsville, Ilinois;* [2]*Pharmacy Practice, Southern Illinois University Edwardsville, EDWARDSVILLE, Ilinois;* [3]*mathematics and Statistics, Southern Illinois University Edwardsville, EDWARDSVILLE, Ilinois*

Presented at American Association of College of Pharmacy Annual Meeting on Pharmacy Education, July 15, 2019.

514E | **Comparison of performance during advanced pharmacy practice experiences (APPEs) after online and on-campus curricular pathways**

Paul Reynolds, Pharm.D.[1], Jason Brunner, Ph.D.[2], Megan Thompson, Pharm.D.[3], Kari Franson, Pharm.D., Ph.D.[4], Monika Nuffer, Pharm.D.[5], Erica Rhein, Pharm.D.[1], Rachel Wagmaister, BA[6], Shaun Gleason, Pharm.D., MGS[1]

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Presented at the American Association of Colleges of Pharmacy Annual Meeting on Education Meeting, Chicago Illinois, July 15th, 2019

515E | **An EPIC alternative: Using an ePortfolio system to create mock electronic medical records**

Adam B. Woolley, Pharm.D., MEd, BCPS[1], Alexa A Carlson, Pharm.D., BCPS[1], Stephanie L. Sibicky, Pharm.D., BCGP, BCPS[1], Jason Lancaster, Pharm.D., MEd, BCPS[1], Mark A. Douglass, Pharm.D.[1], Michael Gonyeau, BS Pharm, Pharm.D., MEd, FNAP, FCCP, BCPS[1]

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Presented at the American Association of Colleges of Pharmacy Annual Meeting on Pharmacy Education, Boston, MA, July 23, 2018.

516E | **Ambulatory care clinical pharmacy training program for pharmacists in the Qatar Primary Care Corporation (PHCC)**

Jodie Malhotra, Pharm.D.[1], Yasser Morsy, MSc, PhD[2], Joseph Saseen, Pharm.D.[3], Kari Franson, Pharm.D., Ph.D.[1]

[1]*Department of Clinical Pharmacy, University of Colorado Skaggs School of Pharmacy, Aurora, Colorado;* [2]*Primary Health Care Corporation, Doha, Qatar;* [3]*Department of Clinical Pharmacy, University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences, Aurora, Colorado*

Presented at the International Pharmacy Federation (FIP) World Congress, Abu Dhabi, UAE, September 22-26, 2019

517E | Pharmacists' perception of international Pharm.D. (ITPD) training to meet local patient care needs

Shaun Gleason, Pharm.D., MGS[1], Jodie Malhotra, Pharm.D.[2], Kari Franson, Pharm.D., Ph.D.[2]
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Presented at International Pharmaceutical Federation (FIP) World Congress, Abu Dhabi, UAE, September 22-26, 2019.

518E | Implementation of an advanced pharmacist training program at a community medical center

Soo Kang, Pharm.D., BCCCP[1], Mitesh Patel, Pharm.D., BCCCP[2], Mark Attalla, Pharm.D.[2], Mona Philips, RPh, MAS[1], Karan Raja, Pharm.D., BCPS, BCIDP[1], Ruben Patel, Pharm.D., BCPS, BCCP[1], Edmund Manger, RPH, MAS[1], Simran Singh, Pharm.D., BCPS[1], Cristina Santos, Pharm.D., BCPS[1]
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Presented at New Jersey Society of Health-System Pharmacists 2019 Annual Meeting & Exhibition, Atlantic City, New Jersey, March 28 - 29, 2019.

519E | Baseline knowledge assessments are an effective tool for retrieval practice in student pharmacists

Sarah Anderson, Pharm.D[1], Amanda Corbett, Pharm.D.[2], *Denise Rhoney, Pharm.D.*[3]
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Presented at Association for Medical Education in Europe (AMEE) Annual Meeting, Vienna, Austria, August 24-28 2019.

520E | Master adaptive learning: Re-engineering core integrated pharmacotherapy curriculum for 21st century learning

Denise Rhoney, Pharm.D.[1], Amanda Corbett, Pharm.D.[2], Sarah Anderson, Pharm.D[3], Ian B. Hollis, Pharm.D.[4], Philip Rodgers, Pharm. D., FCCP[5], Kathryn Morbitzer, Pharm.D.[1]
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Presented at the American Association of Colleges of Pharmacy Annual Meeting, Chicago, Illinois, July 13-17 2019.

521E | Admission predictors of success: 5 year report of an international-trained Pharm.D. (ITPD) program

Shaun Gleason, Pharm.D., MGS[1], Paul Reynolds, Pharm.D.[1], Kari Franson, Pharm.D., Ph.D.[2], Jodie Malhotra, Pharm.D.[2], Rachel Wagmaister, BA[3], Ralph Altiere, PhD[4]
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Presented at the American Association of Colleges of Pharmacy Annual Meeting, Chicago, Illinois, July 13-19, 2019.

522E | Evaluation of parenteral nutrition education among critical care pharmacists

Maria Sheridan, Pharm.D.[1], Corey Witenko, Pharm.D.[2], Johnathan Voss, Pharm.D.[3]
[1]*Department of Medical Affairs, Clinical Nutrition, Fresenius Kabi, Collierville, Tennessee;* [2]*New York Presbyterian Hospital, New York, New York;* [3]*Department of Pharmacy, JPS Health Network, Fort Worth, Texas*

Presented at the Society of Critical Care Medicine Annual Congress, San Diego, California, February 16-19, 2019.

523E | They "Like" It! Use of Web 2.0 technologies on Advanced Pharmacy Practice Experiences

Taylor Imburgia, Pharm.D.[1], *Stephanie Sibicky, Pharm.D., BCPS, CGP*[1], Alexa Carlson, Pharm.D., BCPS[2]
[1]*Northeastern University, Boston, Massachusetts;* [2]*Northeastern University—Bouvé School of Pharmacy, Boston, Massachusetts*

Presented at the American Association of Colleges of Pharmacy Annual Meeting, Boston, Massachusetts, July 21-25, 2018.

524E | **We come together: Integration of adult internal medicine inpatient APPEs**

Stephanie Sibicky, Pharm.D., BCPS, CGP[1], Alexa Carlson, Pharm.D., BCPS[2]
[1]*Northeastern University, Boston, Massachusetts;* [2]*Northeastern University—Bouvé School of Pharmacy, Boston, Massachusetts*

Presented at the American Association of Colleges of Pharmacy Annual Meeting, Boston, Massachusetts, July 21-25, 2018.

Emergency Medicine

525E | **Improving antibiotic stewardship for patients meeting sepsis criteria in the emergency department**

Cierra Treu, Pharm.D., BCCCP[1], Barbara Gatton, MD[2], Theodore Gaeta, DO[2], Lawrence Melniker, MD, MS, MBA[2]
[1]*Department of Pharmacy, NewYork-Presbyterian Brooklyn Methodist Hospital, Brooklyn, New York;* [2]*Department of Emergency Medicine, NewYork-Presbyterian Brooklyn Methodist Hospital, Brooklyn, New York*

Presented at New York American College of Emergency Physicians

526E | **"Do you have the Knack for Dosing e-NAC?"**

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Presented National American Congress of Clinical Toxicology, Nashville, TN, September 23-27th.

Endocrinology

527E | **Impact of single dose systemic glucocorticoids on blood leukocytes in hospitalized adults**

Samah Alshehri, Pharm.D., MSc, BCPS[1], Mohannad Alshibani, Pharm.D., BCPS[1], Khalid Eljaaly, Pharm.D., MS, BCPS[2], Michael Katz, Pharm.D.[3]
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Presented at ENDO annual meeting, Chicago, Illinois, March, 2018.

528E | **An assessment of modifiable risk factor management in hospitalized patients with type 2 diabetes mellitus**

Aleina Haines, BSP, ACPR[1], Jordan Kalesnikoff, BSP, ACPR[1], *Caitlin Roy, BSP, ACPR*[1], Lori Albers, BSP, ACPR[1], William Semchuk, MSc, Pharm.D., FSCHP[1]
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Presented at the Professional Practice Conference of the Canadian Society of Hospital Pharmacists, Toronto, ON, Canada, February 2-5, 2019.

Gastroenterology

529E | **Bone and renal safety are improved in chronic HBV patients switched to tenofovir alafenamide (TAF) after either 2 or 3 years of prior tenofovir disoproxil fumarate (TDF) treatment**

EunYoung Lee, Pharm.D.[1], Maria Buti, MD[2], Xiaoli Ma, MD[3], Young-suk Lim, MD[4], Jia-Horng Kao, MD[5], Elena Nurmukhametova, MD[6], Fehmi Tabak, MD[7], Maciej Jablkowski, MD[8], Suri Vithika, NA[9], Abhijit Chowdhury, MD[10], Scott Fung, MD[11], Wan-Long Chuang, MD[12], Edward Gane, MD[13], John Flaherty, Pharm.D.[9]
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Presented at The International Liver Congress 2019, Vienna, Austria, April 10-14, 2019.

530E | **A phase 3 study comparing switching from tenofovir disoproxil fumarate (TDF) to tenofovir alafenamide (TAF) with continued TDF treatment in virologically-suppressed patients with chronic hepatitis B (CHB): Week 48 efficacy and safety results**

John Flaherty, Pharm.D.[1], Pietro Lampertico, MD[2], Ho Bae, MD[3], Xiaoli Ma, MD[4], Huy Trinh, MD[5], *EunYoung Lee, Pharm.D.*[6], Maria Buti, MD[7], Scott Fung, MD[8], Wan-Long Chuang, MD[9], Won Young Tak, MD[10], Alnoor Ramji, MD[11], Chi-Yi Chen, MD[12], Edward Tam, MD[13], Anuj Gaggar, MD[1], Audrey Lau, PhD[1], Becket Feierbach, PhD[1], George Wu, NA[1], Suri Vithika, NA[1], Seung-Kew Yoon, MD[14], Kosh Agarwal, MD[15], Young-suk Lim, MD[16], Henry Chan, MD[17]
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Presented at The International Liver Congress 2019, Vienna, Austria, April 10-14, 2019.

Geriatrics

531E | **Potentially inappropriate medication use among geriatric patients in primary care setting: A cross-sectional study using the Beers, STOPP, FORTA and MAI criteria**

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532E | **A case of using a combination CBD:THC product for pain management in an older adult**

Hailee Griffin, student[1], Danielle Fixen, Pharm.D.[1]
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Presented at American Geriatrics Society 2019 Annual Scientific Meeting, Portland, Oregon, May 3, 2019.

Hematology/Anticoagulation

533E | **Disproportionate antithrombotic and opioid keyword frequencies in hospital regulations**

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Presented at the Anticoagulation Forum National Conference, Fort Lauderdale, Florida, April 11-13, 2019.

534E | **Validation of the PK/PD model used for dose selection of andexanet alfa for reversal of anticoagulation**

Janet M. Leeds, PhD[1], Yuan Xiong, PhD[2], Mark Lovern, PhD[2], Kenneth Der, BS[1], Genmin Lu, PhD[1], John T. Curnutte, MD, PhD[1], Michele Bronson, PhD[1], Sonia Souza, PhD[1], Patrick Yue, MD[1], Pamela B. Conley, PhD[1]
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Presented at The American Society for Clinical Pharmacology and Therapeutics (ASCPT) 2019 Annual Meeting, Washington, DC, March 13-16, 2019.

535E | **Efficacy and safety outcomes in FXa-associated bleeding following trauma: An Annexa-4 Sub-study**

Truman J. Milling, MD, FACEP[1], *Patrick Yue, MD*[2], Elena Zotova, PhD[3], Juliet Nakamya, PhD[3], John T. Curnutte, MD, PhD[2], Stuart J. Connolly, MD, FRCPC[3], Andrew Demchuk, MD[4]
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Presented at the 17th Annual Meeting of the Neurocritical Care Society (NCS), Vancouver, British Columbia, Canada October 15-18, 2019;.

536E | Andexanet alfa for treatment of factor Xa inhibitor-related acute major bleeding

Truman J. Milling, MD, FACEP[1], Stuart J. Connolly, MD, FRCPC[2], John W. Eikelboom, MD[2], C. Michael Gibson, MD[3], John T. Curnutte, MD, PhD[4], Michele D Bronson, PhD[4], Genmin Lu, PhD[4], Pamela B. Conley, PhD[4], Peter Verhamme, MD, PhD[5], Jeannot Schmidt, MD[6], Saskia Middeldorp, MD[7], Alexander T Cohen, MBBS, MSc, MD, FRACP[8], Jan Beyer-Westendorf, MD[9], Pierre Albaladejo, MD[10], Jose Lopez-Sendon, MD[11], *Patrick Yue, MD*[4], Shelly Goodman, PhD[4], Janet M. Leeds, PhD[4], Deborah M. Siegal, MD[2], Elena Zotova, PhD[2], Brandi Meeks, MSc[2], Juliet Nakamya, PhD[2], John Lawrence, MD[4], Sonia Souza, PhD[4], Andrew Demchuk, MD[12], Daniel Pallin, MD[13], Mark Crowther, MD, MSc, FRCPC[2]

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Presented at The 2019 International Stroke Conference (ISC); Honolulu, Hawaii, February 6-8, 2019;

537E | Reversal of apixaban anticoagulation by andexanet alfa in healthy subjects: a subgroup analysis of the reversal activity using an optimized anti-FXa activity assay vs commercial anti-FXa assays

Genmin Lu, PhD[1], John T. Curnutte, MD, PhD[1], Patrick Yue, MD[1], Pamela B. Conley, PhD[1]

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Presented at the European Congress on Thrombosis and Haemostasis (ECTH); Glasgow, United Kingdom, October 2-4, 2019.

HIV/AIDS

538E | Long-acting cabotegravir + rilpivirine as maintenance therapy: ATLAS week 48 results

David Margolis, MD, MPH[1], Susan Swindells, MBBS[2], Jaime-Federico Andrade-Villanueva, MD[3], Gary Richmond, MD[4], Giuliano Rizzardini, MD[5], Axel Baumgarten, MD[6], Maria Del Mar Masia, MD[7], Gulam Latiff, MD[8], Vadim Pokrovsky, MD[9], Joseph Mrus, MD, MSc[1], Jenny Huang, BS[10], Krischan Hudson, PhD[1], Kimberly Smith, MD, MPH[1], Peter Williams, PhD[11], William Spreen, Pharm.D.[1], *Conn Harrington, BS*[1]

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Presented at Annual Conference of the British HIV Association, Bournemouth, UK April 2-5, 2019.

539E | Long-active cabotegravir + rilpivirine for HIV maintenance: FLAIR week 48 results

Chloe Orkin, MD[1], Keikawus Arasteh, MD[2], Miguel GÃ³rgolas HernÃ¡ndez-Mora, MD[3], Vadim Pokrovsky, MD[4], Edgar Overton, MD[5], Pierre-Marie Girard, MD, PhD[6], Shinichi Oka, MD, PhD[7], *Ronald D'Amico, DO, MSc*[8], David Dorey, MMATH[9], Sandy Griffith, PhD[8], David A. Margolis, M.D.[8], Peter Williams, PhD[10], William Spreen, Pharm.D.[8]

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Presented at the 25th Annual Conference of the British HIV Association, Bournemouth, UK, April 2-5, 2019.

540E | Utilization of emtricitabine/tenofovir disoproxil fumarate (FTC/TDF) for HIV pre-exposure prophylaxis (PrEP) in the United States by age, gender and ethnicity (2014-2017)

Chris Nguyen, Pharm.D.[1], Trevor Hawkins, MD[1], Jonathon Anderson, Pharm.D.[1], Staci Bush, PA[1], Scott McCallister, MD[2], Robertino Mera, MD, MS, PhD[3]

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Presented at the International AIDS Society (IAS) Conference in HIV Science, Mexico City, Mexico, July 21-24, 2019.

541E | The Phase 3 DISCOVER study: Daily F/TAF or F/TDF for HIV pre-exposure prophylaxis

Brad Hare, MD[1], Josep Coll, MD[2], Peter Ruane, MD[3], Jean-Michel Molina, MD[4], Ken Mayer, MD[5], Heiko Jessen, MD[6], Edwin DeJesus, MD[7], Ramin Ebrahimi, MS[8], Robertino Mera, MD, MS, PhD[9], Moupali Das, MD[10], Diana Brainard, MD[10], *Chris Nguyen, Pharm.D.*[11], Scott McCallister, MD[10]

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Presented at the Conference on Retroviruses and Opportunistic Infections (CROI), Seattle, WA, March 3-7, 2019.

542E | Monthly long-acting cabotegravir and rilpivirine is non-inferior to oral ART as maintenance therapy for HIV-1 infection: Week 48 pooled analysis from the Phase 3 ATLAS and FLAIR studies

Edgar Overton, MD[1], Chloe Orkin, MD[2], Susan Swindells, MBBS[3], Keikawus Arasteh, MD[4], Miguel Górgolas Hernández-Mora, MD[5], Vadim Pokrovsky, MD[6], Pierre-Marie Girard, MD, PhD[7], Shinichi Oka, MD, PhD[8], Jaime-Federico Andrade-Villanueva, MD[9], Gary Richmond, MD[10], Giuliano Rizzardini, MD[11], Axel Baumgarten, MD[12], Maria Del Mar Masia, MD[13], Gulam Latiff, MD[14], Sandy Griffith, PhD[15], *Conn Harrington, BS*[15], Krischan Hudson, PhD[15], Marty St. Clair, MD[15], Christine Talarico, MS[15], Veerle Van Eygen, MS[16], Ronald D'Amico, DO, MSc[15], Joseph Mrus, MD, MSc[15], Sterling Wu, PhD[17], Ken Chow, MA[18], Jeremy Roberts, MS[18], Simon Vanveggel, MSc[16], David A. Margolis, M.D.[15], Peter Williams, PhD[19], Kimberly Smith, MD, MPH[15], William Spreen, Pharm.D.[15]

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Presented at the 10th International AIDS Society Conference on HIV Science, Mexico City, Mexico, July 21-24, 2019.

543E | Pharmacist initial evaluation of patients newly referred with human immunodeficiency virus infection: Decreasing time to care

Christin Kilcrease, Pharm.D.[1], Misty Miller, Pharm.D., BCPS, AAHIVP[2], Stephen B. Neely, MPH[3], *Michelle Liedtke, Pharm.D., BCPS, AAHIVP*[2]

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Presented at 2018 National Ryan White Conference on HIV Care and Treatment, Oxon Hill, MD, December 11-14, 2018.

544E | A Phase 3b, multicenter, open-label study switching from an elvitegravir/cobicistat/emtricitabine/tenofovir alafenamide (E/C/F/TAF) or a tenofovir disoproxil fumarate containing regimen to bictegravir/emtricitabine/tenofovir alafenamide (B/F/TAF) in virolo

Franco Maggiolo, MD[1], Giuliano Rizzardini, MD[2], Jean-Michel Molina, MD[3], Stephane DeWit, MD[4], Federico Pulido, MD[5], Juan Berenguer, MD[6], Linos Vanderkerckove, MD[7], Christiana Blair, M.S.[8], Susan Chuck, Pharm.D.[9], David Piontkowsky, JD, MD[9], Hal Martin, MD, MPH[9], *Ian McNicholl, Pharm.D.*[10], Richard Haubrich, MD[10], Joel Gallant, MD[10]

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Presented at the 10th International AIDS Society Conference on HIV Science, Mexico City, Mexico, July 21-24, 2019.

545E | Tenofovir alafenamide versus tenofovir disoproxil fumarate in women: Pooled analysis of 7 clinical trials

Melanie Thompson, MD[1], Indira Brar, MD[2], Cynthia Brinson, MD[3], Catherine Creticos, MD[4], Debbie Hagins, MD[5], Ellen Koenig, MD[6], Claudia Martorell, MD, MPH[7], Cristina Mussini, MD[8], Laura Waters, MD[9], Susan Guo, PhD[10], Ya-Pei Liu, PhD[10], Lauren Temme, Pharm.D., MBA[11], Devi SenGupta, MD[12], *Julie Ryu, Pharm.D., MBA*[11], Moupali Das, MD[12]

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Presented at Presented at Conference on Retroviruses and Opportunistic Infections (CROI), Seattle WA, March 4-7, 2019.

546E | Bictegravir/emtricitabine/tenofovir alafenamide single-tablet regimen in adolescents and children: Week 48 results

Aditya Gaur, MD[1], Carina Rodriguez, MD[2], Eric McGrath, MD[3], Elizabeth HellstrÓ§m, MD[4], Eva Natukunda, MB, ChB, MMED[5], Pope Kosalaraksa, MD[6], Kulkanya Chokephaibulkit, MD[7], Heather Maxwell, MPH, PMP[8], Sophia Majeed, Pharm.D., PhD[9], Danielle Porter, PhD[10], Pamela Wong, MPH[11], Hiba Graham, Pharm.D.[12], *Julie Ryu, Pharm.D., MBA*[13], Cheryl Pikora, MD, PhD, MPH[12]

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Presented at the Conference on Retroviruses and Opportunistic Infections (CROI), Seattle WA, March 4-7, 2019.

Infectious Diseases

547E | Evaluation of a pharmacist-driven oseltamivir stewardship program: A pre-post intervention report

Paul Boylan, Pharm.D., BCPS[1], Melissa Santibanez, Pharm.D.[1], Rebecca Cofsky, Pharm.D.[2]

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Presented at the Making a Difference in Infectious Diseases 2019 Annual Conference, Orlando, FL, May 8-10, 2019.

548E | Efficacy of lefamulin versus moxifloxacin in adults with community-acquired bacterial pneumonia: Results of the lefamulin evaluation against pneumonia (LEAP) 1 and LEAP 2 double-blind noninferiority phase 3 clinical trials

Jennifer Schranz, MD[1], Lisa Goldberg, MS[1], Elizabeth Alexander, MD, MSc., FIDSA[1], Gregory J. Moran, MD, FACEP[2], Christian Sandrock, MD[3], Andrew F. Shorr, MD[4], *Steven P. Gelone, Pharm.D.*[1]

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Presented at CHEST Annual Meeting, New Orleans, LA, October 19-23, 2019.

549E | Safety and tolerability of lefamulin versus moxifloxacin in adults with community-acquired bacterial pneumonia: Results of the lefamulin evaluation against pneumonia (LEAP) 1 and LEAP 2 double-blind noninferiority phase 3 clinical trials

Jennifer Schranz, MD[1], Lisa Goldberg, MS[1], Elizabeth Alexander, MD, MSc., FIDSA[1], Gregory P. Moran, MD, FACEP[2], Christian Sandrock, MD[3], Andrew F. Shorr, MD[4], *Steven P. Gelone, Pharm.D.*[1]

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Presented at CHEST Annual Meeting, New Orleans, LA, October 19-23, 2019.

550E | Antimicrobial Stewardship (ASP) in Rural and Critical Access Hospitals (CAHs) using TeleStewardship® services

Sumaya Ased, Pharm.D., BCPS[1], John Horne, MD[1], Renuga Vivekanandan, MD[2], Christopher Destache, Pharm.D.[2]
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Presented at IDweek 2019, Washington, DC, October 2-6, 2019.

551E | Individualized medication of voriconazole: A practice guideline of the division of therapeutic drug monitoring, Chinese pharmacological society

Ken Chen, Master of Pharmacy[1], Xianglin Zhang, Bachelor of Medicine[2], Xiaoyan Ke, Doctor of Medicine[3], Guanhua Du, Doctor of Phylosophy[4], Kehu Yang, MSc[5], Suodi Zhai, BSc[1]
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Published in Therapeutic Drug Monitoring 2018; 40(6): 663-674.

552E | Evaluation of antibiotic prophylaxis of trans-gastrointestinal gunshot wounds to the pelvis, hip, and spine

Paige Stipanovich, Pharm.D., Emily Welch, Pharm.D., BCPS, Julia Alexander, Pharm.D., BCPS
SSM Health Saint Louis University Hospital, St. Louis, Missouri

Presented at St. Louis College of Pharmacy Resident Research Conference, Saint Louis, Missouri , May 22, 2019.

553E | Effect of procalcitonin monitoring on antibiotic duration in patients with chronic kidney disease

Brandon Powell, Pharm.D. Candidate[1], *Jeff Kyle, Pharm.D.*[2], Elizabeth Covington, Pharm.D.[2]
[1]*McWhorter School of Pharmacy, Samford Univeristy, Birmingham, Alabama;* [2]*McWhorter School of Pharmacy, Samford University, Birmingham, Alabama*

Presented at the 2018 ASHP Midyear Clinical Meeting and Exhibition, Anaheim, CA, December 2-6, 2018.

554E | Effectiveness of oral vancomycin for prevention of healthcare facility-onset clostridioides difficile infection in targeted patients during systemic antibiotic exposure

Steven Johnson, Pharm.D.[1], Shannon Brown, BS[2], David Priest, MD, MPH[3]
[1]*Pharmacy Practice, Campbell University, Lewisville, North Carolina;* [2]*Campbell University, Buies Creek, North Carolina;* [3]*Novant Health Institute for Safety & Quality, Novant Health, Winston-Salem, North Carolina*

Medication Safety

555E | Incidence of acute kidney injury in patients receiving a non-sucrose containing intravenous immune globulin product

Stephanie Salch, Pharm.D., Megan Smetana, Pharm.D., BCPS
Department of Pharmacy, The Ohio State University Wexner Medical Center, Columbus, Ohio.

Presented at the American Society of Health-System Pharmacists Midyear Clinical Meeting, Vizient Resident Poster Session, Anaheim, CA.

Nephrology

556E | Patiromer and healthcare resource utilization in the real-world setting

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Presented at the World Congress of Nephrology, Melbourne, Australia, April 12-15, 2019.

Neurology

557E | False positive or false negative results do not exist in the human photosensitivity Phase IIa model

Ronald Reed, BS Pharm, Pharm.D., FCCP, FAES[1], Dorothee Kasteleijn-Nolst Trenite, MD, PhD, MPH[2]
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Presented at the 72nd Annual Meeting of the American Epilepsy Society (AES), New Orleans, LA, November 30 to December 4th, 2018.

Nutrition

558E | Evaluation of adherence to parenteral nutrition macronutrient dosing limits for total nutrient admixtures

Sarah Cogle, Pharm.D.[1], Lauren Wright, Pharm.D.[2]
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Presented at the American Society of Health-System Pharmacists Midyear Clinical Meeting, Anaheim, CA, Dec 2-6, 2018.

Oncology

559E | CheckMate 384: Phase 3b/4 trial of nivolumab (nivo) 480 mg Q4W vs 240 mg Q2W after ≤12 months of nivo in previously treated advanced NSCLC

Edward B. Garon, MD, MS[1], Neils Reinmuth, MD[2], Lionel Falchero, MD[3], Yolanda Garcia, MD[4], José Hureaux, MD[5], Ira Gore, MD[6], *Ronald Harris, MD*[7], Paolo Bidoli, MD[8], Editta Baldini, MD[9], Silverio Ros, MD[10], Eckart Laack, MD[11], Paul Mitchell, MD[12], Martin Wolf, MD[13], Kenneth O'Byrne, MD[14], Labib Zibdawi, MD[15], Kevin Jao, MD[16], David R. Spigel, MD[17], Ang Li, PhD[18], Sridhar Rabindran, PhD[18], Eric Pichon, MD[19]
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Presented at the Clinical Immuno-Oncology Symposium of the American Society of Clinical Oncology (ASCO) and the Society for Immunotherapy of Cancer (SITC), San Francisco, CA, Feb 28-Mar 2, 2019.

Pediatrics

560E | Impact of pharmacist enhanced antimicrobial stewardship on appropriateness of antimicrobial use in neonates: A systematic review and meta-analysis

Sook Hee An, Ph. D.[1], Dong Wook Choi, B.Pharm[1]
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Presented at 2018 Fall International Convention of The Pharmaceutical Society of Korea.

Pharmacogenomics/Pharmacogenetics

561E | The effect of ABCG2 polymorphism on lipid response and myopathy in statin therapy: A systematic review and meta-analysis

Sook Hee An, Ph. D.[1], Hui Seon Ju, B. Pharm student[1], So Yeon Lee, M.S[1]
College of Pharmacy, Wonkwang University, Iksan, Korea, Republic of (South)

Presented at the 2019 Spring International Convention of The Pharmaceutical Society of Korea.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

562E | Pharmacokinetics (PK) and safety of lefamulin (LEF) after single intravenous dose administration in subjects with impaired renal function and in those requiring hemodialysis

Wolfgang Wicha, MSc[1], Thomas Marbury, MD[2], James Dowell, PhD[3], Lori Lykens, BS[4], Cathie Leister, MS[3], James Ermer, MS[3], *Steven Gelone, Pharm.D.*[4]
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Presented at IDWeek 2019, October 2-6, 2019, Washington, DC.

563E | Pharmacokinetics (PK) and safety of lefamulin (LEF) after single intravenous dose administration in subjects with impaired hepatic function

Wolfgang Wicha, MSc[1], Thomas Marbury, MD[2], James Dowell, PhD[3], Lori Lykens, BS[4], Cathie Leister, MS[3], James Ermer, MS[3], *Steven Gelone, Pharm.D.*[4]
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Presented at IDWeek 2019, October 2-6, 2019, Washington, DC.

Psychiatry

565E | Acute effects of nicotinic acetylcholine receptor stimulation on mismatch negativity: A meta-analysis

Ajna Hamidovic, Pharm.D.[1]
[1]*University of Illinois at Chicago, Chicago, Illinois*

Presented at College of Problems of Drug Dependence, San Antonio, TX, June 16-20, 2019.

Pulmonary

566E | Pulmonary Therapeutic Bioequivalence of Wixela™ Inhub™ and Advair® Diskus® in Adults With Asthma

Richard Allan, BSc[1], Edward M. Kerwin, MD[2], Martha White, MD, CPI[3], S. David Miller, MD[3], Scott Haughie, BSc, MSc[1], *Jonathan Ward, PhD*[1], Dik Ng, BSc, MSc, PhD[4]
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Presented at the American Thoracic Society International Conference, Dallas, TX, May 17-22, 2019.

567E | Wixela™ Inhub™ dry powder inhaler: in vitro performance compared with Advair® Diskus® and inhalation profiles in patients with asthma or chronic obstructive pulmonary disease

Andrew Cooper, BSc, PhD[1], Claire Newcomb, BSc, MSc[2], Kelly Canham, BSc, MBPsS[2], *Jonathan Ward, PhD*[3], Richard Allan, BSc[3], Mark Berry, BS, MS[4], James Parker, BSc, PhD[4], Elizabeth Clift, PhD[4]
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Presented at the American Thoracic Society International Conference; Dallas, TX; USA; May 17-22, 2019.

568E | Usability and robustness of the Wixela™ Inhub™ dry powder inhaler

Richard Allan, BSc[1], Claire Newcomb, BSc, MSc[2], Kelly Canham, BSc, MBPsS[2], RÃ³isÃn Wallace, BSc[3], *Jonathan Ward, PhD*[1]
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Presented at the American Thoracic Society International Conference; Dallas, TX, May 17-22,2019.

569E | **Equivalent systemic exposure to fluticasone propionate/salmeterol following single inhaled doses of Advair® Diskus® and Wixela™ Inhub™: Results of three pharmacokinetic equivalence studies**

Jonathan Ward, PhD[1], Nolan Wood, BSc, PhD[2], Richard Allan, BSc[1], Scott Haughie, BSc, MSc[1]
[1]*Mylan Global Respiratory Group, Mylan Pharmaceuticals UK Ltd., Sandwich, Kent, United Kingdom;* [2]*Mylan Global Respiratory Group, Employee of Mylan Pharmaceuticals UK Ltd. at time of study; now an employee of Certara Strategic Consulting, Sandwich, Kent, United Kingdom*

Presented at the American Thoracic Society International Conference, Dallas, TX, May 17-22,2019.

570E | **Safety and efficacy of revefenacin for nebulization in patients with chronic obstructive pulmonary disease taking concomitant LABA or ICS/LABA**

Sanjay Sethi, MD[1], James F. Donohue, MD, FCCP[2], Gary T. Ferguson, MD[3], Chris N. Barnes, PhD[4], Edmund J. Moran, PhD[4], Glenn D. Crater, MD[4], *Lauren Cochran, Pharm.D., BCPS*[4]
[1]*University at Buffalo, State University of New York, Buffalo, New York;* [2]*University of North Carolina School of Medicine, Chapel Hill, North Carolina;* [3]*Pulmonary Research Institute of Southeast Michigan, Farmington Hills, Michigan;* [4]*Theravance Biopharma US, Inc., South San Francisco, California*

Published in American Journal of Respiratory and Critical Care Medicine 2019;199:A3318.

571E | **Efficacy and safety of revefenacin in patients with chronic obstructive pulmonary disease is not age dependent: A Post Hoc subgroup analysis of three phase 3 trials**

Sanjay Sethi, MD[1], James F. Donohue, MD, FCCP[2], *Jodi Dreiling, Pharm.D., BCPS, BCCCP*[3], Mia Barnes, Pharm.D., BCPS[3], Edmund J. Moran, PhD[3], Chris N. Barnes, PhD[3], Glenn D. Crater, MD[3]
[1]*University at Buffalo, State University of New York, Buffalo, New York;* [2]*University of North Carolina School of Medicine, Chapel Hill, North Carolina;* [3]*Theravance Biopharma US, Inc., South San Francisco, California*

Presented at the Society of Hospital Medicine, National Harbor, MD, March 24-27, 2019

572E | **Tolerability and efficacy of revefenacin when administered with formoterol via nebulization**

Thomas M. Siler, MD[1], Edmund J. Moran, PhD[2], *Brian Roslund, Pharm. D., BCPS*[2], Jang Yun, PhD[2], Chris N. Barnes, PhD[2], Glenn D. Crater, MD[2]
[1]*Midwest Chest Consultants, PC, St. Charles, Missouri;* [2]*Theravance Biopharma US, Inc., South San Francisco, California*

Presented at the American College of Chest Physicians (CHEST) 2019 meeting, New Orleans, LA, October 19-23, 2019.

Urology

573E | **Response and cognitive safety of fesoterodine in patients >65y old with OAB Is there a relationship between cognition and treatment response?**

Adrian Wagg, MB, BS, FRCP, FHEA (MD)[1], Martin Carlsson, MS[2], Mireille Fernet, Pharm D[3], Malak Elsobky, MD[4]
[1]*University of Alberta, Edmonton, AB, Canada;* [2]*Pfizer Inc, New York, New York;* [3]*Pfizer Canada, Montreal, QC, Canada;* [4]*Pfizer Inc, Kirkland, QC, Canada*

Presented at the International Continence Society, Gothenburg Sweden, September 3-6, 2019.

574E | **Effect of flexible dose fesoterodine on cognitive function in >65 year old patients with OAB: Data from two RCT**

Adrian Wagg, MB, BS, FRCP, FHEA (MD)[1], Martin Carlsson, MS[2], Mireille Fernet, Pharm D[3], Malak Elsobky, MD[4]
[1]*University of Alberta, Edmonton, AB, Canada;* [2]*Pfizer Inc, New York, New York;* [3]*Pfizer Canada, Montreal, QC, Canada;* [4]*Pfizer Inc, Kirkland, QC, Canada*

Presented at the International Continence Society 2019, Grothenburg Sweden, September 3-6, 2019.

576E | **How common are adverse events in patients with either a 50 or 100% resolution of OAB symptoms during treatment with fesoterodine?**

Adrian Wagg, MB, BS, FRCP, FHEA (MD)[1], Joseph Laboissiere, MD, MSc, FRCS(C)[2], Matthias Oelke, MD, PhD[3], Mireille Fernet, Pharm D[4], Martin Carlsson, MS[5], Sender Herschorn, MD[2]
[1]*University of Alberta, Edmonton, AB, Canada;* [2]*University of Toronto, Toronto, ON, Canada;* [3]*St. Antonius-Hospital, Gronau, Germany;* [4]*Pfizer Canada, Montreal, QC, Canada;* [5]*Pfizer Inc, New York, New York*

Presented at International Continence Society - Annual Meeting, 2018.

577E | **Symptom relief from OAB: what an "average" patient might expect: data from a pooled analysis of Fesoterodine treated patients**

Joseph Laboissiere, MD, MSc, FRCS(C)[1], Mireille Fernet, Pharm D[2], Sender Herschorn, MD[1], Martin Carlsson, MS[3], Matthias Oelke, MD, PhD[4], *Adrian Wagg, MB, BS, FRCP, FHEA (MD)*[5]
[1]*University of Toronto, Toronto, ON, Canada;* [2]*Pfizer Canada, Montreal, QC, Canada;* [3]*Pfizer Inc, New York, New York;* [4]*St. Antonius-Hospital, Gronau, Germany;* [5]*University of Alberta, Edmonton, AB, Canada*

Presented International Continence Society - 48th Annual Meeting, 2018.

ACCP PRN HISTORIES

Adult Medicine

578 | **The history of the adult medicine PRN**

Andrew Miesner, Pharm.D., BCPS[1], Ryan Owens, Pharm.D., BCPS[2], Carmen Smith, Pharm.D., BCPS[3]
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History of Inception

The Adult Medicine (AMED) PRN formed in 1999 at the ACCP Annual Meeting by 10 adult medicine practitioners. Now, in 2019, the AMED PRN is one of the largest and most diverse PRNs consisting of practitioners, residents, and students who share an interest in shaping the practice of adult medicine through research and practice in areas such as inpatient acute care, outpatient chronic disease state management, and transitions of care.

Organizational Growth

Membership has grown more than 100 fold in the 20 years since the PRN was established. For the last six years, the PRN has consistently maintained over 1000 members. Starting with just two committees, the AMED PRN has grown to seven standing committees to support its work with more than 10% of members volunteering for committee service.

Significant PRN Achievements

In 2019, a survey demonstrated that approximately 95% of members have a Pharm.D., 87% have completed a PGY1 residency, 53% have completed a PGY2 residency or fellowship, 92% are board certified in Pharmacotherapy, and 20% report other certifications. Nearly 90% serve as preceptors, more than 40% are faculty at a college of pharmacy, and 58% report devoting time to research.

The PRN has offered programming at every Annual Meeting since 2001. Members have contributed to 14 ACCP White Papers, Position Statements, Commentaries, Guidelines, and Opinion Papers. Five members have received major ACCP awards. Fifty-two PRN members have become ACCP Fellows. The AMED PRN was also the first PRN to conduct research through a collaboration with the PBRN in 2016.

Future of PRN

As the PRN and its members look to the future, many goals and initiatives are envisioned including expansion of networking and collaborative research opportunities. Future initiatives will remain focused on the core values of *"Dedication to excellence in patient care, research, and education."*

Ambulatory Care

579 | **History of the ACCP Ambulatory Care Practice and Research Network (PRN)**

Kelly A. Lempicki, Pharm.D., BCPS[1], *KyAnn Wisse, Pharm.D., BCACP*[2], Renee Koski, Pharm.D., CACP, FMPA[3]
[1]*Clinical Skills and Simulation Center, Midwestern University, Downers Grove, Ilinois;* [2]*Swedish Medical Group, Seattle, Washington;*
[3]*Department of Pharmacy Practice, Ferris State University College of Pharmacy, Marquette, Michigan*

History of Inception: As one of the first two ACCP Practice and Research Networks (PRNs), the Ambulatory Care PRN was established in 1992 with 63 official members. The PRN is dedicated to supporting pharmacists practicing in ambulatory care settings by furthering members' knowledge, fostering collaboration, supporting research and scholarship, and recognizing member accomplishments.

Organizational Growth: Over its 27 year history, the PRN has grown to approximately 2000 members who are committed to advancing ambulatory care practice, educating future practitioners, and serving the profession through active committee involvement.

Significant PRN Achievements: Programs for mentorship and research collaboration have been initiated, such as the virtual café to match individuals with research ideas to collaborators. PRN-sponsored grant funding supports member participation in professional, scholarly, and clinical development, with $23,000 in seed grants and $32,000 in funding for Mentored Research Investigator Training (MeRIT) and Focused Investigator Training (FIT) program tuition offered over the years. Travel awards have been provided to 70 students and residents since 2010 to encourage participation in annual meetings. The opportunities provided and accomplishments achieved through the PRN remain of high value to the PRN and College, with over 70 PRN members since 1998 receiving fellow recognition or other ACCP awards.

Impact on Patient Care or Outcomes: To enhance patient care, the PRN promotes members' knowledge and skills via focus sessions at

annual meetings, development and updating of the *ACCP Ambulatory Care Pharmacist's Survival Guide*, and maintenance of other online references. The PRN also maintains an active list serve where members discuss clinical questions and scenarios.

Future of PRN: The PRN continues to strive to provide a wide range of opportunities with the objective of advancing pharmacist development, ambulatory care clinical practice, and patient care provision.

Critical Care

580 | The history of the critical care PRN

David D. Leedahl, Pharm.D., BCPS-AQID, BCCCP, BCIDP[1], Jeffrey Fong, Pharm.D., BCPS[2], Alexander Flannery, Pharm.D., BCCCP, BCPS[3]
[1]*Sanford Health, Fargo, ND;* [2]*MCPHS University, Worcester, Massachusetts;* [3]*Department of Pharmacy Services, University of Kentucky HealthCare, Lexington, Kentucky*

History of Inception: The Board of Regents approved the creation of the Critical Care PRN in August of 1992 with 109 members. The first elected Chair was Beth L. Noer for 1992-1993 and the Secretary/Treasurer was Linda B. Uchal. With the dedicated mentoring of both Joseph Dasta and Barbara Zarowitz, Beth and Linda were given the opportunity and necessary support to help launch the Critical Care PRN.

Organizational Growth: The Critical Care PRN reached 2264 members in 2018, making it one of the largest ACCP PRNs. The PRN has established eight active committees, which embody the purpose of the PRN. Our most recent addition was the social media committee in 2017, expanding our influence on various platforms.

Significant PRN Achievements: Since our inception, the Critical Care PRN has contributed over $70,000 to the Frontiers Fund. Our membership has included three ACCP Presidents and numerous elected/appointed leadership positions within ACCP. Over 1000 peer-reviewed publications have been authored by our membership in the critical care literature, including various guidelines (eg. pharmacoeconomic and outcomes research fellowship training).

Impact on Patient Care or Outcomes: The Critical Care PRN's goal is to optimize drug therapy outcomes by promoting excellence and innovation in clinical pharmacy practice, research, and education. Our membership is responsible for development of the key position paper on critical care pharmacy services and a pivotal opinion paper outlining recommendations for training, credentialing, and justifying critical care pharmacy services.

Future of PRN: Next steps include leveraging social media platforms to broadcast key events in the PRN. We are also increasing the role of our steering committee resident member to better engage trainees in leadership. Efforts to continue and expand PRN membership engagement are underway. Continued collaborative efforts with the Society of Critical Care Medicine on critical care pharmacy services are being pursued.

Drug Information

581 | History of the ACCP drug information PRN

Steven Johnson, Pharm.D.[1], Rena Gosser, Pharm.D., BCPS[2], Janna Afanasjeva, Pharm.D., BCPS[3]
[1]*Pharmacy Systems, Inc. (a CPS Company), Dublin, Ohio;* [2]*School of Medicine, University of Washington, Seattle, Washington;* [3]*Chicago College of Pharmacy, University of Illinois, Chicago, Illinois*

History of Inception: The ACCP DI PRN inception was spearheaded by Amy Peak from Butler University, who also served as its first Chair. Official recognition by ACCP as a PRN was granted in December 2002.

DI PRN Goals:

1. Provide opportunities for pharmacists to network, problem-solve, and discuss drug information professional challenges.
2. Promote practice, research, and education related to drug information.
3. Foster the growth of drug information in clinical pharmacy practice.
4. Encourage the practice of evidence-based medicine.

Organizational Growth: Membership has grown from the initial 50 member-minimum in 2002 to over 275 members in 2019. The DI PRN represents students, residents, and practitioners from a variety of settings in the United States and abroad Nearly 70% of DI PRN members are certified by the Board of Pharmaceutical Specialties and several are Fellows of ACCP.

Significant PRN Achievements: The DI PRN provides continuing educational programming, offers networking opportunities, and recognizes individual contributions to drug information practice.

The DI PRN has 4 standing committees:

1. **Educational Programming Committee** (led by the Chair-Elect) - develops the focus session proposal for the ACCP Annual Meeting and identifies speakers.
2. **Membership Committee** (led by the Membership Committee Chair) - formed in 2014 with the goal of bringing journal club/webinar offerings, website enhancements, and other activities to enhance the membership experience and increase membership.
3. **Poster Committee** (led by the Secretary/Treasurer) - peer-reviews drug information-related posters and awards a “best poster” award annually.
4. **Nominations Committee** (led by the Immediate-Past Chair) - formed in 2018 with the initial goal of formulating objective criteria for evaluating candidates for elected office and the Distinguished DI Practitioner award.

Future of PRN: Areas of focus will include membership growth, engagement and recognition of professional contributions to the field

of drug information. The development of mentorship and member collaboration opportunities are also potential areas of pursuit.

Education/Training

582 | The history of the education and training PRN

Sarah T. Eudaley, Pharm.D., BCPS[1], Erica F. Crannage, Pharm.D., BCPS, BCACP[2], Holly Gurgle, Pharm.D., BCACP, CDE[3], Eliza Dy-Boarman, Pharm.D., BCPS[4]

[1]*Department of Clinical Pharmacy and Translational Science, University of Tennessee Health Science Center, College of Pharmacy, Knoxville, Tennessee;* [2]*St. Louis College of Pharmacy, St. Louis, Missouri;* [3]*Family Health Clinic, ARUP Laboratories, Salt Lake City, UT;* [4]*Department of Clinical Sciences, Drake University College of Pharmacy and Health Sciences, Des Moines, Iowa*

History of Inception: The Education and Training PRN was officially recognized by ACCP in 2002 with a mission to promote dialogue among members and develop programs that enhance the knowledge and skills of members involved in education and training within clinical pharmacy. The founding members had a vision of supporting its mission by cultivating a supportive and nurturing community to promote lifelong learning.

Organizational Growth: PRN membership exceeds 500 members representing practitioners, students, and post-graduate trainees from 47 states and 14 countries. Most members serve as faculty within colleges/schools of pharmacy and precept students and/or residents. The PRN has expanded to include eight committees and one task force. Communication platforms have grown to include an email listserv, Facebook and Twitter accounts, and the annual newsletter.

Significant PRN Achievements: Since 2007, the PRN has hosted a mock interview session in conjunction with the PRN business meeting during the Annual Meeting. Members serve as mock interviewers and trainees are invited to prepare for residency, fellowship, and job interviews. Trainee participant's perceptions were described in a recent peer-reviewed publication by PRN members. The PRN is proud to provide financial support for membership growth and development, including annual trainee travel awards, Teaching Enhancement grants, and MeRIT/FIT scholarships. Each year a PRN sponsored educational focus session is delivered during the Annual Meeting, with many of these being offered as elective credit for the ACCP Academy Teaching and Learning Certificate program.

Future of the PRN: PRN goals include continued growth and engagement of members through an increased presence on social media and expanded opportunities for professional development. Current initiatives are focused on the identification and dissemination of best practices related to residency applications.

Emergency Medicine

583 | The history of the ACCP emergency medicine (EMED) practice and research network (PRN): 2008-2019

Craig Cocchio, Pharm.D., BCPS[1], Nadia Awad, Pharm.D., BCPS[2], Molly Howell, Pharm.D., BCPS, BCCCP[3], Elise Metts, Pharm.D., BCPS[4], Preeyaporn Sarangarm, Pharm.D., BCPS, BCCCP[5], Nicole M. Acquisto, Pharm.D., FCCP, BCCCP[6]

[1]*CHRISTUS Trinity Mother Frances Hospital, Tyler, Texas;* [2]*Department of Pharmacy, Robert Wood Johnson University Hospital, New Brunswick, New Jersey;* [3]*Eskenazi Health, Indianapolis, Indiana;* [4]*University of Kentucky Chandler Medical Center, Lexington, Kentucky;* [5]*Department of Pharmacy, University of New Mexico Hospital, Albuquerque, New Mexico;* [6]*Department of Pharmacy, Department of Emergency Medicine, University of Rochester Medical Center, Strong Memorial Hospital, Rochester, New York*

History of Inception: EM pharmacists were first described in the 1970s, but rapid growth occurred since the early 2000s following recognition of the emergency department as a high-risk area for medication errors. The ACCP EMED PRN was formed in August 2008 with support of at least 50 ACCP members (Michael Thomas, Founding Member). Over the past decade the leadership and members have worked towards achieving the long-term vision of the PRN.

Organizational Growth: Membership has increased over 5-fold from 2009 to 2019 (186 to 1067 members, 6th largest PRN).

Significant PRN Achievements: Six committees have been developed and sustained; Awards and Recognition Committee (nominates individuals for ACCP awards, EMED PRN Mentor and Paper of the Year, and Student/Resident Research Travel Awards [12 awarded]), Collaborative Organization for Development of EM Pharmacists (CODE) Committee (matches EM pharmacist partnerships for professional growth), Media Committee (develops PRN newsletters and highlights members [13 published], created and manages the PRN Twitter handle), Programming Committee (organizes the Annual Meeting Focus Session [annually since 2010]), Research Committee (mentors EM pharmacists through research endeavors, creates multicenter research opportunities, organizes professor walk rounds, developed a membership research grant award), and Student Task Force (provides professional development and advocacy for student members, coordinates monthly PRN journal club). Members have won distinguished awards from ACCP and ASHP, are Fellows and of the College, contribute to ACCP committees, collaborate with other national pharmacy and professional organizations on clinical and advocacy endeavors, and are petitioning Board of Pharmacy Specialties to recognize EM pharmacy.

Impact on Patient Care or Outcomes: The PRN work and publications have showcased the benefit EM pharmacists have on patient outcomes in many settings (cardiac arrest, rapid sequence intubation, trauma, myocardial infarction, stroke, sepsis, antimicrobial stewardship, transitions of care)

Future of PRN: Vision for expansion of education, research development, and mentorship.

Gastroenterology

584 | The history of the GI/liver/nutrition PRN

Lauren M. Hynicka, Pharm.D., BCPS[1], Maria Sheridan, Pharm.D.[2]
[1]*University of Maryland School of Pharmacy, Baltimore, Maryland;* [2]*Department of Medical Affairs, Clinical Nutrition, Fresenius Kabi, Collierville, Tennessee*

History of Inception: The GILN PRN was established to create a network of clinical pharmacists interested in gastrointestinal (GI)/liver diseases and nutrition who would promote practice, research, and education in these areas. The PRN's first exploratory meeting was held in Kansas City, Missouri, at the ACCP meeting on October 25, 1999. This meeting was initiated by Rosemary R. Berardi with 25 individuals in attendance. On January 17, 2000, the GILN PRN was officially recognized as an ACCP PRN.

Organization Growth: The PRN has grown considerably over the last 20 years with an average over the last 2 years of close to 200 members.

Significant PRN Achievements: At least 29 GILN PRN members (15%) are currently elected ACCP Fellows, and 115 (58%) are Board Certified Pharmacotherapy Specialists. Members are actively engaged in a variety of educational, professional, and research activities. To this end, GILN PRN members have received at least 10 ACCP Foundation (formerly, ACCP Research Institute) awards, and members have served on the ACCP Board of Regents and as ACCP president. Members have often served the College as authors and reviewers in *Pharmacotherapy* and the Pharmacotherapy Self-Assessment Program (PSAP). Many members are also actively involved in several other professional organizations, including the American Society for Parenteral and Enteral Nutrition and the Society of Critical Care Medicine.

Future of the PRN: The GILN PRN will continue to serve its members by offering high-quality educational and networking opportunities, fostering and promoting advanced training in practice and research related to gastroenterology and nutrition, and promoting collaboration both within and outside ACCP.

Geriatrics

585 | History of the geriatrics practice and research network

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History of Inception: The Geriatrics Practice and Research Network (PRN), recognized on November 12, 1995, is composed of clinical pharmacists dedicated to advancing the care of the aging patient.

Organizational Growth: The Geriatrics PRN has grown five-fold in membership from the 58 founding members to 324 members as of July 2019. Student membership has grown to 55 members.

Significant PRN Achievements: Educating fellow pharmacists on the importance of geriatric pharmacy is a central goal of the PRN. A focus session is held at every ACCP Annual Meeting and frequently at the ACCP Spring Meeting. Members of the Geriatrics PRN have made substantial contributions to the Research Institute, totally over $7000 to the Frontiers Fund from 2008 to 2019. The PRN has provided over $15,000 towards student travel scholarships from 2008-2019.

Our membership is also involved in expanding geriatric pharmacy outside of ACCP. Geriatric PRN members have contributed to a number of significant scholarly activities to advance the safe, effective and appropriate medication use in the geriatric population. During the 24 years of its existence, the PRN membership has published over 1000 articles in almost 200 journals, book chapters, and books with an emphasis on geriatric pharmacotherapy. Additionally, many members have served as reviewers for professional journals. Members of the PRN are active in establishing their credentials in patient care as certified by the Board of Pharmaceutical Specialties (BPS). Currently, over 100 members are currently Board Certified Geriatric Pharmacist (BCGP), and some members hold a variety of additional credentials.

Future of PRN: The future of geriatric pharmacy is bright. The PRN continues to identify, educate, and provide advanced approaches in geriatric pharmacotherapy to optimize medication management in older adults who entrust their pharmaceutical care to geriatric-specialty trained pharmacist.

HIV/AIDS

586 | The history of the HIV PRN

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History of Inception: The HIV PRN was created as a forum where pharmacists, students, residents, and fellows who practice or have an interest within the specialty care area of HIV infection could network, collaborate on research, and discuss clinical controversies and therapeutic issues. The PRN was granted approval in April 2014, and its first business meeting was held in October 2014.

Organizational Growth: Since the HIV PRN's first year, membership has grown from 41 members to more than 200 members. The PRN is composed of the following committees: Education, Research, Nominations & Awards, Advocacy, and Social Media. The HIV PRN aims to enhance its members' expertise through high-level education, collaborative research, and information dissemination. Through collaboration in this forum, its members are able to provide superior care to patients living with HIV in both the inpatient and outpatient settings.

Significant PRN Achievements: The HIV PRN has greatly expanded the number of HIV focus sessions at ACCP Annual Meetings. Topics have been developed alone and in collaboration with other PRNs including "HIV across the Ages," "HIV in Special Populations," "HIV and Gender: Implications for Prevention and Care," as well as focus sessions for inpatient and ambulatory practitioners. The PRN has also produced multiple posters, publications, and 9 members are recognized as ACCP Fellows.

Future of HIV PRN: As advancements in HIV treatment and prevention continue to expand, the role of pharmacists will continue to evolve. The HIV PRN will continue collaborating with other PRNs to increase networking opportunities and educational efforts for pharmacists in various settings. The HIV PRN is working toward further integrating students and trainees into more committees through travel awards and mentorship as the PRN understand the importance of guiding the next generations of pharmacists with an interest in HIV.

Infectious Diseases

587 | Infectious diseases (ID) PRN history 1998-2019

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History of Inception: The ID PRN was established in January 1998 following a petition to the Board of Regents by John Bosso, founding chair. The first formal ID PRN meeting followed in April 1998, with 40 members/prospective members in attendance.

Organizational Growth: Since 1998, membership has grown from 82 to over 2000 members, including 320 student members, making the ID PRN the third largest of 22 PRNs.

Significant PRN Achievements: ID PRN members have played significant roles in leadership positions on the ACCP Board of Regents. Additionally, members have received numerous awards or grants given on behalf of ACCP or funded by the ACCP Foundation. ID PRN members serve on the editorial board or as reviewers of *Pharmacotherapy* in addition to completing many published articles each year, including clinical practice guidelines.

Currently, 105 ID PRN members are recognized as ACCP Fellows. Of the 248 pharmacists with active AQ-ID credentials, 131 are ID PRN members. Additionally, 325 of the 653 practitioners with BCIDP credentials are ID PRN members. The ID PRN has also been a leader in recognizing resident and fellow contributions by establishing fellow membership on the ID PRN Executive Board beginning in 2015, providing travel awards, and recognizing research accomplishments.

The ID PRN significantly contributes to educational opportunities offered its members through sponsorship of focus sessions at every Annual Meeting and every other spring meeting as well as co-development of educational sessions with SIDP and other PRNs throughout the year.

Future of PRN: As the ID PRN looks toward the next 40 years, the PRN will continue to be a resource for clinicians to acquire knowledge on practice, teaching, and research, as well as a facilitator of networking and communication within ID practice. The ID PRN will continue to develop future generations of pharmacists passionate about ID practice.

Nephrology

588 | The history of the nephrology PRN

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History of Inception: The Nephrology PRN was formally approved by ACCP in February 1993, with 73 initial members. The first business meeting was held February 8, 1993, at the ACCP Winter Forum.

Organizational Growth

In the ensuing 15 years, the membership increased to more than 200 members from the United States, Canada, and other countries. Currently, the PRN includes 180 members in total.

Significant PRN Achievements: PRN members have trained more than 90 health care professionals in nephrology-focused programs. The PRN has hosted or collaborated with other PRNs on multiple ACCP educational programs. PRN members have planned and presented at other nephrology meetings, including the National Kidney Foundation (NKF) and the American Society of Nephrology (ASN), and are actively involved in federal programs serving patients with kidney disease, including the Kidney Health Initiative (KHI). PRN

members have been awarded NIH grants and distinguished awards within ACCP and other organizations and several publications have resulted from PRN member collaborations.

Future of PRN: Future PRN aims include: continued training of young pharmacy practitioners, devising training programs to train "eligible professionals" to conduct medication reconciliation, given that CMS recently announced that medication reconciliation would be added as a Quality Improvement Program (QIP) reporting measure for all dialysis units starting in 2022, continued advocacy efforts for additional measures for medication review and comprehensive medication management in patients undergoing dialysis and patients with CKD, continued efforts to promote pharmacist inclusion as a recognized team member in dialysis care for future ESRD Conditions for Coverage, strong advocacy for integrating pharmacy services to improve quality care in patients with stage 4 and 5 CKD, including recognition in payment models that Center for Medicare & Medicaid Innovation (CMMI) given the U.S. governmental administration announcement in 2019 regarding advancing kidney care in the United States.

Oncology

589 | The history of the hematology/oncology PRN

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History of Inception: The Hematology/Oncology (HMON) Practice and Research Network (PRN) was established in 1994 with 50 members to improve professional collaboration amongst clinical pharmacists who practice in hematology and oncology settings; Dr. William Petros of West Virginia University led it. The Hematology/Oncology PRN focuses on developing and promoting the growth of the hematology/oncology clinical pharmacy profession involving hematology/oncology clinical pharmacists, students, residents, and fellows in their education, projects, and initiatives.

Organizational Growth: As of August 2019, the PRN had more than 700 members, and trainees make up nearly 50% of the PRN membership. Throughout the years, the PRN has sponsored resident and student research presentations during the Business Meeting. The PRN also created a biannual newsletter, Facebook, and Twitter to communicate to our PRN members in various novel ways.

Significant PRN Achievements: The Hematology/Oncology PRN has been very fortunate over the years to have had PRN members serve in executive leadership roles with ACCP, earn ACCP Awards, been recognized as ACCP Fellows, and/or achieve Board Certified Oncology Pharmacist (BCOP) status. Some of the ACCP Awards the Hematology/Oncology PRN members have earned include the Therapeutic Frontiers Lecture, Russell R. Miller Award, New Investigator Award, ACCP Clinical Practice Award, and Robert M. Elenbaas Service Award. Currently, 30 members of the Hematology/Oncology PRN have been recognized as ACCP Fellows. Currently, 201 members of the Hematology/Oncology PRN have achieved Board Certified Oncology Pharmacist (BCOP) designation.

Future of PRN: The Hematology/Oncology PRN has taken several steps recently to engage its members more and to have an active role shaping the direction of the PRN. Besides our new ways of communicating with our PRN members, the Hematology/Oncology PRN formed committees to address various needs in the PRN. These PRN committees have included communications, residents and students, and membership, all chaired by the PRN officers.

Other

590 | The history of the pharmaceutical industry PRN (PI-PRN)

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History of Inception: The PI-PRN, founded in 1998, is celebrating its 21 years of serving not only ACCP members in the pharmaceutical industry but also across all therapeutic disciplines/PRNs. This unique PRN included 77 founding members.

Organizational Growth: Membership reached a peak of 440 in 2015 by providing educational and developmental programs, as well as networking opportunities, for pharmacists practicing in all aspects of industry.

Significant PRN Achievements: Multiple on-line forums have been held with pharmacy students and pharmacists about opportunities within the pharmaceutical industry. These forums have resulted in increased enrollment in the PRN from a nadir of 110 members in 2017 to 228 members today. Members of the PI-PRN authored a paper on "Pharmacists and Industry: Guidelines for Ethical Interactions" in Pharmacotherapy 2008. PI-PRN Focus Sessions have included globally-recognized speakers covering topics including discovery and development innovations tying these activities to clinical practice, impact and implications of DTC, US and global pharmacovigilance, changes in the regulatory environment and ethical considerations both in the US and globally, and patient-centric health outcomes. The PI-PRN Focus Sessions have partnered with other PRNs, including Pharmacokinetics/Pharmacodynamics, Endocrine & Metabolism, Global Health, Pain and Palliative Care, and Hematology/Oncology, optimizing the time of ACCP members who have conflicting calendars for Focus Sessions.

Future of PRN: The PI-PRN is focused on education of pharmacists, students, and other health care practitioners on the pharmaceutical industry and future career opportunities. Most members were clinicians prior to joining the industry, and as such, can assist in the

translation of the different roles. Further, the above Pharmacotherapy paper is outdated, thus a position paper needs to reflect the current climate of the industry. Interactions with other PRNs bring the patient to the forefront of unmet needs which is essential for research directions within PhRMA; a primary focus of the PI-PRN.

591 | The history of the central nervous system PRN

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History of Inception: The CNS PRN charter was developed by four ACCP members and approved by the Board of Regents in November 1993. Larry Cohen served as the first PRN chair.
Organizational Growth: Since its conception in 1993, membership has grown over three-fold, serving more than 250 members today.
Significant PRN Achievements: Several current or former members of the CNS PRN have achieved Fellow of ACCP status, served the ACCP Board of Regents, Research Institute Board of Trustees and *Pharmacotherapy*. Many members have also achieved Clinical Practice, Investigator and Education Awards. Three members have served as former ACCP Presidents, including Barbara Wells, William Kehoe and Larry Cohen and Barbara Wells is a recipient of the Paul F. Parker medal in 2012.
Future of PRN: The CNS PRN aims to offer clinical pharmacy practitioners and pharmacy learners the opportunity to develop both clinical and leadership skills by acting as advocates and leaders for advancements in the profession of pharmacy in general and the specialty of neurology and/or psychiatry in specific. The CNS PRN will continue to engage its members and hopes to expand these activities by increasing communication and networking through media and increasing educational opportunities. The CNS PRN also hopes to bring awareness and education to those who are non-psychiatric and non-neurology pharmacy to help advance their practice.

592 | The history of the endocrine and metabolism PRN

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History of Inception: A group of 21 founding members led by Kent Porter established the E&M PRN's goals and objectives during the 2004 ACCP meeting in Dallas, Texas. The ACCP Board of Regents unanimously approved the PRN for acceptance and ratification in 2005.
Organizational Growth: The E&M PRN's membership has increased from 21 founding members to 286 active members in 2019. A recent membership survey revealed over half of PRN members hold two or more certifications, most commonly Board Certified Pharmacotherapy Specialist (BCPS), Board Certified Ambulatory Care Pharmacist (BCACP), Certified Diabetes Educators (CDE) and Board Certified Advanced Diabetes Management (BC-ADM) certifications. PRN members practice in a wide range of settings, with ambulatory clinics and academia being the most common practice areas. Thirty E&M PRN members have obtained fellowship status with ACCP.
Significant PRN Achievements: The E&M PRN has consistently contributed to ACCP through educational programs and networking initiatives. The PRN has continued to support the ACCP Foundation Frontiers Fund and the ACCP Travel Awards Program. The PRN has fostered the development of members in training by establishing resident awards in 2010 and expanding the award to student members in 2014. The PRN has awarded 14 travel awards for students and residents since 2010. The PRN has focused on expanding PRN member contributions to publications that include special topics and opinion papers. The PRN has continued to host an active e-mail list, established the E&M PRN blog, and developed quarterly newsletters as resources for its members.
Future of the PRN: The E&M PRN will continue to contribute to ACCP and the clinical pharmacy profession by developing innovative focus sessions, being involved in advocacy initiatives, promoting scholarly activity and research endeavors within the therapeutic area of endocrine and metabolism, and fostering leadership within ACCP.

593 | The history of the cardiology PRN

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History of Inception: The American College of Clinical Pharmacy's (ACCP) Cardiology Practice & Research Network (PRN) was established May 5, 1993, under the leadership of its first chair, Dennis Clifton (University of Kentucky), with an initial 88 members. The PRN's mission is to advance the pharmacotherapy of cardiovascular disorders by promoting excellence in education, research, and clinical practice.

Organizational Growth: The Cardiology PRN consistently ranks in the top 5 of PRN membership, peaking at over 1300 members. The PRN has an active e-mail list that averages 20-30 messages per month on topics ranging from clinical queries to PRN news and updates. Communication has changed over the years, with the first PRN newsletter issue made available in October 1993. In 2008, the newsletter began publishing once yearly, informing the membership of PRN-related activities as well as advances in practice/research.

Significant PRN Achievements: The Cardiology PRN has a long history of leadership within ACCP, with 7 past Presidents, 4 Secretary/Treasurers, and 17 Regents. As of October 2018, 117 current or former Cardiology PRN members were ACCP Fellows. In 2011, the PRN began working with the Board of Pharmaceutical Specialties (BPS) to develop a cardiology specialty exam (BCCP). The nine-member BPS Specialty Council on Cardiology Pharmacy is composed entirely of PRN members. The PRN has lead and published over 20 â€˜key articles and guidelines' papers across a range of cardiovascular topics. The PRN has also produced/collaborated on six PRN opinion papers including therapeutic, training, and practice topics.

Future of PRN: Because heart disease remains the No. 1 cause of death in the United States, ensuring that patients with heart disease receive appropriate treatment will be as important as ever. The ACCP Cardiology PRN continues to be the leader in practice, scholarship, engagement, and advocacy for clinical pharmacy practitioners interested in cardiovascular pharmacotherapy.

594 | The history of the pharmacokinetics/pharmacodynamics/pharmacogenomics PRN

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History of inception: The Pharmacokinetics/Pharmacodynamics Practice and Research Network (PRN) was established in Fall 1997 under founding chair Dr. Stephen Piscitelli, chair-elect Dr. Aaron Burstein, and secretary/treasurer Dr. Guy Amsden.

Organizational Growth: PRN membership grew from 63 founding members in 1997 to 170 by 2001. Membership was fairly stable through 2010, at which point membership began growing to a peak of 367 members in 2016. One driver of growth was the incorporation of members focusing on pharmacogenomics, and in 2011, the PRN officially changed its name to the Pharmacokinetics/Pharmacodynamics/Pharmacogenomics (PK/PD/PG) PRN.

Significant PRN Achievements: The PK/PD/PG PRN has been active and collaborative in developing educational programing, including 23 ACCP Meeting Focus Sessions. In 2002, the PRN established the M. Kelli Jordan travel award, which has provided a mechanism for 12 trainees to date to attend the ACCP Annual Meeting to present their research. Recently, PRN members led collaborative manuscripts regarding precision medicine/pharmacotherapy that were featured in the June 2019 issue of the *Journal of the American College of Clinical Pharmacy* and also created an online PK/PD/PG post-graduate training database, listing residencies, fellowships, and graduate programs in the field. Several PRN members have served in key ACCP leadership roles, including five ACCP Presidents and four ACCP Regents.

Future of PRN: Over the past two decades, the PRN has expanded from a more traditional PK/PD focus to also include members who are researching and clinically implementing pharmacogenomics. It is likely that over the next decade, more clinicians and scientists specializing in other aspects of precision medicine that affect PK/PD (eg, epigenetics and microbiomics) will join the PK/PD/PG PRN. Still, we expect that the PK/PD/PG PRN will represent a unique group of clinicians, researchers, and drug development experts who have a passion for PK/PD/PG as well as expertise in specific disease states.

595 | Global health PRN

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History of Inception: The establishment of the Global Health PRN was led by Dr. Renee Holder in 2015, who envisioned a place where pharmacists could connect around global health concerns. The PRN's mission is to promote the clinical pharmacist's role in global health and to improve health worldwide. The goals include providing clinical pharmacists, trainees, and researchers with a single network to address global health concerns, reducing international disparities in the delivery of pharmacy services, and learning from the successes and mistakes of other nations through education, research, and idea sharing. The three standing PRN committees include Programming, Member Engagement, and Scholarship.

Organizational Growth: Since inception, the Global Health PRN has had two elected positions: chairs/chair-elects (n = 4) and secretary/treasurers (n = 3). The PRN started with 37 mostly student members and has since stabilized to approximately 160 members, with most being full ACCP members. With more universities and clinical institutions beginning to prioritize global health, the PRN anticipates future growth in membership.

Significant PRN Achievements: The Global PRN has robust communication and networking mechanisms including (1) Triannual newsletters, (2) Social Media, and (3) a postgraduate global health training directory for students and residents.

The PRN has awarded two pharmacist recipients with the annual Renee Holder memorial award, which recognizes an individual who has made innovative and meaningful contributions to improving or expanding global health pharmacy practice.

Educational sessions have been offered at all annual meetings, with two co-sponsored by other PRNs. This past year the PRN also developed instructional webinars for members.

Future of the PRN: As the boundaries of the world dissolve, there is an increasing need for pharmacists equipped to care for culturally diverse patients and globally expand pharmacy practice. The PRN is responding by developing global health pharmacy position statements, partnering with other pharmacy organizations, assisting individual global partnerships and expanding the professional development of its members.

Pediatrics

596 | The history of the pediatrics PRN

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History of Inception: At the 1992 ACCP Annual Meeting, an invitation was sent to ACCP members to attend an organizational meeting for creating a Pediatrics PRN. In 1993, the ACCP Board of Regents approved the creation of the Pediatrics PRN, which included 90 original members.

Organizational Growth: Since its inception, the PRN has grown substantially from 90 members (1993) to over 1,100 members (2019). In part due to this growth, the Pediatrics PRN has been able to sponsor PRN members for ACCP programs including FIT and MeRIT. Additionally, the Pediatrics PRN has been able to develop and sustain a student and a resident/fellow travel award.

Significant PRN Achievements: The strength of the Pediatrics PRN is its membership, who have accomplished many great things over the past decade and beyond. The number of Fellows of ACCP that are also PRN members has grown from 17 (2009) to 40 (2019). Many current and former members of the PRN have served ACCP in other high-level leadership positions including President, Board of Regents and Board of Trustees of the ACCP Foundation. Thirteen current or former PRN members have also been recognized by ACCP through the College's awards such as the Russell R. Miller Award and Paul F. Parker Medal. The members of the PRN have a very strong record of scholarly production and are responsible for delivering the Focus Session each year at the Annual Meeting. Lastly, the membership has developed and now sustains the Pediatric Pharmacy Preparatory Review Course and Pediatric Self-Assessment Programs in support of BCPPS credentialing.

Future of PRN: The Pediatrics PRN has a strong history and a bright future. The PRN will continue to support its members in their pursuits of excellence and innovation in pediatric clinical pharmacy practice, research, and education that will positively influence the patients they serve and the profession.

Women's Health

597 | The American College of Clinical Pharmacy Women's Health Practice and Research Network: A look at 25 years of history

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History of Inception: The Women's Health (WH) Practice and Research Network (PRN) traces its history to the Women's Health Task Force that met in 1992 under the leadership of Rosalie Sagraves, Pharm.D., and David Lourwood, Pharm.D. The group's mission embraced obstetric and gynecologic care, addressed differences in pharmaceutical care between sexes, promoted advancement of health care for women, advocated for future research to include women, and examined the role of women as health care practitioners. In February 1998, the original 50 members successfully submitted an application to form the WH PRN and to be officially recognized by ACCP.

Organizational Growth: The WH PRN now consists of over 200 members including pharmacists, pharmacy residents, and students. Pharmacist members include clinicians, educators, researchers and pharmaceutical industry representatives. Members' interests range throughout the lifespan and include family planning, obstetrics, gynecology, menopause, the aging issues of osteoporosis and heart disease, and sex-related pharmacokinetics.

Significant PRN Achievements: The WH PRN has collaborated with ACCP and various PRNs to develop the ACCP Pharmacotherapy Didactic Curriculum Toolkit. Members have written six opinion papers, developed two textbooks covering women's health issues, contributed to various PSAP and ACSAP Women's and Men's Health series, and have numerous publications.

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Impact on Patient Care or Outcomes: Over the last 25 years, members have furthered the education and practice of gender-based issues in pharmacy care and participated in a number of initiatives in and outside of ACCP. They have developed educational curricula and novel practice sites, written and consulted on position papers and commentaries, and have presented topics of interest to other ACCP members through PSAP modules and programming at national meetings.

Future of PRN: Future goals of the PRN include a review paper on the pharmacist's role in labor and delivery and a multi-site study related to pharmacist prescribing of hormonal contraception.