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ABSTRACTS

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ORIGINAL RESEARCH

ADR/Drug Interactions

1 | Retrospective study evaluating immune related adverse events in cancer patients treated with pembrolizumab

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Introduction: Though pembrolizumab has been on the market for several years, most of its safety data is based on clinical trials with limited literature reflecting real-world analysis of immune-related adverse events (irAEs).

Research Question or Hypothesis: In clinical practice, what are the type of irAEs experienced with pembrolizumab and what is their impact on patient management?

Study Design: Retrospective study at a comprehensive cancer center in Jordan.

Methods: The pharmacy medication system was used to identify adult patients (≥18 years old) who received at least one dose of pembrolizumab between January 2016 and December 2019. Patients with autoimmune disease were excluded. The clinical notes and the pharmacy adverse event reporting system were reviewed to identify any reported pembrolizumab-associated irAEs. The Naranjo scale was used to assess the likelihood of these irAEs. The impact of the adverse events on patient management was evaluated by determining whether it was associated with hospital admission, required initiating medications, or discontinuation of pembrolizumab.

Results: Over the study period, 1,615 cycles of pembrolizumab were evaluated for 223 patients. The mean age was 52 years ±16 (SD), 71% were males, and 62% had metastatic lung cancer. A total of 64 irAEs were reported in 56 (25%) patients. The type of irAEs included respiratory (30%), gastrointestinal (25%), endocrine (25%), and dermatology (20%). Naranjo scale scoring ranged from possible to definite. Among the reported irAEs, 27 (42%) required hospital admission, 45 (71%) required short-term supportive therapy, 15 (24%) required long-term medications, and 9 (14%) required pembrolizumb discontinuation.

Conclusion: About one-fourth of the patients developed irAEs, with respiratory events being the most common. The majority of the reported irEs required supportive therapy. Further studies are necessary to identify predictors of adverse events and measures to minimize their impact.

2 | Categorizing the frequency and severity of potential outpatient rifamycin drug interactions at an academic medical center

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Introduction: Rifamycins are associated with multiple drug interactions and present challenges in medication management. While interactions may be appropriately managed in closed inpatient systems, little is known about rifamycin drug interactions in outpatient settings, where multiple prescribers and pharmacies may be involved.

Research Question or Hypothesis: What is the frequency and severity of drug interactions associated with initiating outpatient rifamycins?

Study Design: Single-centered, retrospective review of electronic medical records.

Methods: Medical records of outpatients prescribed a rifamycin from August 2019-February 2020 were reviewed. To identify potential drug interactions on active medications, fills 4 months prior to rifamycin prescriptions were documented. All medications were entered into the UpToDate drug interaction database to assess for interaction severity. Mitigation of potential interactions was not assessed. This study received IRB approval.

Results: Seventy-seven patients were prescribed a rifamycin, with 1 patient missing other medication information, so ultimately 76 patients were included. Rifampin was prescribed in 96% and rifabutin in 4%. Potential drug interactions were found in 72 patients

Interaction Category	Number of Interactions (n)	Interactions Per Patient, Median (Range)
X	26	0 (0-3)
D	108	1 (0-5)
C	164	2 (0-7)
B	8	0 (0-1)
A	0	0 (0-0)
Total	306	4 (0-12)

(94.7%), and the number of interactions ranged from 0-12 per patient. Potential C-rated drug interactions were the most frequently encountered (66 patients, 86.8%). Potential X-rated interactions were present in 21 patients (27.6%), D-rated in 58 patients (76.3%), B-rated in 8 patients (10.5%) and no A-rated interactions. The distribution of potential drug interactions is in table 1.

Conclusion: This retrospective review demonstrated most patients had potential drug-drug interactions, with up to 78.9% (n = 60) of patients with D-or X-rated interactions. Pharmacists can have a major role in mitigating potential drug interactions in outpatient clinics prescribing rifamycins. Further analysis of drug interactions and development of safety measures may be of future interest.

3 | Relationship between self-reported medication side effects, adherence, and treatment satisfaction among patients with poorly controlled blood pressure in a primary care setting

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Introduction: Among patients with poorly controlled blood pressure (BP), little is known about how medication side effects are related to poor medication adherence and treatment dissatisfaction.

Research Question or Hypothesis: For patients in a primary care setting with poorly controlled BP, how often are common side effects reported as a "Big/Very Big problem", and how is perceived relatedness of side effects to their BP medication associated with adherence and treatment dissatisfaction?

Study Design: Mailed baseline survey in a pragmatic cluster-randomized trial (ClinicalTrials.gov Identifier: NCT02996565)

Methods: 3072 patients with diagnosed hypertension (BP ≥150/95 mm Hg) enrolled at primary care visits were assessed for medication side effects, adherence, and satisfaction.

Results: Among respondents completing the side effect questions (n = 1642) the average age was 62 years, 46% male, 73% white, and 31% had a college degree. Mean baseline BP was 164/93 mm Hg and median number of BP medications was 2. Overall, 22% reported non-adherence (changing/stopping BP medications even for a few days) due to possible side effects and 22% were dissatisfied with their BP medication. Those reporting a big/very big problem with 4 common symptoms, stratified by whether the symptom was perceived as related to the BP medication are described:

Conclusion: Patients reporting side effects perceived as related to their BP medications have much higher rates of BP medication dissatisfaction and poor medication adherence. Research exploring whether side effect information could be used to improve medication adherence and satisfaction may be warranted.

Adult Medicine

4 | Clinical impact of pharmacy students during an international advanced pharmacy practice experience

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Introduction: An international advanced pharmacy practice experience (APPE) in South Africa allows

pharmacy students to practice in an acute care environment typically devoid of daily clinical pharmacist involvement. During the APPE's 10 years of existence, students are responsible for developing and delivering clinical interventions daily. However, to date, intervention acceptance rate and classification have not been evaluated in this setting.

Research Question or Hypothesis: What is the acceptance rate of clinical interventions suggested by pharmacy students while

	Big/Very Big problem with medication				
		Dissatisfaction with BP medication		Self-reported non-adherence	
Side Effect	Reporting symptom (n/%)	Perceived related to BP meds	Not perceived related to BP meds	Perceived related to BP meds	Not perceived related to BP meds
Tiredness	295 (18%)	45%	24%	44%	26%
Dizziness	119 (7%)	48%	33%	62%	31%
Frequent urination	192 (12%)	39%	25%	37%	24%
Sexual symptoms	151 (9%)	37%	25%	52%	24%

completing an international acute care APPE and what types of interventions are most prevalent?

Study Design: This was a prospective, observational quantitative evaluation of total number, acceptance rate, and categorization of suggested interventions by APPE students at a public-sector district-level hospital in Cape Town, South Africa.

Methods: Students were provided a list of literature-based clinical intervention categories (e.g., medication discontinuation, dosage adjustment, route change, etc.) prior to departure. Daily, students documented how many interventions from each category were suggested, after review by a registered pharmacist, via an Excel spreadsheet. For the primary objective, students then documented whether these clinical interventions were accepted at 24-, 48-, and 72-hours. No statistical analysis was conducted as collected data included only de-identified raw numbers of intervention classification(s) and acceptance rate.

Results: During the 4-week APPE in 2019, students suggested a total of 58 interventions via direct discussions with physicians or written progress notes. Medication additions (n = 30), medication discontinuations (n = 14), dosage adjustments (n = 10), route changes (n = 2), and goal-directed therapy alterations (n = 2) were suggested and documented. Overall intervention acceptance rates were 40%, 48%, and 50% at 24-, 48-, and 72-hours, respectively.

Conclusion: A 72-hour intervention acceptance rate of 50% shows the potential impact of APPE students practicing clinically during an international APPE. Through continued clinical pharmacy exposure, these settings will hopefully realize the benefits and continue to expand the role of clinical pharmacists within South Africa.

5 | Threading the needle: A quality improvement project to optimize intravenous drug use documentation and subsequent healthcare

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Introduction: Persons who inject drugs (PWID) have a 60-90% chance of contracting Hepatitis C Virus (HCV) within 5 years. A barrier to identifying PWID and subsequent HCV screening is lack of both standardized documentation in the electronic health record (EHR) and an ICD-10 code specific to intravenous drug use (IVDU). The purpose of this study was to improve identification and documentation of PWID to optimize HCV care in which pharmacists have a growing role.

Research Question or Hypothesis: Lack of standard history collection and documentation regarding IVDU is leading to misclassification of PWID patients.

Study Design: Retrospective review of a quality initiative at a Federally Qualified Health Center.

Methods: To enhance the drug history documentation process, drug use history options were expanded (phase I) and an IVDU-specific question was added (phase II). Data was collected from the EHR. Patients who used substances with IV administration potential, but no route specified, were categorized as "PWID potential." Chi-square test was used to analyze the relationship between groups over time. Z tests were used to analyze the significance of PWID confirmed patients amidst total population as a proportion in each phase.

Results: During phases I and II of the study there were more PWID confirmed and fewer PWID potential (table 1; $P < 0.001$).

PWID status was confirmed in 2.1% (n = 189 of 9095), 5.3% (n = 272 of 5149), and 8.7% (n = 554 of 6401) of patients during baseline, phase I, and phase II, respectively. Differences between each phase were significant ($P < 0.001$).

Conclusion: The enhanced drug use history process and IVDU specific question more than quadrupled the proportion of PWID identified and increased clarity as evidenced by fewer "PWID potential" across all phases. Our data highlights the need to establish best practices for identification and documentation of IVDU.

Table 1: Status by phase

	Baseline	Phase I	Phase II
PWID Confirmed	189	272	554
PWID Potential	391	335	201

6 | Evaluation of basal insulin dose reductions in hospitalized patients while unable to eat

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Introduction: The American Diabetes Association recommends a basal insulin or basal plus correctional insulin regimen for non-intensive care unit (ICU) hospitalized patients with type 2 diabetes mellitus (T2DM) with poor nutritional intake or are unable to eat (NPO, nil per os). There is limited evidence available examining the ideal basal insulin dose reduction for non-ICU patients while NPO. This study aims to determine the percent reduction of maintenance basal insulin that would provide the least hypoglycemic incidence in non-ICU patients with T2DM.

Research Question or Hypothesis: What difference in hypoglycemia exists between various basal insulin dose reductions for hospitalized, non-ICU patients with T2DM?

Study Design: Retrospective, cohort, single-center study

Methods: This IRB-approved retrospective cohort study evaluated adult patients with T2DM prescribed outpatient basal insulin with a

minimum NPO status of two hours. Patients were divided into four groups; <25%, 25-50%, 51-75%, >75% of basal insulin administered compared to home dose. The primary endpoint was the incidence of hypoglycemia during the NPO period. Secondary endpoints included incidence of hyperglycemia, severe hypoglycemia, median daily blood glucose (BG) and hospital length of stay. Nominal and continuous data were analyzed with the Chi-square and Kruskal-Wallis tests, respectively. Bonferroni testing strategy was utilized to control for overall type I error.

Results: A total of 173 patients were included. The primary outcome of hypoglycemia (5.9% vs 8.8% vs 14.3% vs 12.3%; $P = 0.578$) was similar in all treatment groups. There were no significant differences in hyperglycemia ($P = 0.0701$), severe hypoglycemia ($P = 0.578$) and median daily BG ($P = 0.428$). Patient's receiving 25-50% of home basal insulin had the longest NPO duration (11.5 hrs; $P = 0.026$); however, this was not statistically significant when adjusted using the Bonferroni correction for multiple tests.

Conclusion: No differences were observed in hypoglycemic events in hospitalized, non-ICU patients with T2DM while NPO receiving various basal insulin dose reductions.

7 | Improving utilization of primary care clinical pharmacy services with robotic calls

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Introduction: Literature supports the use of pharmacists to positively impact patient care, however pharmacist utilization to combat the polypharmacy prevalence remains low. Dartmouth-Hitchcock has embedded pharmacists within primary care to provide clinical services such as polypharmacy review, however the service has largely relied on provider referrals. In the 3 months before the implementation of this strategy, 26 new referrals for polypharmacy review were placed.

Research Question or Hypothesis: Is the implementation of robocalls an effective strategy to increase the utilization of clinical pharmacy services in the primary care setting?

Study Design: retrospective review

Methods: Eligible patients had to meet the following criteria, age 18-75, taking 10 plus medications and have established a PCP within the clinic. Patients were excluded if they had a prior or future visit scheduled with the pharmacist. Eligible patients were contacted over two months using a contracted company who provides scripted robotic calls introducing pharmacy services to offer clinic appointments.

Results: Using robotic calls, 1308 potential polypharmacy patients were outreached with a 55% engagement rate. A total of 80 unique patients were successfully seen for a polypharmacy review over 3 months with a high patient satisfaction rate. During these visits, an average of 4.4 medication discrepancies were reconciled in the EMR per patient. An average of 2.8 additional interventions were made to optimize drug therapy. 26% were informational and 74% were recommendations to improve care with a 94% provider acceptance rate.

Conclusion: Leveraging the use of robocalls to increase utilization of clinical pharmacy services is an effective strategy. Through the use of robocalls, direct patient care appointments with the pharmacist increased by more than 200% without the need for additional scheduling staff. This increase in utilization led to an improvement in patient care by providing evidence based clinical interventions with a high acceptance rate by providers.

8 | Implementation of daily pharmacy student new medication education during hospitalization to improve patient satisfaction

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Introduction: Studies have shown that patients would like to receive more medication education while hospitalized. Nurses primarily take on this responsibility. Patient satisfaction is measured using surveys and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores. Higher patient satisfaction has been correlated with lower mortality and fewer hospital readmissions.

Research Question or Hypothesis: By introducing pharmacy students to provide new medication education to inpatients, HCAHPS scores will increase for the medication-related questions.

Study Design: This was a quasi-experimental study. Four pharmacy students were assigned one inpatient general medicine unit to provide education on new medications during the study period, June-September 2019.

Methods: Patients were included if they were age 18 or older, admitted to the unit for over 24 hours, and were started on new medications. Students focused on the purpose and side effects of each medication. The primary end point was the change in HCAHPS scores for the medication communication domain on the intervention unit compared to a control medicine unit for the pre-intervention (March-May) to the intervention period.

Results: A total of 123 patients were educated during the intervention period, with a mean age of 63.1 ± 16.9 and mean number of new medications 2.2 ± 1.2. The most common categories of medications included anticoagulants (66, 25%), antibiotics (59, 22%), and analgesics (31, 12%). Average HCAHPS scores for the medication communication domain for the intervention unit increased from 68% pre-intervention to 91% during the intervention (23% change, $P = 0.036$), while the control unit remained stable at 78% both pre- and during the intervention ($P = 0.98$).

Conclusion: In this study, an increase in the medication communication HCAHPS score for the intervention unit was observed, while the control unit remained stable. This study has the potential to drive change by implementing pharmacy students throughout inpatient units to educate patients on new medications thereby improving patient satisfaction.

9 | Effects of utilization of an insulin/dextrose order panel for hyperkalemia for the prevention of hypoglycemia

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Introduction: Administration of insulin with dextrose is among the first-line pharmacologic treatments for hyperkalemia to drive potassium intracellularly. Iatrogenic hypoglycemia occurs in around 20% of patients treated with insulin for hyperglycemia. An order set is imperative for decreasing the rates of hypoglycemia and increasing appropriate use of dextrose. The updates to our order set included adding IV dextrose 25 g every 1 hour for 2 doses and an automatic order for blood glucose monitoring every hour for 5 hours after insulin administration.
Research Question or Hypothesis: Did the updates to the hyperkalemia order decrease the incidence of hypoglycemia?
Study Design: This was a retrospective chart review.
Methods: 105 patients treated for hyperkalemia with the order set in 2019 were randomly selected until 35 patients were identified from the following areas: the emergency department, intensive care, and medicine floors. A group of randomly selected patients treated with the previous order set was used for comparison.
The primary endpoint is the rate of hypoglycemia (blood glucose <70 mg/dL). The secondary endpoints include the rate of severe hypoglycemia (blood glucose less than 50 mg/dL), reduction in serum potassium, and frequency of glucose checks.
Results: In comparison to data collected in 2017, there is a decrease in the incidence of hypoglycemia from 26% (40/153) to 14% (15/105) in patients that receive insulin for the treatment of hyperkalemia. There were no differences in the rates of hypoglycemia and severe hypoglycemia in the practice areas. There was no difference (P = 0.882) between doses of dextrose given and severe hypoglycemia. There were no differences in percentages of blood glucose checks.
Conclusion: An updated order set including the addition of a second dose of dextrose and routine blood glucose monitoring resulted in fewer hypoglycemic events. There is room for improvement for obtaining blood glucose measurements.

10 | Recurrent stroke in mono versus dual antiplatelet therapy in patients with ischemic stroke

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Introduction: The use of single antiplatelet after stroke is well established. Yet, the use of dual antiplatelet is controversial and might be effective in specific patients with ischemic stroke. The 2018 Guidelines for Management of Acute Ischemic stroke stated that the use of dual antiplatelet can be continued for 21 to 90 days. However, whether to continue mono or dual antiplatelet after 90 days is a source of debate.
Research Question or Hypothesis: The purpose of this study is to compare mono and dual antiplatelet therapy in patients with ischemic stroke.
Study Design: Single center, retrospective, and chart review from January 2015 to October 2019.
Methods: Adult patients who had first incidence of ischemic stroke and started on aspirin alone, clopidogrel alone or combination therapy for at least 6 months were included. Patients who had hemorrhagic stroke and transient ischemic attack were excluded. Primary outcome was recurrent stroke within 9 months. Secondary outcomes were readmission rate and any bleeding events.
Results: A total of 353 patients were included, 184 patients were on mono therapy while 169 patients were on dual therapy. There was no difference between the two groups in baseline characteristics and comorbidities. The mean age of included patients was (63.2 ± 13.9 years in Mono group versus 62.1 ± 13.2 in Dual group, P = 0.68). Regarding recurrent stroke, there was a statistical difference between the groups (Mono = 19 (10.3%) versus Dual = 6 (3.6%), P < 0.013). Regarding secondary outcomes, there were no difference between the two groups, readmission rate (Mono = 37 (20.1%) versus Dual = 26 (15.4%), P = 0.247), and any bleeding events (Mono = 3 (1.6%) versus Dual = 3 (1.8%), P = *0.92*).
Conclusion: Dual therapy was superior to mono therapy in preventing recurrent stroke in patient with ischemic stroke; however, there were no differences in regard to readmission rate and any bleeding events.

11 | Outcomes and risk factors associated with presumptive treatment of urinary tract infection in asymptomatic older patients presenting after a fall

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Introduction: Older adults admitted after a fall are frequently evaluated for urinary tract infections (UTI) even in the absence of localizing signs or symptoms. Although there are many etiologies for a fall, a UTI diagnosis is often considered first in this population. Without urinary symptoms, there is no clear indication for antibiotic treatment in patients who experience a fall and treatment may lead to adverse outcomes and increased length of stay.

Research Question or Hypothesis: The primary objective was to evaluate if treatment of presumed UTIs in older patients admitted following a fall led to adverse clinical outcomes. The secondary objective was to determine factors that led to the receipt of antibiotics.

Study Design: Single center, retrospective cohort study.

Methods: Patients 65 years or older admitted to the hospital following a fall and who had a urinalysis within 72 hours of admission were included. Patients with urinary and systemic signs and symptoms of infection were excluded. The primary endpoint was hospital length of stay. Secondary endpoints included *Clostridioides difficile* infection and multidrug resistant organism (MDRO) acquisition. Variables, including patient demographics, clinical characteristics, urinalysis, and urine culture results, were collected. Logistic regression was used to determine significant predictors of antibiotic treatment.

Results: Of the 105 patients included, 25 (24%) received antibiotics. There were no differences in hospital length of stay, *C. difficile* infection, or MDRO acquisition. In a logistic regression model, the presence of pyuria was associated with receipt of antibiotics (P = 0.001), whereas patients undergoing orthopedic surgery secondary to the fall were less likely to receive antibiotics (P = 0.007).

Conclusion: Older patients presenting after a fall were evaluated for UTIs even in the absence of symptoms, setting up a prescribing cascade most often associated with the presence of pyuria. Receipt of antibiotics was not associated with adverse clinical outcomes, although there was limited power to detect these events.

Ambulatory Care

12 | Evaluating an integrated chronic obstructive pulmonary disease management program implemented in a primary care setting

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Introduction: Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity, mortality, and health care costs but is underdiagnosed and undertreated. This study evaluated the impact of a COPD disease management program involving a pharmacist-physician partnership model in a primary care setting.

Research Question or Hypothesis: We hypothesized that a COPD disease management program will improve symptoms, reduce exacerbations, and decrease maintenance inhaler regimen costs.

Study Design: Single-center, pre-post intervention

Methods: Patients with COPD were identified by ICD-10-CM diagnosis code with a hospital admission or emergency department (ED) visit or by physician referral. Eligible patients were enrolled in a COPD disease management program and received pharmacist services at an initial, face-to-face visit then monthly telephonic visits over a 3-month time period. Services included a medication review; COPD assessment test (CAT), (scores range from 0 [low] to 40 [very high]); exacerbation history and technique assessment; self-management education; and financial assistance support. Outcomes were changes in mean CAT score, median number of exacerbations, median number of hospital admissions and ED visits and mean monthly maintenance inhaler regimen cost savings per patient based on average wholesale price (AWP). Outcomes were compared pre- and post-intervention using Wilcoxon Signed-Rank test.

Results: The study population was 24 patients (mean age 62.1 years, 54.2% female, 79.2% FEV1/FVC <0.7, 58.3% GOLD Group D) enrolled in the program. The mean change in CAT score (95% CI) significantly improved by 8.73 (4.43-13.04). Per 10 person-years of follow-up, the median number of exacerbations significantly decreased by 10.0 (6.7-14.9; P = 0.022) and the median number of hospital admissions and ED visits non-significantly decreased by 5.4 (3.6-8.1; P = 0.112). There was a significant savings of $229.72 per patient in mean monthly maintenance inhaler regimen costs ($101.41-$358.03; P = 0.003).

Conclusion: A COPD disease management program improved symptoms, reduced exacerbations, and decreased maintenance inhaler regimen costs.

13 | Providers' perspectives of a pharmacy-led medication reconciliation program and vaccination improvements in a university-based peritoneal and home hemodialysis population

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Introduction: Studies have demonstrated that pharmacist led medication-reconciliation services decrease medication errors and improve patient outcomes. However, a common problem is lack of well-defined expectations of this service among the healthcare team creating the need to evaluate service delivery. Due to dialysis patients' suppressed immune system and multiple comorbidities, they are at increased risk of medication errors and vaccine preventable illnesses.

Research Question or Hypothesis: What are providers' perspectives of the medication reconciliation program and the impact of including immunization recommendations in medication reconciliation notes?

Study Design: Survey of clinic providers and retrospective chart review of clinic patients.

Methods: Monthly medication reconciliation calls and notes are completed for peritoneal dialysis and home hemodialysis clinic (HHD/PD) patients by the pharmacy team. A survey of HHD/PD clinic providers was created to assess their perspectives of this program. Additionally, in February 2020 immunization recommendations for hepatitis B, PCV13, and PPSV23 were added to these notes. HHD/PD clinic patient charts (N = 18) were retrospectively reviewed from January

2020 to April 2020 to determine the impact of this addition. Descriptive statistics were used to analyze the data.

Results: The survey was completed by 6 providers, 83.3% were MDs. 83.3% read medication reconciliation notes often or more, 66.7% would like to be informed of note submission, 50% opted to continue the current note format, and 66.7% made interventions based on a note. 83.3% of respondents agree note information is at least very helpful. Baseline immunity for hepatitis B was 72.2% (N = 13) and remained unchanged. Baseline vaccination with PCV13 was 27.7% (N = 5) and 38.9% (N = 7) for PPSV23 and increased to 77.8% (N = 14) for PCV13 and to 44.4% (N = 8) for PPSV23.

Conclusion: Providers value the medication reconciliation program, but changes can further increase its use by providers. PCV13 and PPSV23 vaccination rates increased after addition of recommendations.

14 | Pharmacist intervention lowers HGBA1C in patients regardless of HIV status

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Introduction: Despite the high prevalence of type 2 diabetes mellitus (T2DM) in patients with human immunodeficiency virus (HIV), little evidence exists on the ability of HIV-positive patients to meet glycemic targets compared to HIV-negative patients.

Research Question or Hypothesis: Is there a difference in the ability to achieve glycemic control between HIV-positive and HIV-negative patients managed by clinical pharmacists at a federally qualified health center (FQHC)?

Study Design: retrospective, single-center observational cohort

Methods: This FQHC-based study included T2DM adults with or without HIV who attended two or more pharmacist appointments between January 1, 2018 and July 31, 2019. Exclusion criteria included no pre- or post-HgbA1c, type 1 diabetes, pregnancy, breastfeeding, deceased, or untreated HIV. The primary endpoint was change in HgbA1c to month 3. Additional endpoints included change in HgbA1c at 6, 9, and 12 months, number of anti-diabetic agents, blood pressure, hypoglycemic events, percent of patients on a sodium-glucose co-transporter-2 (SGLT-2) inhibitor or glucagon-like peptide (GLP-1) agonist, and time-to-goal. Thirty-six patients per group would provide 80% power and a two-sided alpha of 0.05 for the primary endpoint.

Results: Seventy-eight patients were included, 17 of whom were HIV-positive. At 3 months, HgbA1c was reduced by 1.7% in HIV-positive patients and 1.2% in HIV-negative patients (P = 0.31). In the pooled cohort, HgbA1c was reduced from baseline by at least 1% at all time-points and 24% of patients achieved HgbA1c levels <7.0%. SGLT-2 inhibitors or GLP-1 agonists were initiated in 22% of patients, hypoglycemic episodes decreased by 9%, and systolic and diastolic blood pressures were reduced by 4.3 mmHg and 5.1 mmHg, respectively. The number of anti-diabetic medications remained unchanged or was decreased in 60% of patients.

Conclusion: While our study was under-powered to find a difference in glycemic control in HIV-positive versus HIV-negative patients, pharmacist intervention resulted in clinically significant HgbA1c reduction from baseline, without increasing medication burden for most patients.

15 | Do multiple touchpoints with a pharmacist across the transitions of care continuum aid in reducing 30-day hospital readmission rates?

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Introduction: Pharmacist-driven inpatient (INTOC) and outpatient (OUTTOC) transitions of care initiatives have been shown as an effective strategy to reduce 30-day readmission rates; however, sparse literature exists evaluating the impact on patients who receive both INTOC and OUTTOC (ALLTOC) during their continuum of care.

Research Question or Hypothesis: Do ALLTOC services provide additional reduction in the incidence of 30-day readmission compared to INTOC or OUTTOC services alone?

Study Design: A retrospective analysis of patients who received either ALLTOC, INTOC, or OUTTOC services between 07/01/2017 and 02/29/2020 was conducted.

Methods: Inclusion criteria: age > 18 years, discharged to home, OUTTOC visit within 14 days of hospital discharge. Exclusion criteria: incomplete chart documentation, had seen their primary care provider before/alongside the OUTTOC visit. Patients were categorized to the ALLTOC group if they received INTOC services and had completed an OUTTOC visit. The primary outcome was rate of 30-day readmissions. Secondary outcomes included 90-day readmission and 30 and 90-day emergency department (ED) visit rates, and number of pharmacist interventions at OUTTOC visits.

Results: Of the 224 patients screened, 178 were included (n = 75 INTOC, n = 75 OUTTOC, n = 28 ALLTOC). Differences in baseline characteristics included age, uninsured status, Medicare insurance, and number of discharge medications. No significant difference in the

primary outcome of 30-Day hospital readmission was seen (10.6% INTOC vs. 6.6% OUTTOC vs. 7.1% ALLTOC; P = 0.631). Ninety-day readmissions and 30-day ED visits were significantly different between the groups (9.3% INTOC, 2.7% OUTTOC, 17.9% ALLTOC; P = 0.037 and 4% INTOC, 1.3% OUTTOC, 14.3% ALLTOC; P = 0.022, respectively). No significant differences in 90-day ED visits were observed. The median number of pharmacist interventions per OUTTOC visit was 6.6.

Conclusion: In our study, incidences of patients receiving ALLTOC touchpoints in the transition of care continuum was low. Larger studies are needed to elucidate if multiple touchpoints are effective at reducing 30-hospital readmissions.

16 | Examination of clinical outcomes associated with using Direct Oral Anticoagulants (DOACs) in patients with weight > 150 kg or BMI >50 kg/m2

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Introduction: Current evidence recommends against using direct oral anticoagulants (DOACs) in morbidly obese patients with a body mass index (BMI) > 40 kg/m^2 or weight of >120 kg, with further restrictions for use in extremely obese (EO) patients who weigh ≥150 kg or have BMI ≥ 50 kg/m^2 due to lack of reporting of this subgroup in the pivotal trials.

Research Question or Hypothesis: to examine the clinical outcomes associated in DOAC EO patients.

Study Design: retrospective single center cohort study

Methods: The study included EO veteran patients who were prescribed DOACs or warfarin for AF or VTE between January 1st, 2016 to January 1st, 2019. The primary outcome was combined incidence of stroke/transient ischemic attack (TIA) and venous thromboembolism (VTE). Secondary outcomes included major bleed and clinically relevant non major bleed. All the outcomes reported in EO group were compared to moderately obese (MO) patients with BMI 30-40 kg/m^2 and weight between 120-150 kg, receiving DOACs and warfarin EO patients using Fisher exact test.

Results: The study included 59 patients in DOAC EO, 172 in DOAC MO and 51 in warfarin EO group. Baseline characteristics were well matched between groups compared. No difference was observed in the primary outcome between DOAC MO versus DOAC EO group (2.33% vs. 0%, P = 0.5746) with no events to report in the EO group receiving either warfarin or DOACs. Those receiving in DOAC EO group were followed for average of 1.34 years. No difference was found in major bleeding events or CRNMB between either group comparisons.

Conclusion: This study describes the outcomes observed with using DOACs in EO patients who are sparsely reported in the current literature and shows promising trends. Future studies with focus on this weight category are needed to further guide use of DOACs in clinical practice.

17 | Effects of non-insulin anti-hyperglycemic agents in persons with type 1 diabetes

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Introduction: The only agents approved by the FDA for use in people with Type 1 diabetes mellitus (T1DM) include insulin and pramlintide. The beta-cell centric classification of diabetes provides rationale for using non-insulin agents to target other organ systems to improve glucose management. This study aims to evaluate the efficacy and safety of metformin, sodium–glucose co-transporter 2 (SGLT2) inhibitors, and glucagon-like peptide 1 (GLP-1) receptor agonists for adults with T1DM.

Research Question or Hypothesis: Is the use of metformin, SGLT2 inhibitors, or GLP-1 receptor agonists added to insulin safe and effective in adults with T1DM?

Study Design: Retrospective, pre-post comparison

Methods: Participants with a diagnosis of T1DM, who were initiated on metformin, SGLT2 inhibitors, or GLP-1 receptor between January 2013 and December 2017 were included. People with type 2 diabetes diagnosis, pregnancy, C-peptide level > 0.5 ng/mL, or absence of documented HbA1c at baseline or post initiation were excluded. The primary efficacy endpoint was change in hemoglobin A1c (HbA1c) from baseline to 6 months, while the secondary efficacy endpoint was change in bodyweight from baseline to 6 months. Data was analyzed using Wilcoxon sign-ranked.

Results: A total of 171 participants were included. During the study period, the three-month HbA1c decreased from 8.4% (IQR 7.7 - 9.5) to 8.05% (IQR 7.2 - 8.9) (P = 0.002). The six-month HbA1c decreased from 8.4% (IQR 7.6 - 9.3) to 8.1% (IQR 7.3 - 9) (P = 0.006). The six-month weight comparison decreased from 92.5 kg (IQR 79.5 - 104.8) to 90.0 kg (IQR 75.8 - 103) (P < 0.0001). There was more weight loss with GLP-1 receptor agonists, with a weight lowering of 6 kg from baseline.

Conclusion: In this real world study, both weight and HbA1c decreased at three and six months after initiation of non-insulin agents in people with T1DM. The study was not large enough to detect differences between classes.

18 | Evaluation of a pharmacist-driven advanced heart failure transitions of care pilot program

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Introduction: Heart failure is the primary diagnosis for greater than 1 million hospitalizations annually. Due to the large volume and increased risk for readmission, transitions of care (TOC) programs are being utilized to achieve optimal patient outcomes. Pharmacist impact has been well documented for the general heart failure population; however, it is less clear as the disease advances as conventional therapies and strategies lose effectiveness. A pilot program was conducted to determine if pharmacists can impact readmission rates in this population.

Research Question or Hypothesis: Does a pharmacist-driven transitions of care program impact readmissions in an advanced heart failure (AHF) population?

Study Design: Retrospective, cohort study conducted between 10/1/2019 and 11/8/2019

Methods: Patients were included if they were: age ≥ 18 years, discharged to home from AHF service, and had follow-up appointment with AHF provider. Patients were excluded with left ventricular assist device, heart transplant, or expired within the evaluation window. Patients received phone or face-to-face follow up with a pharmacist at least once weekly for up to 4 weeks. Pharmacists titrated, initiated, and discontinued therapies during the TOC visits. The primary endpoint was 30-day all-cause hospital readmission. Secondary endpoints were 90-day readmission, 30 and 90-day emergency department (ED) visits. Statistics were analyzed using SPSS.

Results: 58 patients were included in the analysis (TOC = 24 vs. No Intervention [NI] = 34). Baseline demographics were similar except for baseline number of readmissions (TOC = 2.04 vs. NI = 4.47; $P = 0.004$). There was no difference in 30-day hospital readmissions (TOC = 13 vs. NI = 16; $P = 0.594$). No difference was present in 30-day ED visits (TOC = 2 vs. NI = 3; $P = 0.948$), 90-day ED visits (TOC = 0 vs. NI = 1), or 90-day hospital readmissions (TOC = 10 vs. NI = 20; $P = 0.821$).

Conclusion: A pharmacist-driven transitions of care program did not reduce ED visits or readmissions in an advanced heart failure population.

19 | Evaluation of a pharmacist-led, self-management strategy to reduce COPD-related admissions and emergency department visits in high risk patients

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Introduction: Chronic obstructive pulmonary disease (COPD) imposes a substantial economic and social burden on patients and health systems. Approximately 1.5 million COPD-related emergency department (ED) visits occur annually. In an effort to reduce COPD-related ED visits and hospitalizations, Community Physician Network (CPN) developed a COPD Rescue Pack Protocol – a self-management strategy for high risk patients to treat COPD exacerbations without delay. The rescue pack consists of a corticosteroid and antibiotic, along with the patient's short-acting inhaler. Patients also receive personalized education by the Ambulatory Care Pharmacist (ACP) and a COPD Action Plan to guide treatment use.

Research Question or Hypothesis: Assess the impact of this service on COPD-related hospitalizations and ED visits

Study Design: Prospective, matched cohort study

Methods: This study includes patients enrolled in the CPN COPD Rescue Pack Protocol, beginning in September 2019. The primary objective is to compare the composite number of COPD-related ED visits and hospitalizations 1 year prior to and 90 days after enrollment. Secondary objectives include number of COPD-related ED visits and hospitalizations 1 year prior to and 30 days after enrollment, COPD exacerbations at 30 and 90 days after enrollment, and interventions by the ACP.

Results: A total of 151 patients were included. The primary outcome of number of hospitalizations and ED visits was lower at 90 days after enrollment (61 vs 38, $P = 0.014$) compared to the same time period 1 year prior. At 90 days, there was a decrease in COPD-related hospitalizations (28 vs. 16, $P = 0.048$) and a trend towards decreased COPD-related ED visits (33 vs 22, $P = 0.128$). The number of COPD exacerbations was higher (18 vs 53, $P < 0.001$) at 90 days following enrollment. There were no differences in outcomes at 30 days.

Conclusion: The CPN COPD Rescue Pack Protocol was associated with reduced COPD morbidity outcomes as early as 90 days.

20 | Impact of a pharmacist-implemented protocol on calcium monitoring and safety outcomes with denosumab use in ambulatory patients

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Introduction: Denosumab is associated with an increased risk of hypocalcemia. In 2017, a pharmacist-implemented protocol at Mercy Clinic Family Medicine (MFM) was developed to monitor denosumab therapy and mitigate risk for hypocalcemia.

Research Question or Hypothesis: What is the impact of the MFM protocol on calcium monitoring for patients with osteoporosis taking denosumab?

Study Design: This was a retrospective cohort analysis.

Methods: Patients who received a denosumab injection from 12/13/2017 - 12/1/2019 were included in the analysis. MFM clinic patients were matched 1:1 to patients from other Mercy East Communities clinics. The primary outcome was percentage of patients with a calcium level drawn within 30 days prior to denosumab administration. Secondary outcomes included additional safety and efficacy endpoints for denosumab. Chi-square or Fisher's exact tests, with a 2-sided alpha level of 0.05, were used to determine a difference between groups for all outcomes, except days since last calcium level, which was analyzed using a student's t-test.

Results: In the 206 patients included in the study, MFM patients were more likely to have a calcium level drawn within 30 days before denosumab injection (85% vs 48%, $P < 0.001$). MFM patients also had fewer days between documented calcium level and denosumab administration (mean 24 vs 98, $P = <0.001$). There was no significant difference seen in the other secondary outcomes. The percentage of correctly timed injections at the MFM clinic was significantly better (79% vs 57%, P 0.037) when the pharmacists completed the monitoring as compared to the nursing staff.

Conclusion: The pharmacist-implemented protocol at MFM significantly improved the frequency of calcium monitoring before denosumab administration. This significant difference did not translate to the other secondary clinical outcomes. Pharmacists can have a significant impact on the appropriate monitoring of denosumab.

21 | Evaluation of the utilization of SGLT-2 inhibitors in patients with type 2 diabetes and established ASCVD in the primary care setting

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Introduction: SGLT-2 inhibitors (SGLT2i) are recommended for patients with type 2 diabetes (T2D) and established ASCVD to reduce the risk of major adverse cardiovascular events. The purpose of this study was to evaluate the utilization of SGLT2i in patients with T2D and ASCVD in a primary care setting. Results can provide insight into real-world adherence to guideline recommendations and inform pharmacist-driven quality improvement (QI) initiatives.

Research Question or Hypothesis: Are SGLT2i utilized appropriately in patients with T2D and ASCVD within a primary care setting?

Study Design: single-center, retrospective, QI project

Methods: Patients with diagnoses of T2D and ASCVD and a primary care provider visit between 7/1/2018 and 6/30/2019 were identified. Conservatively, we identified SGLT2i eligible patients as those with a current or previous metformin prescription and A1C ≥ 7%. The primary endpoint was the proportion of patients prescribed an SGLT2i. Patient characteristics and potential reasons for non-use were evaluated. Continuous and categorical data were analyzed using unpaired t-test and Fisher's-exact test, respectively.

Results: Of 423 patients with T2D and ASCVD, 142 met SGLT2i eligibility criteria. Twenty-seven patients (19%) were currently prescribed an SGLT2i, 13 (9%) were previously prescribed an SGLT2i but discontinued use, and 102 (72%) were never prescribed an SGLT2i. Of those never prescribed an SGLT2i, 20 had potential reasons for non-use identified including 16 with eGFR<45 mL/min/1.73^2, leaving 82 (58%) patients as candidates for SGLT2i use. Patients currently or previously prescribed an SGLT2i had a higher average eGFR compared to never users (79.5 vs. 69.2 mL/min/1.73^2, $P = 0.024$). No other significant differences were noted between groups. For those that discontinued treatment, common reasons included patient-reported side effects and cost.

Conclusion: Utilization of SGLT2i in patients with T2D and ASCVD remains low, despite evidence of CV benefit. This data will inform QI initiatives to improve evidence-based use of SGLT2i in our primary care clinics.

22 | Effects of adding a GLP-1 agonist to basal + bolus insulin: A retrospective chart review

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Introduction: Current guidelines recommend Glucagon-Like Peptide-1 (GLP-1) agonists after metformin for most patients with type 2 diabetes. Addition of a GLP-1 agonist to regimens including basal insulin has demonstrated improved glycemic control, weight loss, and cardiovascular protection. Few studies have evaluated supplementing basal + bolus insulin therapy with a GLP-1 agonist.

Research Question or Hypothesis: What are the effects of adding a GLP-1 agonist to basal + bolus insulin therapy in patients with type 2 diabetes?

Study Design: Retrospective chart review, single study cohort.

Methods: Adults with type 2 diabetes during a five-year period were identified. Patients were included if they were treated with basal + bolus insulin prior to starting a GLP-1 agonist. The primary outcome was change in A1C from baseline over time, evaluated at 3, 6 and 12 months. Secondary outcomes included changes in weight and insulin doses at the same intervals. Exploratory outcomes identified ASCVD events occurring within the study period.

Results: Of 1042 charts reviewed, 150 patients were included. From a median (IQR) baseline A1C of 9.8% (8.4%-11.0%), a reduction in A1C was observed at each interval: 7.8% (7.2%-8.8%) at three months, 7.8% (7.2%-8.8%) at six months, and 7.7% (6.8%-8.8%) at 12 months ($P = 0.01$). From a median (IQR) baseline weight (kg) of 116.3 (93.4-128.8), there was a reduction in weight at each interval: 115.4 (92.4-129.6) at three months, 111.5 (90.0-128.8) at six months, and 110.8 (89.4-130.9) at 12 months ($P = 0.001$). There were no statistically significant changes in basal or bolus insulin doses. Fourteen patients (9%) had an ASCVD event after addition of GLP-1 agonist.

Conclusion: In patients with uncontrolled diabetes, adding a GLP-1 agonist to a basal + bolus insulin regimen showed a statistically significant reduction in A1C and weight over time, but not insulin doses. This study supports supplementing basal + bolus insulin with a GLP-1 agonist to improve glycemic and weight outcomes.

23 | Implications of an electronic dispensary and inventory management system at a rural clinic in Honduras

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Introduction: Medical clinics in rural areas struggle with inventory management and subsequent stock outs. The Shoulder-to-Shoulder Pittsburgh-San José (STS) medical clinic is a community-oriented primary care program in rural Honduras. Most medication supply is delivered semi-annually during medical brigades from Pittsburgh, USA. STS implemented an electronic dispensary and inventory management (eDIM) system in 2017 to enhance inventory documentation and dispensing.

Research Question or Hypothesis: How does the implementation of eDIM impact medication stock outs at a clinic in rural Honduras?

Study Design: Retrospective descriptive analysis of inventory data pre- and post-implementation of eDIM

Methods: Monthly inventories were documented manually in the year prior to the implementation of eDIM, and extracted from the eDIM system post-implementation. Inventory data were analyzed to identify the proportion of time each formulary item was out of stock (OOS) pre and post-eDIM. Data was sub-analyzed by therapeutic category. Pre and post data were compared using descriptive statistics.

Results: Overall, 27 agents were OOS for at least 1-month pre-eDIM, compared to 37 agents post-eDIM. Pre-eDIM, agents were OOS for an average of 1.8 months of the year compared to 2 months post-eDIM. Pre-eDIM, the categories of agents with the longest period OOS were vitamins (4.4 months), antihistamines (3.7 months), and asthma medications (2.3 months). Post-eDIM included ophthalmologics (6.3 months), vitamins (5.5 months), and cardiovascular agents (2.4 months). Differences pre and post-eDIM were not statistically significant.

Conclusion: The implementation of eDIM has not substantially impacted medication availability and stock outs at this clinic. Although better track of inventory was achieved, further research must investigate other challenges to medication availability including medication forecasting, wholesale backorders, and the changing needs of the clinic. While an electronic system such as eDIM provides unique benefits to rural clinics, further evaluation of those benefits is needed.

24 | Evaluation of the impact of pharmacist-led diabetes mellitus (DM) management on hemoglobin A1c (HgbA1c) values in a primary care clinic

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Introduction: Subpar management of DM can lead to poor outcomes and excessive costs, often related to poor medication adherence and access. Positive DM clinical and economic outcomes highlight the value of management by a clinical pharmacy team. Nevertheless, best practices for DM across practice settings and their outcomes are undefined.

Research Question or Hypothesis: What is the impact of an ambulatory pharmacist on HgbA1c among patients with uncontrolled DM in a primary care clinic in the two years pre- vs two years post-intervention?

Study Design: Retrospective observational study two years pre- vs two years post-intervention

Methods: The primary outcomes were to evaluate: (1) change in mean HgbA1c at baseline pre- vs post-intervention, (2) change in overall average HgbA1c two years pre- vs post-intervention, and (3) proportion patients with HgbA1c 9-9.9% or > 10% pre- vs post-intervention. The study included adults with type 1 or 2 DM who had ≥1 face-to-face or telephonic encounter with the pharmacy team and had ≥1 pre-intervention HgbA1c value ≥7%. Paired t-test, mixed linear model, and logistic regression were used for analysis (SAS 9.4).

Results: The study included 116 patients (mean age 54, 50% female, 48% African American, mean 5.5 face-to-face and 6.8 telephonic encounters with pharmacy team). Mean HgbA1c at baseline (last pre-intervention HgbA1c) was 8.8% vs 7.8% post-intervention. HgbA1c was <7% in 12.9% (n = 15) patients at baseline pre- vs 42.2% (n = 49) patients post-intervention ($P < 0.001$). Overall average of HgbA1c two years pre- vs post-intervention was 8.8% vs 8.2% ($P < 0.001$); among patients with pre-intervention HgbA1c average ≥ 8%, average HgbA1c was 9.7% pre- vs 8.6% post-intervention (adjusted for age, sex, race, and pre-intervention HgbA1c, $P < 0.001$). Overall average HgbA1c in the range of 9-9.9% was 21.6% pre- vs 14.8% post-intervention and ≥ 10% for 22.7% pre- vs 11.4% patients post-intervention.

Conclusion: DM management by an ambulatory pharmacist demonstrated improved HgbA1c (reduction of ~1%) in the two years pre- vs post-intervention.

25 | The association between flash glucose monitors and A1C: A retrospective pre-post cohort study

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Introduction: Randomized controlled trials have investigated the effect of continuous glucose monitors on A1C; however, there are currently no published studies that investigate the A1C lowering effect of flash glucose monitors (FGMs). This project will help fill this gap in medical literature and will help pharmacists evaluate costs and benefits when considering FGMs for patients.

Research Question or Hypothesis: Does the use of FGMs help lower A1C in patients with type 1 or type 2 diabetes?

Study Design: Retrospective, pre-post, cohort study

Methods: Pharmacy dispensing records were used to identify patients for inclusion. Patients were included if they received an FGM from a University of Utah pharmacy between 7/7/18-7/7/20. Patients who did not receive at least an 84-day supply of FGM sensors and/or did not have a baseline or follow-up A1C were excluded. Baseline and follow-up A1Cs, defined as A1Cs that are within one year before and 3-12 months after the sensor dispense date, were collected for each patient. New diabetes medications within a six-month window were also recorded. The control and intervention groups were all patients before and after they received their first dispense of an FGM (pre-FGM vs. post-FGM). The primary outcome was the difference between follow-up and baseline A1C. Descriptive statistics were used to summarize baseline characteristics and outcome data. Paired Student's t-tests were used to evaluate differences for primary and secondary outcomes ($\alpha = 0.05$). All statistical analyses were performed using Microsoft Excel's Data Analysis software.

Results: 57 patients (50.8% male; mean age: 49 yrs) out of 171 were included. For the primary outcome, A1C decreased from 9.3% to 8.3% in the pre- and post-FGM groups, respectively (difference -1.0% [95% CI; -1.3 to -0.7; $P < 0.0001$]).

Conclusion: The use of FGMs is associated with decreases in A1C within a cohort of patients at one health system. Further effort to determine impact of FGMs on clinical and economic outcomes is warranted.

26 | Weight loss in a medically underserved population taking combination therapy for type 2 diabetes

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Introduction: Concomitant use of GLP-1 receptor agonists (GLP-1RA) or SGLT-2 inhibitors (SGLT-2i) with insulin leads to some weight loss in clinical trials. These effects have not been evaluated in populations that have a lower risk of achieving and maintaining weight loss, such as those in a medically underserved population (MUP).

Research Question or Hypothesis: To evaluate the effect on weight with the use of SGLT-2is or GLP-1RAs with insulin in a MUP.

Study Design: A retrospective, multi-center, observational study of outpatients.

Methods: Patients with type 2 diabetes who were treated with insulin therapy, were identified from an electronic medical record when a GLP-1RA or SGLT-2i was initiated during a five year period at one of three clinics. Change from baseline in weight, glycated hemoglobin A1c, total daily insulin dose, and hypoglycemia were assessed.

Results: A total of 34 patients were included in the analysis, and 74% were treated with a GLP-1RA. Baseline characteristics of the population were (mean ± standard deviation): age: 52 ± 10 years, weight: 250.7 ± 68 pounds, body mass index 39.8 ± 9.9 kg/m^2, A1c 10.1 ± 2.3%, and 65% were male. At baseline, patients took an average of 3 medications for diabetes. At 12 weeks, the addition of a GLP-1RA or SGLT2 did not significantly reduce weight (-2.0 ± 6.4 pounds; $P = 0.077$), or total daily insulin dose (-6 ± 24 units; $P = 0.160$), but did reduce A1c (-1.5 ± 2.3%; $P = 0.004$). Hypoglycemia occurred in two patients.

Conclusion: The use of GLP-1RA or SGLT-2i with insulin did not demonstrate a significant or clinically meaningful reduction in weight in patients with T2DM on insulin therapy in this MUP. These findings suggest that clinicians may need to discuss the loss of this benefit with patients.

27 | Appointment attendance and patient perception of drive-up INR testing in a rural anticoagulation clinic during the COVID-19 pandemic

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Introduction: The Anticoagulation Forum and the CDC recommend drive-up INR testing in response to the COVID-19 pandemic. Patient perceptions and impact on patient attendance have not been studied.

Research Question or Hypothesis: Does drive-up INR testing impact patient attendance during the COVID-19 pandemic? How is it perceived? How long should drive-up INR testing continue?

Study Design: Cross-sectional cohort study surveying pharmacist-managed anticoagulation clinic patients, with retrospective medical record analysis of appointment volume.

Methods: Patients attending the anticoagulation clinic via drive-up or in-office visits were surveyed from May 27 – July 2, 2020. Patients tested off-site were excluded. Study endpoints included monthly patient volume, and visit type preference, INR testing barriers, desired drive-up INR testing duration, and overall clinic satisfaction from the survey. Clinic appointment volume from October 2019 – June 2020 was collected retrospectively through schedule review. SPSS 24 (Chicago: IBM Corporation) was used for analysis.

Results: Sixty-four (80%) of 80 surveys offered were completed. Twenty-eight (47%) of patients preferred drive-up testing, sixteen (26%) indifferent, and sixteen (26%) preferred in-office visits. Forty-six and twenty-seven percent of respondents identified reduced COVID-19 transmission risk and ease of transportation as benefits of drive up INR testing, respectively. Thirty-five (59%) wanted drive-up testing to continue indefinitely. Patient satisfaction before and after drive up testing remained high at 2.75 on a scale of 0-3. March and April clinic volumes were 19% and 22% below average, respectively, returning to baseline after drive-up testing was implemented.

Conclusion: Drive-up INR testing improves patient attendance during the COVID-19 pandemic. Patient perception of drive-up testing is positive. The large percentage of patients who want drive-up testing

to continue indefinitely suggest this as a potential method to allay barriers to routine monitoring beyond the scope of the pandemic.

28 | Outcomes associated with integrating pharmacy technicians and clinical decision support in a pharmacist-managed cardiovascular risk reduction clinic

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Introduction: Kaiser Permanente Colorado's pharmacist-managed cardiac risk reduction service (CPCRS) manages dyslipidemia, hypertension, and diabetes for all patients with ASCVD. In 2019, a protocol that optimized electronic health record (EHR) capabilities and allowed work to be offloaded to pharmacy technicians was implemented.

Research Question or Hypothesis: Did implementing the CPCRS "Tech-Enhanced" protocol maintain clinical outcomes while decreasing pharmacist workload?

Study Design: This retrospective, cohort study compared a "Tech-Enhanced" group to a historical control "Pharmacist-Driven" group. The index dates for patients in the "Pharmacist-Driven" and "Tech-Enhanced" groups were 01/01/16 and 01/01/19, respectively.

Methods: All patients ≥18 years of age enrolled into the CPCRS for a minimum of six months prior to and one year after the index dates and with a diagnosis of coronary artery disease were eligible. Low density lipoprotein cholesterol (LDL-c), non-high density lipoprotein cholesterol (non-HDL) and blood pressure (BP) data were administratively identified. Counts of health care encounters documented within the EHR were collected through 1-year after the index dates and grouped into "Pharmacist-Driven" and "Tech-Enhanced". The primary outcome was the proportion of patients in both groups with LDL-c, non-HDL, and BP at goal at 1-year after the index dates. The proportion of work identified as "pharmacist" was also compared in both groups.

Results: There were 6813 patients included (mean age: 70.2 years, 71.4% male): 3130 and 3683 in the "Pharmacist-Driven" and "Tech-Enhanced" groups, respectively. Compared to the "Pharmacist-Driven" group, the proportion of patients who attained LDL-c, non-HDL and BP goals was higher in the "Tech-Enhanced" group (LDL-c: 71.2% vs. 58.6%, non-HDL: 73.0% vs. 60.7%, and BP: 88.9% vs 86.0%, all $P < .0001$). The percent of encounters handled by pharmacists in the "Pharmacist-Driven" and "Tech-Enhanced" groups were 84.0% and 44.7%, respectively.

Conclusion: The protocol integrating pharmacy technicians and decision-support maintained clinical outcomes and significantly offloaded pharmacist time.

29 | Factors associated with diabetes distress

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Introduction: Self-management is an important component of controlling diabetes mellitus (DM). Diabetes distress (DD) can impair patients' ability to perform self-management activities. However, DD is not often assessed, leading to limited data on contributors to DD and the effects of DD on progression of DM.

Research Question or Hypothesis: What factors are associated with presence of DD?

Study Design: Retrospective, interim review of patients screened for DD by pharmacists at a family medicine clinic.

Methods: Pharmacists administered the 2-item Diabetes Distress Scale (DDS2) to all patients receiving pharmacist-led diabetes management. If a patient screened positive with DDS2, the 17-item DDS (DDS17) was administered. Medication adherence was assessed through the 5-item Medication Adherence Reporting Scale (MAR-5). The Mann Whitney U test was used for analyzing DDS2, MAR-5, and DDS17, student T-tests were used for other continuous variables, and chi-square tests were used for categorical variables. Statistical analysis was performed using SAS version 9.4, Cary N.C.

Results: Of 35 patients screened, 15 (42.9%) screened positive on the DDS2, with a mean score of 4.3. Those who screened positive were more likely to be female ($P = 0.0137$) and have comorbid depression ($P = 0.0024$). There were no significant differences in A1c, blood pressure, weight, or MAR-5. Potentially clinically significant differences were seen in higher prevalence of retinopathy (67% vs. 45%, $P = 0.2029$), stroke (27% vs 5%, $P = 0.1411$), and cardiovascular disease (33% vs. 20%, $P = 0.4505$) in patients with DD. More patients with DD were on insulin (66% vs 35% non-DD, $P = 0.0636$) and fewer were on metformin (33% vs 80% non-DD, $P = 0.0132$). The 15 who were DDS2-positive received the DDS17. Four of these patients screened positive for DD on the DDS17, with the highest scores in the domains of regimen-related distress and emotional burden.

Conclusion: The rate of DD was relatively low and there was no association between the presence of DD and glycemic control.

30 | Development and implementation of a pharmacist-administered penicillin allergy assessment and skin testing service in an outpatient internal medicine clinic

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Introduction: The unintended consequences of a false penicillin allergy label are well documented. There are few published data on improving allergy reconciliation in the outpatient setting.

Research Question or Hypothesis: To assess the impact of pharmacist-administered penicillin allergy assessment on allergy reconciliation in an outpatient internal medicine (IM) clinic.

Study Design: Single-center, prospective, cohort study

Methods: Adult patients with a documented beta-lactam allergy at an IM clinic in Columbia, South Carolina were included. Pharmacy personnel (e.g. pharmacist, pharmacy students) contacted included patients via phone using an approved allergy assessment algorithm. Patient allergies were either resolved (allergy removed from electronic health record [EHR]), reconciled (complete allergy information documented in EHR), and/or an in-person clinic visit for allergy skin testing or oral challenge was recommended. Patients were surveyed on their perceptions and attitudes toward pharmacy personnel performing allergy assessment using a 5-point Likert Scale. The primary endpoint was the proportion of allergies reconciled in the EHR between IM clinic standard of care and pharmacist-administered allergy assessment. Secondary endpoints included the assessment of patients' perception of the process and outcomes of the allergy skin tests and oral challenges.

Results: Among 314 patients included, 37% of allergies were reconciled through pharmacist intervention versus 7% with standard of care (P = 0.0001). Forty-four patients were scheduled for a skin test or oral challenge. Four skin tests (3 negative, 1 indeterminate) and 1 negative amoxicillin oral challenge were performed. Due to COVID-19, the remainder of clinic visits were canceled. Among the 94 patients reached via phone, 90% of allergies were fully reconciled in the EHR. Survey results showed 99% of patients are fully comfortable (strongly agree/agree) with a pharmacist performing allergy reconciliation. Average time spent to perform allergy reconciliation was 10.3 ± 5.5 minutes.

Conclusion: Pharmacist-performed allergy reconciliation in an outpatient, IM clinic improves resolution of beta-lactam allergies and is well received by patients.

Cardiovascular

31 | Impact of metformin use on statin persistence in patients with type 2 diabetes: A post-hoc analysis

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Introduction: Cardiovascular disease is the leading cause of death, and statins are a cornerstone therapy. However, muscle pain can limit statin use, increasing cardiovascular risk. No validated therapies for statin associated muscle symptoms (SAMS) exist. Metformin counter-regulates downstream mediators of muscle function via AMP-activated protein kinase. Prior findings demonstrated metformin reduced the odds of muscle cramps and pain in statin-treated patients. The purpose of this analysis is to investigate metformin's association with statin non-persistence.

Research Question or Hypothesis: Is there a difference in statin non-persistence in patients taking metformin versus those not taking metformin?

Study Design: We completed a *post-hoc* analysis of the ACCORD Lipid trial, which compared fenofibrate versus placebo in statin-treated patients with type 2 diabetes mellitus.

Methods: We compared patients taking metformin to those not taking metformin, at study exit, for the primary endpoint of statin non-use at study exit (i.e., statin non-persistence). We performed a multivariable regression adjusting for known or suspected confounders with statin persistence or SAMS. The University of South Florida Institutional Review Board determined this study exempt. This abstract was prepared using ACCORD Research Materials obtained from NHLBI Biologic Specimen and Data Repository Information Coordinating Center and does not necessarily reflect the opinions/views of the ACCORD researchers or NHLBI.

Results: Among the 3408 patients using metformin at study exit, 191 (5.6%) were statin non-persistent, whereas 145 of 1365 (10.6%) patients not using metformin at study exit were statin non-persistent (odds ratio [OR] 0.50; 95% confidence interval [CI]: 0.40 – 0.63). Of these patients, 3883 had complete data for multivariable regression, which remained significantly different (OR: 0.58; 95% CI; 0.42 – 0.78).

Conclusion: This *post-hoc* analysis demonstrated metformin use was associated with almost one-half the odds of statin non-persistence. The potential benefit of preventing diabetes and statin non-persistence in patients with prediabetes and cardiovascular risk is large. Future clinical trials are warranted.

32 | Effect of video-assisted counseling versus traditional counseling on patient comprehension of prescribed direct oral anticoagulants

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Introduction: Although direct oral anticoagulants (DOACs) are considered high-risk medications, many patients discharged on a DOAC do not receive adequate counseling. The use of technology (e.g., educational videos, mobile devices) may be able to assist with DOAC counseling and reduce healthcare resources. The objective of this study was to compare the impact of video-assisted counseling

(VAC) versus traditional counseling (TC) by a pharmacist on DOAC comprehension in patients being discharged from an inpatient cardiology service.

Research Question or Hypothesis: VAC and TC by a pharmacist will result in similar patient comprehension of their prescribed DOAC.

Study Design: Prospective, randomized, open-label, parallel-group study

Methods: Counseling transcripts (for both groups) and animated videos with voiceover and images (VAC group only) were created for DOAC counseling. Patients were randomized to the VAC or TC group. Patient comprehension was assessed before and after counseling with the validated Knowledge Of Direct Oral Anticoagulants (KODOA)-test on a mobile tablet device. A mixed-model ANOVA was used to analyze differences in KODOA test scores by treatment and time. The goal was to enroll 40 patients.

Results: A total of 15 patients were enrolled; 7 in the VAC group and 8 in the TC group. Enrollment was halted due to Coronavirus disease-2019. Mean KODOA score increased from 9.1 to 11.5 (out of 15) in the TC group and from 9.3 to 11.6 in the VAC group ($F = 51.87$, $P < 0.0001$, Eta-squared = 0.80). The mean KODOA test score did not differ between groups according to type of counseling intervention ($P = 0.74$).

Conclusion: KODOA scores after counseling were significantly higher than before counseling in both groups. VAC resulted in similar patient comprehension of their prescribed DOAC as TC. VAC may be a viable alternative to TC while saving resources (e.g., pharmacist time and salary).

33 | A thorough QT study to evaluate the effects of oral rilzabrutinib administered alone and with ritonavir to achieve supratherapeutic concentrations in healthy subjects

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Introduction: Rilzabrutinib is an oral, first-in-class, reversible, covalent inhibitor of Bruton tyrosine kinase being investigated in B-cell-mediated autoimmune diseases.

Research Question or Hypothesis: Define the clinically-relevant supratherapeutic rilzabrutinib dose and evaluate potential effects of therapeutic and supratherapeutic rilzabrutinib exposures on cardiac repolarization in healthy subjects.

Study Design: This was a two-part study: *Part A* was an open-label, three-period, single-dose crossover study (N = 12) with rilzabrutinib 100 mg, 1200 mg, and 100 mg + ritonavir (100 mg) to define the supratherapeutic dose for Part B. *Part B* was a double-blind, placebo-controlled, 4-way single-dose crossover study (N = 39) with placebo, rilzabrutinib 400 mg, rilzabrutinib 400 mg + ritonavir 100 mg, and open-label moxifloxacin (positive control).

Methods: Frequent pharmacokinetic and ECG sampling via Holter monitors was conducted. Baseline- and placebo-adjusted heart rate-corrected QTcF interval (ΔΔQTcF [two-sided 90% CI]) was the primary endpoint.

Results: *Part A:* The clinically-relevant supratherapeutic exposures were achieved through co-administration of rilzabrutinib with ritonavir: ~18-fold AUC and ~ 8-fold C_{max} increase. The 1200 mg arm was discontinued due to mild-to-moderate gastrointestinal adverse effect that was not related to systemic exposure since rilzabrutinib exposure at 1200 mg was only slightly higher than that of the 400 mg dose (historic data). *Part B:* Co-administration of therapeutic rilzabrutinib 400 mg with ritonavir increased the rilzabrutinib mean AUC from 455 to 3640 ng.hr/mL and C_{max} from 144 to 712 ng/mL, demonstrating a dose-dependent effect of ritonavir on rilzabrutinib pharmacokinetics. The upper limit of 90% CIs for ΔΔQTcF was <10 ms at all rilzabrutinib doses and time points. The concentration-QTc relationship was slightly negative and very shallow (-0.01 ms/ng/mL [90%CI: -0.016, -0.0010]). QT assay sensitivity was confirmed with moxifloxacin. Rilzabrutinib had no clinically-significant effect on QTc.

Conclusion: Rilzabrutinib exposures were increased by co-administration with ritonavir, and defined the clinically-possible supratherapeutic exposures. Rilzabrutinib, at studied doses, did not have clinically relevant impact on cardiac repolarization.

34 | Differences in outcomes among racial groups in patients receiving angiotensin receptor blocker/neprilysin inhibitors for reduced ejection fraction heart failure

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Introduction: Despite having a higher prevalence of heart failure, black patients are underrepresented in clinical trials.[1] It remains unknown whether there is a difference in outcomes with the use of sacubitril/valsartan among black patients with reduced ejection fraction heart failure (HFrEF) compared to other races.

Research Question or Hypothesis: The objective was to determine if racial differences affect the safety of sacubitril/valsartan in HFrEF patients.

Study Design: Retrospective cohort study of Veterans aged 18-80 years who received sacubitril/valsartan for HFrEF at the VA North Texas Health Care System from July 1, 2016 to July 31, 2019.

Methods: The primary outcome was percent change in eGFR from baseline between black and non-black patients. Secondary outcomes included HFrEF associated emergency room (ER) visits and hospitalizations, serum potassium >5.2 mEq/L, changes in HFrEF severity (LVEF and NYHA class), vital signs, and biomarkers. Pertinent exclusion criteria included eGFR <30 mL/min/1.73 m^2 and sacubitril/

valsartan prescribed by a non-VA provider. Wilcoxon Rank-Sum, Chi Square, and Kaplan Meier tests were utilized as appropriate for statistical analysis.

Results: Baseline characteristics between groups (n = 62 in each group) were similar with the exception of ischemic heart disease (P = 0.001), hypertension (P = 0.05), and etiology of HFrEF (P = 0.004). No significant difference was found in the percent change in eGFR from baseline between the groups. For the secondary outcomes, there was no statistically significant differences between the groups (26% vs. 13% visited an ER and 26% vs.11% were hospitalized for black vs. non-black patients, respectively).

Conclusion: The use of ARNI did not show a statistically significant worsening of renal function in black patients with HFrEF compared to other races. Although not statistically significant, the results showed a trend toward black patients experiencing more ER visits and hospitalizations compared to non-black patients.

35 | Statin dose appropriateness in patients living with HIV compared to uninfected patients

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Introduction: Human immunodeficiency virus (HIV) infection is an independent risk factor for the development of atherosclerotic cardiovascular disease (ASCVD). Prior data have demonstrated that people living with HIV (PLWH) are less likely to receive a statin than uninfected patients; however, these data did not consider implications of patient-related factors and drug-drug interactions (DDIs) on appropriateness of statin dosing.

Research Question or Hypothesis: After accounting for comorbidities, concomitant medications, and lab values are rates of appropriate statin dosing lower among PLWH than uninfected patients?

Study Design: This is a retrospective cohort study comparing statin dose appropriateness among PLWH and uninfected patients.

Methods: Adults with an indication for statin therapy were included from outpatient clinics at an academic medical center. Patients allocated based on HIV status and statin benefit group were evaluated for DDIs, among other factors that influence statin dosing. Statin intensity was then categorized as appropriate, too high, or too low. Propensity score matching analysis using t-test or Fisher's exact test were used for between group comparisons. Multivariate analysis was conducted to evaluate the association between statin appropriateness and patient-related factors.

Results: Even after accounting for DDIs, less PLWH were prescribed an appropriate statin (n = 244, 27.8%) than uninfected patients (n = 356, 40.5%, P-value <0.0001). Multivariate regression analysis revealed that HIV infection status was independently associated with a lower likelihood of being prescribed an appropriately dosed statin (OR 0.59; 95% CI 0.47-0.75). Lower rates of appropriate statin use in PLWH were seen in those with ASCVD and 10-year ASCVD risk score ≥ 7.5%, but not in those with low-density lipoprotein cholesterol ≥190 mg/dL or diabetes.

Conclusion: PLWH were less likely than matched uninfected patients to receive appropriately dosed statins. Regardless of DDI, HIV status was independently associated with a lower likelihood of receiving an appropriately dosed statin. Our study highlights the statin gap and the need to optimize statin therapy, particularly in PLWH.

36 | Fewer patients receive recommendations for primary drug prevention using the 2018 atherosclerotic cardiovascular disease risk estimator

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Introduction: The original Pooled Cohort Equation (PCE) was introduced in 2013 to estimate atherosclerotic cardiovascular disease (ASCVD) risk. Besides clinical guidelines have endorsed its use for primary prevention, an overestimation of risk has been suggested. As such, the updated 2018 PCE was developed to more accurately assess ASCVD risk in the population.

Research Question or Hypothesis: Drug prescribing recommendations would differ depending on the PCE used to estimate 10-year ASCVD risk in a large, real-world patient population.

Study Design: This retrospective cohort study enrolled 20,843 patients aged between 40-75 years with no previous ASCVD.

Methods: The 10-year ASCVD risk score was assessed by using both PCE. Patients were assigned to risk categories according to the following cutoffs (<5%, 5-7.5%, 7.5-20% and ≥ 20%). Risk categories were compared between the two scores. Patients were reclassified into a higher or lower risk categories if a different risk estimation with the updated PCE was observed.

Results: Risk reclassification occurred in 26.7% of patients (n = 5,571). Ninety-eight percent (n = 5,466) of the reclassifications was due to lower risk categories assigned with the updated PCE. Diabetic (6.5%) patients changed recommendations from high- to moderate-intensity statins and non-diabetic (14.0%) patients lost the statin recommendation for primary prevention with the updated PCE. Likewise, 13.8% of patients with stage I hypertension also lost the recommendation for antihypertensive drugs after reclassification with the updated PCE.

Conclusion: Risk reclassification occurred among 26.7% of patients, mostly due to lower risk categories assigned by the updated PCE. Up to 14.0% of patients with a recommendation for statin therapy and/or antihypertensive drugs were no longer candidates for such treatment by using the updated PCE. These findings suggest that using the updated PCE could translate into fewer patients receiving drug therapy for ASCVD primary prevention.

37 | Comparison of oral metolazone versus oral chlorothiazide in patients with acute decompensated heart failure with loop diuretic resistance

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Introduction: In acute decompensated heart failure (ADHF), thiazide-type diuretics are used to augment diuresis. While retrospective studies have concluded no difference between intravenous chlorothiazide and metolazone, no studies to date have addressed the efficacy and safety of oral chlorothiazide compared to metolazone.

Research Question or Hypothesis: Comparison of efficacy and safety between oral chlorothiazide and metolazone in ADHF patients with loop diuretic resistance.

Study Design: Retrospective, single-center study at a community-based, teaching hospital.

Methods: Chart review was conducted of adult patients admitted between July 1st, 2016 to July 31st, 2018 with ADHF and loop diuretic resistance, who received oral chlorothiazide or metolazone. The primary endpoint was 24-hour urine output (UOP) before thiazide-type diuretic administration.

Results: Seventy-five patients were included in the analysis, with 22 patients in the oral chlorothiazide group and 53 patients in the metolazone group. 24-hour UOP before thiazide-type diuretic administration were similar between patients who received oral chlorothiazide and those who received metolazone (2135.2 ± 1161.0 vs. 1855.6 ± 1231.0, P = 0.366). Average dose of chlorothiazide was 545.5 ± 198.8 mg and metolazone was 7.5 ± 2.5 mg. Adding a thiazide-type diuretic similarly improved 24-hour UOP for both groups (2950.7 ± 1345.6 vs. 3151.1 ± 1349.2, P = 0.559). No differences noted in electrolytes, creatinine, length of stay, or intensive care unit transfer. A greater weight decrease was noted in the metolazone group (-0.47 ± 1.8 vs. -2.42 ± 3.3, P = 0.016) and higher 30-day readmission was noted in the chlorothiazide group (45.5% vs. 20.8%, P = 0.030).

Conclusion: In patients with ADHF and loop diuretic resistance, adding oral chlorothiazide or metolazone similarly improved 24-hour UOP without changing renal function or electrolytes. These findings suggest similar efficacy and safety between chlorothiazide and metolazone in this patient population. However, additional studies with a larger sample size are recommended.

38 | A pharmacovigilance study of adverse drug reactions reported for new pulmonary arterial hypertension medications in the United States Food and Drug Administration Adverse Event Reporting System (FAERS) database

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Introduction: Pulmonary arterial hypertension (PAH) is a rare, debilitating, and rapidly progressive disease. Between 2012-2017, the FDA approved 29 therapies for a cardiovascular disease (CVD) indication, currently lacking post-marketing safety data.

Research Question or Hypothesis: What adverse drug reactions (ADRs) are reported in the FDA Adverse Event Reporting System (FAERS) for PAH medications approved between 2012-2017?

Study Design: Retrospective pharmacovigilance study with disproportionality analysis of spontaneously reported ADRs.

Methods: Reports involving PAH medications were identified in FAERS from Quarter 1, 2012, through Quarter 1, 2019, allowing a two-year buffer following drug approval in 2017. Top 10 most commonly reported ADRs were analyzed using reporting odds ratio and 95% confidence interval (ROR;CI).

Results: Of 7,952,147 ADR reports from 2012-2019, 23,800 (0.300%) were for three recently approved PAH medications: 3,804 (16.0%) selexipag; 3,915 (16.45%) riociguat, 16,081 (67.57%) macitentan. A majority of reports were for females (76.0%), mean age was 61.9 years, with a similar number of younger adults age 18-64, (50.5%) and older adults age 65-85, (49.5%). Males receiving PAH medications had a greater ROR for hemorrhages and increased fluid volume than females. Younger adults receiving PAH medications had a greater ROR for diarrhea, headaches, and nausea/vomiting than older adults. Selexipag had the greatest ROR for bone-related-signs/symptoms (4.86;4.29-5.51), diarrhea (2.56;2.36-2.77), headaches (2.68;2.50-2.87), joint-related-signs/symptoms (3.19;2.76-3.69), muscle pains (5.43;4.74-6.22), and nausea/vomiting (1.77;1.65-1.89). Riociguat had the greatest ROR for hemorrhages (1.69;1.47-1.95) and vascular hypotension (2.22;2.00-

2.46). Macitentan had the highest ROR for increased fluid volume (1.27;1.19-1.37) compared to the other two PAH agents.

Conclusion: Promising novel therapies are increasingly being recognized as important treatment options for improving long-term outcomes of PAH. This post-marketing FAERS surveillance data highlights the potential risk of ADRs for each new PAH medication to provide insight into their safety profile to improve the management of this complex disease. Notably, selexipag had a strong signal for bone/joint-related-signs/symptoms, suggesting further investigation.

39 | Identifying predictors for sacubitril/valsartan target dose 97/103 mg achievement in patients with heart failure with reduced ejection fraction

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Introduction: The guideline recommends replacing angiotensin-converting enzyme inhibitors or angiotensin receptor blockers with sacubitril/valsartan. The landmark trial for sacubitril/valsartan required dose up-titration to target dose prior to randomization. However, there is a paucity of data about what factors predict successful up-titration to target dose 97/103 mg.

Research Question or Hypothesis: To identify predictors for achieving sacubitril/valsartan target dose in patients with heart failure with reduced ejection fraction (HFrEF)

Study Design: A retrospective, multi-center cohort study

Methods: Patients aged older than 18 years with HFrEF taking sacubitril/valsartan were included. Follow-up period was at least 1 year and patients receiving dialysis were excluded. Univariate analyses exploring associations between predictors and sacubitril/valsartan target dose achievement were performed. Multivariate logistic regression models were developed. The significant level was set at 0.05. All statistical analyses were conducted using SPSS Statistics.

Results: One hundred thirty patients receiving sacubitril/valsartan target dose were identified out of 431 patients on sacubitril/valsartan. Univariate analysis showed that higher body mass index (BMI) (hazard ratio [HR] 1.05, 95 % confidence interval [CI] 1.03-1.07), younger age (HR 0.97, 95% CI 0.95-0.98), higher systolic blood pressure (SBP) (HR 1.01, 95% CI 1.001-1.02), higher diastolic blood pressure (DBP) (HR 1.02, 95% CI 1.01-1.04), lower serum creatinine (Scr) (HR 0.54, 95% CI 0.35-0.82), and no loop diuretic use (HR 0.53, 95% CI 0.35-0.82) were significantly associated with the use of target dose. Multivariate logistic regression analyses found that age (HR 0.97, 95% CI 0.95-0.99), BMI (HR 1.04, 95% CI 1.01-1.07), Scr (HR 0.55, 95% CI 0.31-0.95) and loop diuretic use (HR 0.44, 95% CI 0.27-0.73) were significantly associated with the use of target dose but SBP (HR 1.00, 95% CI 0.99-1.02) and DBP (HR 1.01, 95% CI 0.99-1.04) were no longer significant predictors.

Conclusion: Younger age, higher BMI, lower Scr level and no concomitant loop diuretic therapy are the significant predictors for sacubitril/valsartan target dose achievement.

40 | Impact of nonsteroidal anti-inflammatory drugs on the prevention of atrial fibrillation after cardiac surgery

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Introduction: Atrial fibrillation is the most common complication following open-heart surgery. Literature supporting the use of nonsteroidal anti-inflammatory drugs (NSAIDs) for prevention of this complication is controversial and requires further investigation.

Research Question or Hypothesis: The purpose of this study is to determine the impact of postoperative prophylactic NSAIDs on the incidence of new-onset atrial fibrillation after cardiac surgery (AFACS).

Study Design: Multicenter, retrospective cohort study.

Methods: All adult patients who underwent open-heart surgery at Baptist Hospital of Miami or South Miami Hospital between May 2019 and December 2019 were reviewed. Patients were separated into two cohorts – those who received postoperative AFACS prophylaxis with an NSAID (cohort A) and those who did not receive NSAIDs as prophylactic therapy (cohort B). All patients in both cohorts also received metoprolol and amiodarone. The primary outcome was incidence of new-onset AFACS. Secondary outcomes included incidence of acute kidney injury (AKI) as defined by KDIGO and length of stay in the intensive care unit (ICU) and hospital. Baseline renal dysfunction was controlled for by removing patients with a history of chronic kidney disease. A chi square and independent two sample t-test were used for categorical and continuous variables respectively, and statistical significance was set a priori at a P value of <0.05.

Results: A total of 140 patients were included in the final analyses. The incidence of new-onset AFACS was 16.2% (12/74) in cohort A versus 15.2% (10/66) in cohort B (P = 0.86). There was no difference in the postoperative rates of AKI between cohorts (20.3% vs 25.8%, P = 0.44), and the average length of stay in both the ICU and hospital were also similar (P = 0.23 and P = 0.63, respectively).

Conclusion: This study demonstrates that when administered after an open-heart procedure, NSAIDs do not influence the incidence of new-onset postoperative atrial fibrillation.

41 | Impella heart pumps: The role of heparin in the purge

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Introduction: The Impella system of percutaneous, catheter-based devices offer hemodynamic support to the heart. The designs allow for flow through of heparin-containing glucose purge solution intended to prevent gross blood ingress into the motor. Heparin is added to protect the small gaps of the motor against forming

biological deposits; however, it is not intended to prevent thrombus formation on other locations of the device. Specifically, the two critical purge gaps are 1) the small radial gap between the shaft and distal sleeve bearing which controls the purge flow rate, and 2) the axial gap between the impeller distal sleeve bearing which is where purge fluid and blood initially mix.

Research Question or Hypothesis: Due to flow co-mixing and rotor dynamics some blood components may potentially reach these gaps. Without heparin added to the purge rising purge pressure and motor current trends have been observed, making patient management more challenging. We set out to determine the mechanisms behind these observations.

Study Design: 27 pumps were examined for evidence of deposits after clinical use, and after *in vitro* blood loop testing with and without heparin in the purge.

Methods: Histopathology using H&E staining and D-dimer ELISA analysis was performed on deposits.

Results: Pumps that develop high purge pressure without heparin in the purge showed evidence of deposits in gaps 1 and 2. Initial suggests that deposits in gap 1 are denatured protein, while deposits in gap 2 have a formed thrombus appearance. The use of heparin in the purge reduced the presence of deposits in both gaps and improved purge reliability.

Conclusion: The size of the purge gaps is critical to pump operation and heparin enhances protection against deposition in these gaps. Future work remains to demonstrate the hypothesized mechanisms of heparin/protein adsorption to the surface due to surface charge, and protein denaturing due to the acidic pH of the glucose solution.

42 | Efficacy and safety of a new inhaled epoprostenol formulation compared to inhaled nitric oxide for pulmonary hypertension after cardiothoracic surgery

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Introduction: Inhaled nitric oxide (iNO) or inhaled epoprostenol (iEPO) can be used for pulmonary hypertension (PH) that develops after cardiothoracic surgery. Epoprostenol (Flolan®) was reformulated with a high pH diluent to allow for stability at room temperature and remove the need for ice packs. The efficacy and safety of this epoprostenol formulation for inhalation has not been described to date.

Research Question or Hypothesis: Is there a difference in attainment of a mean pulmonary arterial pressure (mPAP) goal and safety outcomes between iNO and a new formulation of iEPO in patients undergoing cardiothoracic surgery that develop PH?

Study Design: Retrospective cohort study conducted at 887 bed tertiary care center.

Methods: Patients were included if they were ≥ 18 years old, had a pulmonary artery catheter, underwent cardiothoracic surgery, and received iEPO or iNO for PH diagnosed peri-operatively between January 2014 and July 2019. The primary outcome was attainment of a > 15% reduction in mPAP from baseline at 6 hours after initiation of the pulmonary vasodilator in the iNO versus iEPO groups. Safety outcomes assessed included hypotension, thrombocytopenia, and acute lung injury (ALI) defined as a PaO2:FiO2 < 150. Cost of therapy was calculated using average wholesale price and duration of therapy. Chi-squared and Mann-Whitney U tests were performed for categorical and continuous variables, respectively. Statistics were analyzed using IBM SPSS version 25.

Results: A total of 50 patients, 25 in both the iNO and iEPO group, were included. The primary outcome was achieved by 12 (48%) and 14 (56%) patients in the iEPO and iNO groups, respectively (P = 0.572). No patients in either group experienced ALI, thrombocytopenia, or hypotension. The median cost of therapy in the iEPO and iNO groups was $270.00 vs. $5,580.00, respectively.

Conclusion: No differences were identified in the attainment of an mPAP goal or safety outcomes between iNO and a new iEPO formulation.

43 | The impact of the first 24 hours of loop diuretic on kidney function in acute decompensated heart failure

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Introduction: Because of the uncertainty of the appropriate initial loop diuretic dose in acute decompensated heart failure (ADHF), the risk of acute kidney injury (AKI) is believed to be increased with the increase dose of initial intravenous (IV) loop diuretic.

Research Question or Hypothesis: The purpose of this study is to examine the impact of the initial IV diuretic dose on kidney function in ADHF.

Study Design: Retrospective single-center observational study included patients with ADHF admitted to a tertiary hospital from March 2016 to March 2019.

Methods: The included patients were divided into two groups: the first group received an initial total IV diuretic dose that was equal or 2.5 times less than the home dose in the first 24 hours, while the second group received 2.5 times more than the home dose in the first 24 hours. Patients who received inotropes or vasodilators during admission were excluded. The primary outcome was the incidence of

developing AKI within 48 hours of first IV diuretic. The secondary outcome was all-cause 30-day readmission rates.

Results: A total of 252 patients were available for analysis; 172 patients received equal or 2.5 times less than the home dose in the first 24 hours, while 80 patients received 2.5 times more than the home dose in the first 24 hours. The incidence of AKI was seen more in the high dose group compared to the other group (25.0% vs 9.9%); $P = 0.002$. There was no significant difference between the high dose group and the other group in all-cause 30-day readmissions (23.8% vs 26.2%); $P = 0.74$.

Conclusion: In patients with ADHF, the initial high dose of IV loop diuretics is associated with increased risk of developing AKI. Larger studies are needed to confirm these findings.

44 | Impact of hydroxychloroquine and azithromycin on QTc in patients positive for COVID-19

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Introduction: Hydroxychloroquine and azithromycin gained early popularity for treatment of Coronavirus Disease 2019 (COVID-19) following preliminary in-vivo data. This combination regiment was considered to have high cardiac risk, primarily due to QTc prolongation. The effect these medications have however, has not been quantified.

Research Question or Hypothesis: Does the addition of azithromycin increase QTc prolongation in COVID-19 patients treated with HCQ?

Study Design: Single center retrospective review at a community hospital.

Methods: Adult patients with COVID-19 between 3/17 and 4/14/2020 who were treated with hydroxychloroquine with or without azithromycin were targeted. Patients discontinued from treatment for non-cardiac reasons or not monitored on electrocardiography were excluded from the study. The primary outcome was incidence of increased QTc, defined by the American College of Cardiology as a QTc increase of greater than 60 msec or absolute QTc greater than 500 msec. Secondary outcomes included incidence of ventricular tachycardia, all-cause mortality, and change in QTc. Data was assessed using descriptive statistics, Student's t-test or Fisher's exact test as appropriate using Prism8.

Results: 168 patients were included, 126 in the hydroxychloroquine monotherapy arm and 42 in the combination therapy arm. Both groups had a similar Tisdale risk score for QT prolongation (7.03 vs 7.24, $P = 0.62$). There was no difference in incidence of QTc prolongation (34.9% vs 35.7%, $P = 1.00$). There was no difference in either the average post-treatment QTc (478.17 vs 482.4, $P = 0.63$) or average change in QTC (34.47 vs 30.31, $P = 0.60$). No difference was found in incidence of ventricular tachycardia (2.4% vs 4.8%, $P = 0.60$). There was a higher rate of mortality in patients treated with combination therapy (26.4% vs 45.2%, $P = 0.03$).

Conclusion: Utilization of combination therapy does not result in higher QTc or incidence of ventricular tachycardia when compared to monotherapy. The mortality rate was higher for combination therapy. Further controlled trials are needed to fully assess this therapy.

45 | Lifting COVID-19 shelter-in-place restrictions: Impact on heart failure hospitalizations in Northeast Georgia

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Introduction: During the COVID-19 pandemic, the heart failure (HF) community has witnessed unprecedented declines in HF related patient visits and hospitalizations. On April 24th, Georgia became the first state to allow businesses to reopen after the coronavirus shutdown. Here, we describe the trend in HF hospitalizations before the state of emergency, during Shelter-in-Place order, and after the reopening. The data was collected at the Northeast Georgia Health System, which is a large, quaternary care, community health system with 713 beds and a large HF/left ventricular assist device program.

Research Question or Hypothesis: Did the COVID-19 cause a decline of HF hospitalizations during Shelter-in-Place order followed by a surge in hospitalizations once restrictions were lifted?

Study Design: Retrospective study

Methods: Data was retrospectively collected using the electronic health record system from February 1st to June 12th in 2020 to obtain numbers of weekly HF hospitalizations. Before the state of emergency, during Shelter-in-Place order, and after the reopening were defined as 02/01/20 - 03/06/20, 03/07/20 - 05/08/20, and 05/09/20 - 06/12/20, respectively. This data was compared to the same period in 2019 (Jan 31st [due to a shorter February] to June 12th).

Results: Weekly HF hospitalizations before the state of emergency were comparable between 2019 and 2020, with an average admission rate of 27.4 and 28.2 ($P = 0.785$), respectively. During Shelter-in-Place order, there was a significant reduction of 36.5% in mean weekly admissions from 33.2 ± 4.7 in 2019 to 21.1 ± 5.3 in 2020 ($P < 0.001$). Two weeks after the reopening, the weekly hospitalizations returned to a similar level as it was observed in 2019 (28.4 ± 4.2 in 2019 vs 29.8 ± 5.0 in 2020, $P = 0.288$).

Conclusion: No surge in HF hospitalization was observed after a decline in weekly HF hospitalizations, despite the "hospitalization debt" incurred during the Public Health State of Emergency and Shelter-in-Place periods.

46 | Correlation of aPTT and anti-Xa monitoring in patients with mechanical circulatory support devices on unfractionated heparin

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Introduction: Patients implanted with mechanical circulatory support (MCS) devices are at increased risk for bleeding and thrombosis. Patients requiring MCS devices are frequently anticoagulated with unfractionated heparin (UFH), monitored using aPTT. Physiological factors in critically ill patients can elevate aPTT, leading to under-dosing of heparin and subtherapeutic anticoagulation.

Research Question or Hypothesis: aPTT is artificially elevated in patients with MCS leading to subtherapeutic dosing of heparin and high incidence of device-related thrombosis.

Study Design: Retrospective descriptive analysis in a cardiac intensive care unit (ICU) at a large academic medical center.

Methods: Patients with MCS devices implanted during the index admission with at least one aPTT and anti-Xa while on a UFH infusion were included. Endpoints included time to therapeutic anticoagulation, therapeutic UFH dose, correlation between anti-Xa and aPTT, and the incidence of bleeding and thrombotic events. Descriptive statistics were used for analysis. Pearson coefficient was utilized to determine correlation between aPTT and anti-Xa.

Results: Fifty-nine patients met inclusion criteria. 32.2% ECMO/RVAD, 30.5% LVAD, 23.7% ECMO/Impella, and 13.6% Impella. 52 (88.1%) patients achieved therapeutic aPTT at a median of 38.75 [24.75, 70.375] hours and 24 (40.7%) patients achieved therapeutic anti-Xa at a median of 62.75 [33.75, 90.875] hours. Correlation analysis of aPTT and anti-Xa values demonstrated an R^2 of 0.0283. Of 48 aPTTs that were therapeutic, 33 (68.75%) of the corresponding anti-Xa measurements were subtherapeutic. Median therapeutic heparin dose was 10.2 units/kg/hr and 10.0 units/kg/hr for aPTT and anti-Xa, respectively. Device-related thrombosis occurred in 30 (50.8%) patients; the most common event was formation of thrombus in the cannula. Median time to a thrombotic event was 27.5 [14, 49.5] hours. Major bleeding occurred in 8 (13.6%) of patients.

Conclusion: Our findings suggest that there is low correlation between therapeutic aPTT and anti-Xa in patients with MCS. Future studies are warranted to determine the reliability of anti-Xa for monitoring UFH with MCS devices.

Clinical administration

47 | National trends in direct patient care and payment models among US Colleges of Pharmacy

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Introduction: The scope of pharmacy practice continues to expand into comprehensive medication management (CMM) and value-based, direct patient care models. Embedding practice faculty and students into primary care settings to deliver CMM can improve patient outcomes, leading to significant clinical revenue.

Research Question or Hypothesis: What are the trends, perceptions, and barriers to implementing practice plan models among pharmacy practice departments at Colleges/Schools of Pharmacy?

Study Design: Cross-sectional qualitative survey.

Methods: An anonymous 25-item survey was piloted and tested, then sent to Pharmacy practice department chairs at US Colleges/Schools of pharmacy to determine workload allocations, direct patient care activities, and billing/reimbursement trends among practice faculty.

Results: Survey respondents included 43 institutions (32.6% institutional response rate) representing over 1,200 practice faculty. Of those represented in the survey, 887 (72%) are involved in direct patient care activities at a level of at least 10% effort. The majority of faculty positions were funded entirely by the College/School of pharmacy, with only 20% being split-funded positions (<1.0 FTE paid by college). Faculty at private institutions tended to have a higher degree of effort in direct patient care (26.3% vs. 4.3%), and were more involved in billing for services in the clinic setting, when compared to public institutions. Although Collaborative Practice Agreements were widely utilized, very few institutions employed practice revenue plans.

Conclusion: The findings of our study indicate that pharmacy practice faculty provide significant effort in direct patient care that is critical to advancing the profession. However, practice plan payment models appear to be rarely utilized. Failure to account for and recognize these valuable direct patient care activities may adversely impact the financial sustainability of schools and colleges of pharmacy in the future.

48 | Provincial clinical pharmacy practice model: Survey of frontline pharmacists' values and priorities

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Introduction: In December 2017, the provincial Saskatchewan Health Authority (SHA) was formed from12 Regional Health Authorities.

Subsequently, a provincial Patient Care portfolio was mandated to develop a unified clinical pharmacy practice model (CPPM).

Research Question or Hypothesis: What are practicing pharmacists' 1) values and 2) priorities in relation to the SHA CPPM?

Study Design: Survey

Methods: The Canadian Society of Hospital Pharmacists Excellence, American Society of Health-System Pharmacists Practice Advancement Initiative, and current provincial practice models informed the survey questions. The REDCap™ survey including 25 questions regarding current clinical practice, level of agreement with practice model value statements, and suggested clinical activity priorities was emailed to SHA pharmacists February 2020.

Results: Of 281 SHA pharmacists, 157 responded (56% response rate), predominantly front-line clinical pharmacists (121/157, 77%) integrated into the multidisciplinary team (93/157, 59%) providing direct patient care requiring the unique skills of a pharmacist the majority of time (50-74%) (65/157, 41%). All fourteen value statements garnered 69% or more agreement, with the top three related to patient interaction (152/157, 97%), not limiting patient care to reactive order processing (152/157, 97%), and attending interprofessional patient care rounds (149/157, 95%). Those statements with the most disagreement related to refraining from new services until resourcing is established (18/157, 11%), caring for a targeted number of patients (16/157, 10%), and favoring a specialist-based practice model (12/157, 8%). Establishing pharmacist:patient ratios and optimizing skill-task alignment were most commonly suggested to be priorities.

Conclusion: This provincial CPPM values survey indicates that SHA pharmacists desire to provide optimal patient care utilizing the unique skills of the pharmacist as a part of the interprofessional team. Concern regarding a standardized practice not applicable to all settings was evident. Continued engagement and education of pharmacists will be important for successful CPPM implementation.

community pharmacy practice

49 | Improving the uptake of expanded scope services among pharmacy professionals: A mixed method study using the theoretical domains framework

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Introduction: As the role of pharmacy professionals in care provision evolves, pharmacy professionals continue to struggle to practice to their full scope. Hence, a theoretically-informed intervention to change practice is needed. The Theoretical Domains Framework (TDF) can inform the design of a behavior change intervention to improve the uptake of expanded scope services among pharmacy professionals.

Research Question or Hypothesis: What are the barriers to adopting expanded scope practice among pharmacy professionals, and what behavior change techniques (BCTs) can be used to address these barriers?

Study Design: A mixed method study that combined a cross-sectional survey with semi-structured telephone interviews.

Methods: A three-phase project aims to refine Pharmacy5in5, an existing computer-based educational platform. In Phase 1, a 24-item questionnaire based on the 12 TDF domains was sent via email to the platform's pharmacy users (n = 2696). In Phase 2, TDF-based interviews were conducted with a purposive sample of pharmacy professionals and analyzed using the framework method. In Phase 3, interview data were analyzed using a deductive approach to guide the selection of BCTs that address the identified barriers.

Results: A total of 225 participants completed the survey. In Phase 2, 24 telephone interviews were conducted (17 pharmacists, 7 pharmacy technicians). A number of key barriers were identified on an individual level (e.g., lack of clear professional identity and limited decision-making skills in ambiguous cases) and on an organizational level (e.g., lack of social support from managers and concerns about making more errors with the current workflow). Mapping the barriers to BCTs yielded 19 BCTs, including modeling, behavioral rehearsal/practice, and social support.

Conclusion: Pharmacy professionals highlighted several factors influencing the uptake of expanded scope services including professional collaboration, strong professional identity, and adequate training. A comprehensive intervention combining skills training, social support and decision-making tools could encourage practice change.

50 | Identifying the relationship between pharmacist workload and medication errors at a local community pharmacy site

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Introduction: Medication errors increase healthcare costs and result in poor patient outcomes. Dispensing errors are a group of medication errors that are predictable and preventable. A local community pharmacy aimed to improve medication error rates by identifying when they occur throughout the work shift of the pharmacist.

Research Question or Hypothesis: This project aimed to determine any relationship between pharmacist workload and medication errors at one location of a community pharmacy and determine if the severity of the medication error was associated with hours worked during a pharmacist shift.

Study Design: The retrospective study analyzed incident report data from the 2019 calendar year.

Methods: The research team used descriptive statistics to present the findings. Variables of interest included: number of medication error;

hours worked by the pharmacist when the error occurred; if medication was used by the patient; and if the medication was refilled.

Results: A total of 24 incident reports were included in the retrospective descriptive study. The medication errors were predominantly reported by pharmacists (83.3%), with all medication errors resulting in no harm to the patient. Overall, the majority of medication errors were incorrect strength (29.2%), incorrect drug (25%), incorrect directions (16.7%), followed by incorrect patient (16.7%). Of these medication errors, the majority of medication errors resulted in the patient taking the medicine (66.7%), and half of the patients refilling the medication. Most medication errors occurred during the 3rd work shift hour (25%), the 10th work shift hour (20.8%), followed by the 5th work shift hour (20.8%).

Conclusion: This study found that medication errors occur at various times throughout the pharmacist work shift. The study also demonstrated that medication errors related to incorrect drug and strength were more common in this sample.

51 | Learning from patient experience at independent community pharmacies in Massachusetts

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Introduction: Independent pharmacies comprise about 35% of US community pharmacies and 15% of prescription drug sales. The market pressures in the last fifteen years led to increased independent pharmacy closures. However, many independent pharmacies continue to innovate in order to stay in business and attract new customers. Online reviews are common for many types of business, including independent pharmacies. Patients can access these reviews and decide to patronize a business based on the experiences of others, thus influencing the success of an enterprise.

Research Question or Hypothesis: We aimed to evaluate online reviews for the census of independent pharmacies in the state of Massachusetts (MA).

Study Design: Cross-sectional sentiment analyses of narrative Google reviews of MA independent pharmacies.

Methods: A census list of independent pharmacies from the MA Board of Pharmacy was used to collect 10 most recent Google reviews for each pharmacy (collected in June 2020). We classified the reviews by the tone of the sentiment into positive and negative. Each review was assigned into the following themes: service, personnel, overall experience, products and pricing experience, and variety of services offered. The themes were then further assigned into categories.

Results: A total of 159 independent pharmacies were evaluated, of which 123 had Google reviews as of June 2020. Nearly 97% (n = 119) of pharmacies had at least one narrative google review. Fifty four percent of independent pharmacies (n = 66) had at least 10 reviews, with an average of 8 reviews per pharmacy. Of these, 84% (n = 817, total = 978) expressed positive sentiments with majority focusing on the following themes: personnel (26%, n = 210), experience (20%, n = 166), and service (12%, n = 98).

Conclusion: The majority of independent pharmacies in MA are reviewed by customers online. Pharmacy owners may use the customer feedback for quality improvement.

52 | Impact of directed health assessments for patients with diabetes in the age of COVID-19

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Introduction: In Spring 2020, the COVID-19 pandemic led to significant changes across the United States as cities imposed "lockdowns" to control spread of the SARS-CoV-2 virus. Increasing unemployment rates and social isolation can potentially lead to changes in overall health and wellbeing. Ozanam Charitable Pharmacy provides pharmacy services to the indigent and uninsured population of Mobile, Alabama. Services include free prescription dispensing and medication therapy management.

Research Question or Hypothesis: To assess the effects of the COVID-19 pandemic on the overall health and wellbeing of patients with diabetes at Ozanam Charitable Pharmacy.

Study Design: A cross-sectional survey study.

Methods: Patients at Ozanam with a medication history for any antidiabetic medication were contacted telephonically to conduct a structured health assessment survey. The survey was designed to collect data regarding participants' usual diabetes care, as well as the effects of the COVID-19 pandemic on medication access. Effects on social and mental well-being were also assessed. Survey questions were a combination of multiple-choice, free response, and Likert-type items, including the validated PHQ2.

Results: A total of 60 patients participated in the study between June 8th and July 2nd, 2020. Participants were mostly African-American (60%) or White (33%), female (57%), with a mean a mean age of 54 years, and reported no college degree (75%). Survey results showed that among this sample of vulnerable patients, 48% of respondents agreed or strongly agreed that diabetes takes up too much of their mental and physical energy. Patients with higher A1C values and those experiencing more symptoms of depression as measured by the PHQ2 were more likely to report difficulty with picking up medications due to COVID-19.

Conclusion: Uninsured patients with diabetes are at an increased risk to face worsening health and wellness status as a result of the

COVID-19 pandemic. Pharmacists can provide telemedicine services and prescription delivery services to address identified patient needs.

53 | Community pharmacist use of mobile ECG to inform drug therapy decision making for patients receiving QT_c prolonging medications

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Introduction: For patients using QT_c prolonging medications, the health care system is challenged to mitigate risk of drug induced long-QT syndrome (DiLQTS) and sudden cardiac death (SCD). Community pharmacists (CPs) receive QT_c alerts when dispensing, but intervene infrequently. Personal ECG monitors are a new, inexpensive technology that could provide additional patient risk information to identify individuals with prolonged QT_c interval in real time.

Research Question or Hypothesis: CPs can measure QT_c interval in patients receiving QT_c interval prolonging medications to identify those at highest risk of DiLQTS.

Study Design: A prospective, pilot study of 9 month duration in 3 community pharmacies.

Methods: CPs were trained to measure QT_c interval using the KardiaMobile ECG monitor. English speaking patients aged ≥18 years were recruited to have a 30 second ECG tracing if the CP received a computer QT_c-related alert or had concern about QT_c effect/interaction. CPs used professional judgment regarding prescriber contact, but were required to contact the prescriber if QT_c interval was prolonged (>470 ms males, >480 ms females).

Results: There were 53 patients who met study criteria. Mean age was 55.1 years, 38 (72%) were female, and 19 (36%) received QT_c interval prolonging medications which were newly prescribed. A computer generated QT_c alert was present for 36 (68%) of participants. CPs contacted a prescriber for 6 (11%) patients regarding concern for DiLQTS (mean QT_c 495 msec). Of these 6 instances, 3 had QT_c prolongation requiring mandatory prescriber contact (mean QT_c 529 msec). Prescriber contact resulted in medication changes for 3 (50%) patients.

Conclusion: CPs were able to measure QT_c interval, identify patients at risk for DiLQTS, and make accepted medication therapy recommendations related to QT_c prolongation. CP assessment of QT_c interval may be a useful approach to improve risk stratification of individuals at risk of DiLQTS and SCD. (Clinical Trials.gov Identifier: NCT04000542)

Critical care

54 | Financial impact of 4F-PCC re-dosing based on clinical or radiographic evidence versus anti-Xa monitoring for emergent F-Xa inhibitor reversal

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Introduction: Measurement of factor Xa inhibitors (F-Xa) anti-coagulation effect or drug serum concentrations may be necessary in emergent situations. Anti-Xa (aXa) levels correlate with F-Xa inhibitor serum concentration but do not reflect the degree of anticoagulation or the risk of bleeding.

Research Question or Hypothesis: What impact does aXa monitoring have on PCC utilization in patients requiring emergent F-Xa inhibitor reversal?

Study Design: Retrospective, pre-post intervention

Methods: Historically, our institution utilized 35 units/kg 3F-PCC + 2 units of FFP with additional 15 units/kg based on clinical or radiographic evidence or aXa levels. aXa levels were checked prior to and every 6 hours for 24 hours post 3F-PCC administration to ensure a downward trend for correlated drug clearance. In January 2019, we converted to 4F-PCC and aXa monitoring post dose was abandoned as it was resulting in inappropriate re-dosing in clinically stable patients. We conducted a retrospective chart review on patients who were identified as receiving either 3F-PCC or 4F-PCC between October 2017 and December 2019 on an inpatient floor. ED administrations were excluded since the primary goal was the assess re-dosing of PCC.

Results: Sixty-one patients were included, 31 and 30 in the pre-intervention and post-intervention group respectively. Repeat doses were administered in 15 (48.4%) patients in the pre-intervention group and five (33.3%) of them were based on aXa levels alone in clinically stable patients. Appropriately 6,490 units of PCC could have been avoided in the pre-intervention group which would have resulted in a cost savings of $11,422. Repeat doses were administered in four (13.3%) patients post-intervention and 100% were appropriately based on clinical and radiographic evidence.

Conclusion: Removal of routine aXa level monitoring resulted in substantial cost savings associated with decreased frequency of PCC re-dosing. This process improvement may also lead to improved patients safety due to lower exposure to procoagulation factors in patients already predisposed to thromboembolic events.

55 | Evaluation of vasopressor requirements with pentobarbital therapy in the treatment of refractory intracranial hypertension

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Introduction: Pentobarbital may be employed as salvage therapy in the treatment of refractory intracranial hypertension secondary to traumatic brain injury. Data supporting the benefits of pentobarbital are limited to surrogate endpoints, such as decreased intracranial pressure (ICP). Adverse effects, including hemodynamic instability, may be observed with prolonged use. Given the need to maintain a cerebral perfusion pressure (CPP) above 60 mmHg, understanding the hemodynamic effects of pentobarbital is necessary.

Research Question or Hypothesis: Pentobarbital will require adjunct vasopressors to maintain CPP above 60 mmHg.

Study Design: Single-center, retrospective cohort study.

Methods: Adult patients admitted to the trauma ICU at an academic Level 1 Trauma Center between September 2015 and July 2018 receiving at least one dose of pentobarbital were included. The primary outcome compared the median change in vasopressor requirements 24 hours prior to and during pentobarbital therapy. Secondary outcomes evaluated the median change in CPP, ICP, and mean arterial pressure (MAP) 24 hours prior to and during pentobarbital therapy. The incidence of in-hospital mortality was also reported. All patients received dosing in accordance with the Eisenberg protocol, which has been previously described.

Results: Of 13 patients included, 14 occurrences were observed. Baseline characteristics revealed a median age of 28 years, 69% male and 92.3% with injuries due to blunt trauma. Vasopressor use was required in 10/14 (71.4%) occurrences at any time point. Higher vasopressor requirements were observed during pentobarbital therapy as opposed to 24 hours prior (9.5mcg/min NE equivalents vs. 10.3mcg/min NE equivalents). A median CPP reduction of 5 mmHg (68 mmHg vs. 63 mmHg) was observed during pentobarbital. The median ICP increased slightly (19 mmHg vs. 21 mmHg) and the median MAP was higher (84 mmHg vs. 89 mmHg) during pentobarbital to maintain the goal CPP. In-hospital mortality occurred in 53.8% of patients, all of whom required vasopressors.

Conclusion: Vasopressors were required to maintain the goal CPP in the majority of patients on pentobarbital.

56 | Impact of opioid administration in the intensive care unit and subsequent use on opioid-naïve patients

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Introduction: Opioids remain a mainstay of therapy in patients with acute pain states and are recommended as part of analgesia-first sedation the intensive care unit (ICU). While there are continued efforts to reduce opioid administration in the ICU, the downstream effects of opioids remain unclear.

Research Question or Hypothesis: Explore the relationship between intensive care opioid administration and opioid prescribing at discharge.

Study Design: Retrospective, multicenter, cohort analysis.

Methods: Opioid-naïve, adult patients admitted to an ICU that received an intravenous opioid infusion from July 1, 2011 and June 30, 2018 were included. The primary objective was to evaluate the relationship between total morphine milligram equivalents (MME) administered in the ICU and daily opioid MME prescribed at discharge. Secondary objectives included evaluating incidence of opioid prescription filling at 3, 6, and 12-month intervals, long-term opioid use and associated predictors.

Results: Of the 346 patients included for analysis, 164 (47.3%) received an opioid at discharge. Linear regression analysis did not detect a correlation between total MME administered in the ICU and daily MME prescription at discharge (R^2 = 0.008). When controlling for various confounding factors, total ICU MME did not predict discharge opioid receipt or long-term opioid use. At 3, 6, and 12-month intervals, the incidence of a prescription opioid in patients with an opioid prescription at discharge compared to patients without an opioid prescription at discharge was significantly higher ($P < 0.0005$). Long-term opioid use was also significantly higher in patients that received an opioid prescription at discharge compared to those that did not (8.5% vs 1.6% respectively, $P = 0.005$).

Conclusion: This study failed to find a significant relationship between ICU opioid administration and discharge opioid prescribing practices. Additionally, ICU opioid administration was not found to be a significant predictor of long-term opioid use. Larger, multicenter studies are needed to confirm a lack of relationship between ICU opioid administration and chronic use outcomes.

57 | Gabapentin hits a nerve with opioid use in rib fracture patients

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Introduction: Chest injuries, specifically rib fractures, are a prevalent and complex injury in trauma patients. Gabapentin is a non-narcotic medication often used as part of a multi-modal approach to pain management, but its safety and efficacy in patients with rib fractures has not been widely studied.

Research Question or Hypothesis: We hypothesized that the use of gabapentin would be associated with a lower daily opioid amount in patients with rib fractures.

Study Design: A retrospective cohort study was conducted at a Level I trauma center in the Midwest. We compared rib fracture patients who received at least three doses of gabapentin daily throughout their stay (n = 167) with those who received no gabapentin (n = 166).

Methods: Charts were randomly selected for inclusion from a larger sample (May 2014-May 2019). Opioid amounts were converted to milligrams morphine equivalent (MME). Differences between groups were assessed using chi-square tests and Kruskal Wallis one-way analysis of variance.

Results: Patients who received gabapentin had similar median Injury Severity Scores to those who did not receive gabapentin (13 vs 13, P = .72) but were also more likely to have a complex injury such as a pneumothorax (49% vs 30%, P = .001) or pulmonary contusion (41% vs 24%, P = .001). Patients who received at least three doses of gabapentin per day received significantly more opioid daily than those who did not receive gabapentin (median MME/day 53 vs 40, P = .02). They were also more likely to receive three or more different opioids during hospitalization (62% vs 45%, P = .003) and to have utilized opioids via patient-controlled analgesia (39% vs 18%, P < .001). Total milligrams of gabapentin was correlated with ISS (r = .34, P < .001) and number of broken ribs (r = .34, P < .001).

Conclusion: Gabapentin use was not associated with lower daily opioid amounts. Findings suggest that gabapentin may have been utilized more frequently for patients with complex injuries and uncontrolled pain.

58 | Characterization of rapid response calls leading to intensive care unit admissions in an academic medical center

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Introduction: Rapid response teams (RRTs) were created by hospitals around the country in response to the 2008 Joint Commission National Patient Safety Goals. The goal of RRTs are to identify and intervene on high risk patients in order to prevent serious events (i.e. cardiac arrest) from occurring.

Research Question or Hypothesis: The objective of this study was to characterize rapid response calls (RRCs) at an academic medical center resulting in patient transfer to the intensive care unit (ICU). Further analysis of medication related RRCs was conducted to identify any potentially preventable causes of RRCs.

Study Design: Retrospective chart review

Methods: This retrospective chart review was conducted on adult patients that had a RRC and were subsequently admitted to an ICU. Demographic information, RRC characteristics, non-medication and medication interventions, potential medication causes of RRCs, and outcomes were collected from the American Heart Association Get With The Guidelines registry and manual data extraction from the electronic health record.

Results: Out of 265 RRCs between May 29th, 2019 and October 31st, 2019 one hundred patients were transferred to an ICU (37.6%). Respiratory triggers were the main cause of RRCs in the majority of patients (87%). Mortality during hospitalization was 21%. Seventeen patients had a RRC that was potentially medication related. Medication related RRCs were due to opioids (n = 5), antihypertensive medications (n = 4), anticoagulants (n = 3), diuretics (n = 2), antimicrobials (n = 1), insulin (n = 1), and a reaction to ophthalmic drops (n = 1).

Conclusion: One hundred out of 265 RRCs (37.6%) activated during our study period resulted in patients being transferred to an ICU. Seventeen percent of those 100 RRCs requiring transfer to an ICU were likely related to medication causes. Some of those likely medication related causes could potentially have been avoided and serve as an area of focus in the future.

59 | MeRIT project: Impact of early antibiotic renal dosing in septic shock patients utilizing real-world evidence

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Introduction: Clinical guidelines for the management of sepsis and septic shock (SS) recommend broad antibiotic use with aggressive dosing to maximize exposure, particularly early in the disease course. In practice, critically ill patients may also have antibiotic doses renally adjusted to prevent drug accumulation and associated adverse drug events. However, the impact of early renally-adjusted antibiotic doses in SS patients is unknown.

Research Question or Hypothesis: Is reduced dosed piperacillin-tazobactam (P-T) in early-phase SS associated with worsened clinical outcomes?

Study Design: Retrospective, observational study in adult critically ill patients with SS; data collected from a multi-institutional EHR dataset

Methods: Adult SS inpatients admitted from 1/2012- 12/2018 who received were considered for study inclusion. Patients were categorized based on cumulative 48-hour P-T dose beginning with the first dose after SS diagnosis: Normal dose (NORM) (≥ 27 grams) and Low-dose (LOW) (< 27 grams). The primary outcome was 28-day norepinephrine-free days (NFD). Secondary outcomes include 28-day

hospital-free days (HFD), anti-Pseudomonal escalation (APE) rate, and in-hospital mortality/hospice disposition.

Results: In total, patients met inclusion criteria (NORM: 72.7% [325/447]; LOW: 27.3% [122/447]). Median baseline Charlson Comorbidity Index (NORM: 3; LOW: 4, $P = 0.065$) and Rothman Index (NORM: 37; LOW: 24, $P = 0.098$) were similar. Median 28-day NFD was increased in the NORM group (NORM: 25.2 [IQR: 0-27]; LOW: 12.7 [IQR: 0-26.8] days, $P = 0.028$). In-hospital mortality/hospice disposition was lower in the NORM group (NORM: 35.7% [116/325]; LOW: 45.9% [56/122], $P = 0.048$). There were no differences in median 28-day HFD (NORM: 0 [IQR: 0-11]; LOW: 0 [IQR: 0-13] days, $P = 0.268$), APE rate (NORM: 20.9% [68/325]; LOW: 14.8% [18/122]; $P = 0.14$), or time to APE (NORM: 5.7 [IQR: 2.4-9.5]; LOW: 3.9 [IQR: 2.6-6.8] days, $P = 0.835$).

Conclusion: In patients with SS, reduced P-T dosing was associated with significantly fewer 28-day NFD, and increased mortality/hospice disposition compared to NORM P-T, despite similar baseline comorbidities and severity of illness.

60 | Creation and validation of a novel vancomycin dosing protocol in critically ill patients on continuous renal replacement therapy

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Introduction: Continuous renal replacement therapy (CRRT) is commonly used to provide renal support in hemodynamically unstable, critically ill patients with renal failure. These patients experience life threatening infections with high mortality rates and require optimal dosing of antimicrobials. Limited literature is available to guide clinicians on dosing antimicrobials during CRRT.

Research Question or Hypothesis: The objective of this study was to validate a novel vancomycin dosing table for adult patients on CRRT.

Study Design: This is a retrospective cohort study in critically ill adults who received vancomycin during continuous venovenous hemofiltration (CVVH).

Methods: Patients dosed using a new dosing table were compared to a control group, who were dosed based on random vancomycin serum level monitoring. Patients were included if they received at least 48 hours of vancomycin while on CVVH. Residual renal function (≥400 ml/day), interruptions in CVVH >6 hr/day or significant fluctuations (>1000 ml/day) in ultrafiltration rates were excluded.

Results: During the study period, 173 patients were evaluated and 43 met study criteria. Of the 43 vancomycin levels assessed, the median trough level was 16.6, versus 16.2 in the control group. Mean trough was 16.8 ± 3.04 mcg/ml. In total, 56% of the trough levels were in the range of 15-20 mcg/ml using the new dosing table. When including levels within 1 standard deviation of the target range (11.96-23.03 mcg/ml), the percent of trough levels within target increased to 95%. When compared to the control group, patients treated using the new dosing table achieved a higher percentage of vancomycin trough levels in the target range of 15-20 mcg/ml (56% vs 38%, $P = 0.0297$). Also, no levels were < 9.7 mcg/ml or higher than 22.4 mcg/ml.

Conclusion: Implementation of a CVVH vancomycin dosing table based on ultrafiltration rates and patient weight improved target trough attainment and reduced pharmacist time and excessive laboratory costs.

61 | Bronchoalveolar lavage (BAL) Gram stains for early bacteria identification in pneumonia: Should they stay or should they go?

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Introduction: Commonly, broad-spectrum antibiotics are continued for pneumonia treatment until evidence is available via respiratory cultures to guide pathogen-directed therapy. Utilizing culture data to de-escalate antibiotic therapy may prevent development of antimicrobial resistance by limiting broad-spectrum antibiotic exposure. Conflicting evidence exists on the concordance of Gram stains from bronchoalveolar lavage samples (BAL) with cultures; use of this information for early de-escalation of antibiotics is questionable.

Research Question or Hypothesis: Do Gram stains correctly identify final BAL culture results?

Study Design: Retrospective, cohort study

Methods: Patients at least 18 years of age admitted to an intensive care unit at UT Southwestern Medical Center between June 1, 2012 to June 1, 2019 with a diagnosis of pneumonia, positive respiratory isolate from a BAL sample, and receipt of antibiotics during the encounter were included. Patients with cystic fibrosis or samples with >10 squamous epithelial cells per low power field were excluded. The primary endpoint was the proportion of Gram stains from BALs that accurately identified the isolate on final culture. Secondary endpoints included identifying factors that might influence the Gram stain result including duration of antibiotic treatment before BAL collection, immunosuppression, and chronic lung disease.

Results: Data from 4,248 patients with BALs were screened. Sixty-one patients (1.4%) with 73 isolates were included. Gram stains correctly identified culture results in 63.2% of Gram positive cocci cultures and 53.7% of Gram negative rod cultures ($P = 0.48$). The median time of appropriate antimicrobial coverage prior to the BAL was 22.6 (range 1.8-284.7) hours for correctly identified cultures vs 40.1 (range

3.2-573) hours for incorrectly identified cultures (P = 0.27). No variable predicted the primary outcome in the logistic regression.

Conclusion: Gram stains accurately identified causative organisms in a limited number of patients, regardless of influencing factors or patient characteristics. Therefore, the utility of the Gram stain is an uncertain modality for predicting causative respiratory pathogens.

62 | Effects of an institutional acute respiratory distress syndrome management protocol in the critical care setting

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Introduction: Early treatment with neuromuscular blocking agents (NMBAs) is common in patients with acute respiratory distress syndrome (ARDS). However, a recent randomized-controlled study showed no difference in benefits between patients with moderate-to-severe ARDS using neuromuscular blockage and those treated with a usual-care approach with lighter sedation. An institutional ARDS management protocol focusing on guiding the use of NMBAs was initiated in July 2019 to optimize the treatment outcomes.

Research Question or Hypothesis: To evaluate the impact of the protocol implementation on moderate-to-severe ARDS patients treated in the intensive care unit (ICU).

Study Design: Retrospective, before and after chart review, cohort study.

Methods: Adult ARDS patients with a ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen of <150 mm Hg receiving mechanical ventilation and admitted to the medical ICU were included. Patients with ICU stay less than 24 hours were excluded. Patients admitted between July 2018 and June 2019 were in the pre-implementation cohort and those admitted after July 2019 were in the post-implementation cohort. The percentage of patients on NMBAs, the ventilator free days at day 28, ICU free days at day 28, and mortality in ICU were compared.

Results: A total of 61 patients were included for data collection. Twenty-five (41%) were in the pre-implementation cohort and 36 (59%) were in the post-implementation cohort. Fewer patients in the post-implementation group were receiving NMBAs than the pre-implementation group (67% vs.84%, respectively). At 28 days, the mean ventilator free days (5.5 days vs. 2.9 days) and ICU free days (5.4 day vs. 2.6 days) were both longer in the post-implementation cohort. Mortality rate in ICU was significantly decreased post protocol implementation (50% vs. 72%, P = 0.044).

Conclusion: The initiation of the institutional protocol has successfully improved the outcomes of moderate-to-severe ARDS patients.

63 | Association between opioid use and daily delirium risk in critically ill adults

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Introduction: Opioids are the mainstay of pain management in the ICU. While small, poorly-controlled studies suggest opioid use and delirium are associated, none have considered the potential confounding effect of pain on delirium occurrence.

Research Question or Hypothesis: Opioid exposure in the ICU will increase the daily odds of transitioning from being awake without delirium to having delirium.

Study Design: Retrospective cohort study.

Methods: Patients admitted ≥24 hours to a 32-bed medical-surgical ICU in the Netherlands between 01/2011-06/2018 were enrolled. Patient wakefulness was assessed 6x daily using the RASS and delirium was assessed 2x daily using the CAM-ICU when RASS ≥-3. An ICU day with delirium occurred if ≥1 CAM-ICU was positive; a day with coma occurred when ≥1 RASS was ≤-4 and delirium not present; and a day of wakefulness occurred when all RASS scores were ≥ -3. We conducted first-order Markov multinomial logistic regression, using the transition from "awake without delirium" to "awake without delirium" as a reference and included 12 total model transitions. Primary exposure to opioids was modeled using an interaction term of log-transformed opioids per 10 mg IV morphine equivalents on day t and mental status on day t. The regression model controlled for admission service, age, gender, illness severity, BMI, Charlson comorbidity index, ICU admission day, modified SOFA score, mechanical ventilation use, benzodiazepine use, and severe pain (either VAS≥7 and/or CPOT≥5) presence in the 24 hours.

Results: 4075 patients (age 60.9 ± 15.4, 63.6% male, 62.2% surgical, APACHE IV 58.5 ± 28.0), accounted for 26,250 different 24-hour ICU periods (57.0% opioid used, 79.4% ventilated). Receipt of an opioid was associated with an increased odds of transitioning to delirium [odds ratio(OR) 1.45; 95%CI 1.24-1.69]. The daily opioid dose was also associated with increased odds of transitioning to delirium (OR 1.27; 95%CI 1.15-1.39).

Conclusion: Receipt of opioids in the ICU increases the odds of transitioning to delirium in a nonlinear, dose-dependent fashion.

64 | Characterizing pharmacist clinical intervention documentation in the intensive care unit

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Introduction: The American College of Clinical Pharmacy (ACCP) and Society of Critical Care Medicine (SCCM) position paper on critical care pharmacy services describes three tiers of responsibilities: fundamental, desirable, and optimal activities. Documentation of these activities can be important for justifying pharmacist salaries, communicating information to other healthcare professionals, conducting performance evaluations, and tracking workload.

Research Question or Hypothesis: How are critical care pharmacists documenting clinical interventions in the intensive care unit, and how is this documentation used by management?

Study Design: Cross-sectional survey

Methods: This survey was distributed to members of the ACCP Critical Care Practice and Research Network. The survey encompassed five core themes of pharmacist productivity: (1) patient care (2) quality improvement (3) research/scholarship (4) training/education (5) professional development. The primary outcome assessed was the relationship between pharmacist clinical intervention documentation and estimated patient workload. Descriptive statistics were used to analyze the survey results.

Results: Seventy-nine critical care pharmacists from sixty-seven institutions completed the survey. Of the pharmacists who document clinical intervention daily or on rounds (n = 61), the average ICU census was ≤15 patients for 26 pharmacists (42.6%), 16 – 25 patients for 25 pharmacists (40.9%), and > 25 patients for 10 pharmacists (16.4%). In comparison, of the pharmacists who document clinical interventions never or on spot check (n = 12), the average ICU census was ≤15 patients for 6 pharmacists (50.0%), 16 – 25 patients for 5 pharmacists (41.7%), and > 25 patients for 1 pharmacist (8.3%). Intervention documentation was utilized for position justification and annual reviews among 54.4% (n = 37) and 44.1% (n = 30) of pharmacists.

Conclusion: A majority of critical care pharmacists have an expectation to document interventions daily or on rounds. Increased expected frequency of clinical intervention documentation was not associated with a decreased patient workload. Approximately half of pharmacists use intervention documentation to justify their position.

65 | Adapting clinical pharmacy staffing models during the COVID-19 pandemic: Lessons learned and considerations for future disaster planning

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Introduction: In response to the COVID-19 pandemic, healthcare institutions faced challenges that required operational agility to facilitate provision of optimal patient care.

Research Question or Hypothesis: This research was performed to elucidate how pharmacy departments adapted their staffing models and the impact on frontline staff satisfaction.

Study Design: Critical care pharmacists in ACCP and ASHP list-serves were electronically invited to participate in a 28-question survey in April/May 2020.

Methods: Likert-like questions used a 1-5 (strongly agree to strongly disagree) scale, and responses were compared based on degree of satisfaction with pharmacy leadership strategies implemented. Practice model changes were compared before and during COVID-19. Multivariate logistic regression was used to assess the effects of independent variables on the primary outcome, satisfaction with pharmacy leadership response.

Results: Respondents (N = 168) representing 40 United States participated. Forty percent of respondents experienced a surge, 68% experienced a staffing model change, and the majority (64.9%) were satisfied overall with their pharmacy leadership's response to the COVID-19 pandemic. Both specialists (50% vs. 21%, $P = 0.013$) and unit-based generalists (65% vs. 35%, $P < 0.001$) decreased rounding in the unit. Disagreement with "Satisfied with leadership efforts to protect staff (limiting in-person meetings, changing code response)" decreased the odds of satisfaction by 96% [Odds Ratio (OR) 0.043 (95% CI 0.005-0.336), $P = 0.003$). Disagreement with "Satisfied with voice of front-line staff" was associated with an 84% reduction in satisfaction [OR 0.165 (95% CI 0.049- 0.549), $P = 0.003$]. Eliminating in-person rounds associated with a 95% decrease in satisfaction with

pharmacy leadership [OR 0.053 (95% CI 0.007-0.392), $P = 0.004$]. Disagreement with "I believe I am at increased risk of getting COVID-19 due to departmental staffing decisions (as compared to ICU peers in other institutions)" increased satisfaction [OR 3.8, 95% confidence interval (CI) 1.06-13.91].

Conclusion: Frontline staff perceptions can inform practice model changes to improve employee satisfaction while providing safe, reliable, and responsible patient care.

66 | Effectiveness of weight-based versus standard midazolam dosing in mechanically ventilated patients

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Introduction: Although non-benzodiazepine (BZD) sedation is preferred in mechanically ventilated patients, BZDs are sometimes required in patients who cannot tolerate other agents. Two dosing strategies of midazolam infusion have been used: standard dosing (i.e., mg/hr) and weight-based dosing (WBD, i.e., mg/kg/hr). Little is known about the impact of dosing strategy on achieving sedation targets or on clinical outcomes.

Research Question or Hypothesis: Is WBD of midazolam associated with achievement of sedation targets or with improved clinical outcomes?

Study Design: Single-center, retrospective chart review.

Methods: Patients mechanically ventilated (MV) for >24 hours and receiving midazolam by continuous infusion were included. Patients with severe central nervous system pathology or receiving a continuous neuromuscular blocking agent were excluded. Admissions between May 2017 and 2018 received standard dosing midazolam. Admissions between August 2018 and 2019 received WBD midazolam. The primary endpoint was the time from intubation to first target RASS. Secondary endpoints included cumulative and maximum midazolam dose, overall sedative and opioid exposure, delirium, MV-free days, hospital and ICU length of stay, and mortality.

Results: The standard dosing and WBD groups included 28 and 49 patients, respectively. There was no difference in time to first target RASS (standard: median 10.1 vs WBD: 12.1 hours, $P = 0.846$). WBD resulted in a higher maximum midazolam infusion rate (3 vs 6.2 mg/hr, $P < 0.001$), increased incidence of ICU delirium (5 vs 30%, $P < 0.001$), higher as needed opioid exposure (17.5 vs 46 mg morphine equivalents, $P = 0.048$), and fewer MV-free days (25 vs 21 days, $P = 0.023$). There was no difference in cumulative midazolam dose, overall sedative exposure, mortality, or hospital and ICU length of stay.

Conclusion: WBD was associated with higher infusion rates of midazolam, increased rates of delirium, and decreased MV-free days when compared to standard midazolam dosing. Results suggest that non-WBD may be preferred when BZD sedation is required.

Drug information

67 | Accuracy, consistency, and readability of consumer medication information

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Introduction: Previous studies have shown consumer medication information (CMI) or patient leaflets distributed by pharmacies in the community setting do not fully adhere to FDA guidance for quality and accuracy.

Research Question or Hypothesis: This study evaluated the accuracy, consistency, and readability of drug information found in CMI compared to the FDA medication guides of ten drugs

Study Design: Prospective, cross sectional, observational analysis

Methods: Nine domains in the medication guide were used as a standard for comparison for the CMI obtained from 10 different community pharmacies. The accuracy of drug information was quantified using a scoring system of 1 (less than 25% accurate) to 5 (100% accurate). The consistency of drug information in the CMI and medication guides were manually quantified based on absence or presence of the domains. The readability of the CMI and medication guides were determined using the Flesch-Kincaid and McLaughlin Simple Measure of Gobbledygook formulas. The results of the accuracy ratings and consistency for each product were reported using descriptive statistics (means, standard deviations, percentages).

Results: The average ratings for accuracy of all the CMI were below 3.1 (51-75%). The domain with the highest accuracy rating was storage recommendations with an average score of 4.9 (75%-99%) and the "what is [product?" domain had the lowest score with an average of 1.00 (<25%). The CMI from all ten pharmacies were consistent in having 6/9 (67%) of the domains present. The average reading grade level for the CMI and medication guides ranged from 4th to 12th grade.

Conclusion: The CMI sheets were found to have less than 50% accuracy but lower reading grade level than the medication guides. This study may highlight the need for CMI vendors to improve accuracy and readability of the patient leaflets.

Education/training

68 | Faculty perceptions and value of using electronic assessment rubrics in pharmacy practice simulation laboratory courses

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Introduction: Use of electronic rubrics is common practice in many institutions. Literature is available for perceptions and acceptance of students, but is lacking for faculty.

Research Question or Hypothesis: What is the impact of implementing electronic rubric use on teaching and student feedback for faculty?

Study Design: Survey

Methods: A 22-item survey was developed and distributed electronically to faculty who actively teach in the P2 and/or P3 pharmacy practice simulation laboratory courses and have used the new electronic rubrics. An expert review of the survey was conducted prior to survey finalization and distribution. Survey questions focused on faculty perceptions regarding their satisfaction of electric rubric use, ability to provide effective student feedback, and evaluation of student-standardized patient interactions. Participation was voluntary and data was collected anonymously. The University Institutional Review Board reviewed and approved this study.

Results: A total of 21 of 23 faculty members (91%) completed the survey. More than 90% of respondents *strongly agreed* or *agreed* that the electronic rubrics allowed for a clear and concise way to provide students with immediate grades, comments, and recommendations based on their assessments, and effectively calculated assessment grades. In addition, more than 80% of respondents *strongly agreed* or *agreed* that they received adequate training on the use of the electronic rubrics prior to implementation in the lab courses, and the electronic rubrics were well organized and easy to use. The majority also *strongly agreed* or *agreed that* the electronic rubrics reduced the number of errors/discrepancies in grade generation, were preferred over paper rubrics, and should be recommended for continued use in the laboratory courses.

Conclusion: Overall, the incorporation of electronic rubrics in the pharmacy practice simulation laboratory courses was well-received by faculty. Grading was simpler, more consistent and standardized compared to paper rubrics. While faculty reported certain technological issues, feedback was generally positive and supportive for continued use of electronic rubrics.

69 | Pharmacy student podcast presentations on an internal medicine rotation: A 5 year experience

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Introduction: Enhanced podcasts (recorded audio with video components) are increasingly popular in pharmacy education due to their accessibility and flexibility for both faculty and students. There is minimal data on students creating podcasts themselves and how this may be used to teach their peers.

Research Question or Hypothesis: Do podcast presentations created by pharmacy students improve quiz scores when viewed by their peers?

Study Design: Retrospective quantitative review of pre- and post-scores of student quizzes.

Methods: From July 2015 to April 2020, P4 students on an internal medicine advanced pharmacy practice experience (APPE) were assigned to create an enhanced podcast and 4-6 associated assessment questions over the course of the rotation. Topics were suggested by clinicians at the site; recordings targeted 10-12 minutes. Students received instruction and feedback on development of learning objectives, multiple choice questions, slides, and recording and editing using Panopto. In the final week of the rotation, students submitted their recording and assessment questions to the preceptor. Multiple choice questions were divided randomly in to "pre-podcast" and "post-podcast" quizzes with 2-3 podcast topics per session, resulting in 4-9 questions on each pre and post quiz. All students on the APPE completed a pre-podcast quiz, viewed podcasts created that rotation block, and then completed a post-podcast quiz.

The primary outcome was change in mean percentage scores after the podcasts which were aggregated over 5 academic years. Means were compared using paired t-tests in SPSS v26.

Results: Eighty-one students created podcasts viewed in 38 quiz sessions. The mean pre-podcast score was 80.57% and 89.93% post-podcast viewing ($P < 0.001$, 95% CI 4-99-13.73). When comparing only questions created by other students, scores increased by 18.13% (62.63% vs 80.76%, $P < 0.001$, 95% CI 9.97-26.24). Over half (54.3%) improved quiz scores following viewing, 29.6% remained the same, and 16.1% had lower scores.

Conclusion: Student-created podcasts increased quiz scores of their peers after a viewing session.

70 | Evaluation of pharmacy student education on transitions of care services

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Introduction: There is a strong need for enhanced pharmacists' roles in transitions of care (TOC) and studies have shown that incorporation of pharmacists and pharmacy students with TOC services results in improved health and financial outcomes. By incorporating additional education in TOC, pharmacy students can acquire the skills and become well-versed in patient care beyond hospital discharge. TOC training commonly occurs during experiential education, while didactic training is lacking with most pharmacy curricula.

Research Question or Hypothesis: What is the level of understanding and training of pharmacy students on TOC services?

Study Design: Cross-sectional, descriptive.

Methods: A convenience sample of pharmacy students in one college of pharmacy participated in an anonymous Qualtrics® survey disseminated via email. Survey items included students' current understanding and educational training on TOC services. Data collection occurred March 4, 2020 to May 1, 2020. Results were summarized using means and standard deviation for continuous data; frequencies and percentages for categorical data.

Results: Of 116 responses, 112 provided informed consent. Seventy-eight percent stated they have learned about TOC in the classroom, during experiential education, or pharmacy-related job, and 66% felt they understood what TOC entail. When asked to identify disease states commonly targeted for TOC, 77% failed to identify the correct disease states. When asked to select clinical activities associated with TOC services, 66% selected medication dispensing and 59% selected appointment scheduling. Majority of students see the value of TOC services to positively impact patient care outcomes (79.5%) and reduce healthcare costs (76.8%). Ninety-six percent responded additional training on TOC would be beneficial.

Conclusion: There is a mismatch in the students' perception of their level of understanding in the TOC services and their knowledge in what TOC services entail. Students understand the benefits of TOC services and majority of them agree that they would benefit from further training in this area.

71 | Study of bioterrorism and emergency preparedness in a clinical toxicology course active learning lab

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Introduction: Although bioterrorism and emergency preparedness are included in many pharmacy curricula, evidence on the impact of active learning in this area is lacking.

Research Question or Hypothesis: To evaluate the impact of an active learning lab on student knowledge of bioterrorism and building confidence in navigating online resources for emergency preparedness.

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

Methods: Seventy second-year pharmacy students in a clinical toxicology course participated in a small group active learning lab. Students developed recommendations for bioterrorism and emergency preparedness cases utilizing the Centers for Disease Control (CDC) website. The Qualtrics® survey consisted of 7 pre-post knowledge multiple-choice questions, 4 pre-post perception questions on navigating online resources, and 4 post survey perception questions on the impact of the lab, based on a 7-point Likert scale (strongly agree to strongly disagree). Paired data were evaluated using contingency tables and McNemar's test using SPSS software.

Results: The response rate was 91% (64/70). Correct responses increased for 6 of 7 knowledge questions: CDC categories (65.6% vs. 95.3%, $P < 0.05$), anthrax (59.4% vs. 87.5%, $P < 0.05$), smallpox (43.8% vs. 96.9%, $P < 0.05$), plague (90.63% vs. 96.9%, $P > 0.05$), botulinum (50% vs. 79.7%, $P < 0.05$), tularemia (45.3% vs. 95.3%, $P < 0.05$), viral hemorrhagic fevers (43.8% vs. 76.6%, $P < 0.05$). Student confidence in navigating the CDC website significantly increased for emergency preparedness (50% vs. 98.4%, $P < 0.05$), food-borne outbreaks (48.4% vs. 100%, $P < 0.05$), traveler health (54.7% vs. 100%, $P < 0.05$), and bioterrorism agents (40.6% vs. 100%, $P < 0.05$). Students agreed this lab increased knowledge about bioterrorism agents (95.3%, 61/64), CDC website (93.8%, 60/64), and ability to navigate the website (95.3%, 61/64); 95.3% (61/64) are more likely to use the CDC website.

Conclusion: This activity increased bioterrorism and emergency preparedness knowledge and increased confidence in navigating online resources.

72 | Knowledge and attitudes of doctor of pharmacy students regarding polypharmacy and deprescribing

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Introduction: Pharmacists play a key role in deprescribing. Incorporation of this concept into pharmacy school curriculums is important to ensuring graduates can address the complex needs of an aging population.

Research Question or Hypothesis: We hypothesize that those who report curricular exposure to deprescribing will have more favorable perceptions regarding their school's curriculum on deprescribing, patient willingness to deprescribe, and barriers to deprescribing and their attitudes, ability, and confidence in deprescribing.

Study Design: This is a cross-sectional study of student pharmacists at U.S. schools of pharmacy.

Methods: An electronic survey was distributed to third and fourth-year pharmacy students at 132 schools of pharmacy. Students were asked about their exposure to deprescribing within their curriculum and to rate their agreement to questions regarding patient willingness to deprescribe, barriers to deprescribing, and their attitudes; ability; and confidence regarding deprescribing (5-point Likert-scale). Two 6-item knowledge assessments assessed knowledge on polypharmacy and deprescribing. Twelve items made up three scales measuring student perceptions regarding deprescribing attitudes, ability, and confidence. Comparisons were made on each variable between students with and without curricular exposure to deprescribing using t-tests. Cohen's d was computed as a measure of effect size.

Results: Ninety-one responses were included in the analysis. Only 59.3% of respondents reported exposure to deprescribing in their didactic coursework. Students generally agreed that deprescribing can add value to patient care. More variability was seen in responses pertaining to ability and confidence in deprescribing. The mean scores on the polypharmacy and deprescribing knowledge assessments were 61.0% and 64.5% respectively. Those with exposure to deprescribing concepts within their curriculum were more likely to agree that their school's curriculum prepared them to deprescribe in clinical practice (P = .03) and that patients would be willing to have medications deprescribed (P = .03).

Conclusion: Pharmacy schools should evaluate their curricula and consider the addition of specific deprescribing objectives and outcome measures for didactic and experiential training.

73 | Assessment of a flipped classroom and case based learning activity to teach safe medication use and deprescribing for older adults

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Introduction: Deprescribing is a Tier 1 topic for curricular inclusion per the 2019 American College of Clinical Pharmacy Pharmacotherapy Didactic Toolkit. Pilot survey data from our institution suggested that current methods used to teach this material were not adequately preparing students for practice.

Research Question or Hypothesis: Does use of a flipped-classroom approach with case-based learning to teach safe medication use and deprescribing in older adults improve exam performance and student attitudes as compared to lecture-based instruction?

Study Design: Quasi-experimental nonequivalent groups design.

Methods: Third-year students enrolled in the geriatric pharmacotherapeutics module in 2019 (n = 117) and 2020 (n = 116) were included. In 2020, a flipped-classroom approach with case-based learning replaced a lecture-based approach to teach safe medication use and deprescribing for older adults. The primary endpoint was the difference in performance on 10 related items on the unit exam. An electronic survey was distributed to both class years to assess student attitudes, perceived ability, and confidence in deprescribing (5-point Likert-scale). Percent agreement was compared with a chi-squared test. Questions were grouped into scales with the mean calculated for each and compared across years with an unpaired t-test. Cohen's d was calculated as a measure of effect size for all comparisons.

Results: The mean exam score on related items was 74.6% in the lecture group and 75.6% in the flipped-classroom group (P = 0.62; Cohen d = 0.07). When comparing individual items, students in the flipped-classroom group reported higher confidence in their ability to recommend appropriate deprescribing strategies for potentially inappropriate medications (P = 0.02). Scale scores were higher in the flipped-classroom group for perceived ability and confidence, but the differences were not statistically significant (P = 0.17 and P = 0.18, respectively).

Conclusion: A flipped-classroom approach with integrated case-based learning did not lead to improved exam performance; however, students trained with this pedagogy had higher self-confidence in their ability to engage in deprescribing in practice.

74 | Formulary drug monograph preparation and presentation as an application of evidence-based medicine in a formulary management elective

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Introduction: Preparing a monograph requires the ability to evaluate medical evidence ensuring safety and efficacy of formulary medications. Given the limited research on how this is taught, a formulary drug monograph assignment was designed to evaluate this skill requiring preparation and assessment of a monograph incorporating evidence-based medicine and pharmacoeconomic principles.

Research Question or Hypothesis: The formulary drug monograph activity will increase student confidence to apply evidence-based medicine in preparation and presentation of a formulary drug monograph.

Study Design: A prospective, pre and post cohort survey design.

Methods: Students enrolled in the elective were required to prepare a monograph for presentation to a mock Pharmacy & Therapeutics (P&T) Committee. The students received education on performing literature searches, evaluating primary literature, formulary systems, composition and purpose of the P&T Committee and preparation of a monograph. Students were partnered to present evidence for or against inclusion of the drug to the health-system formulary. Students completed a pre/post 5-point Likert scale survey, delivered via Google forms, to measure confidence change before and after compiling and presenting the formulary drug monograph.

Results: The average score on the written portion was 99.5% and on the oral presentation 98.2%. A total of 15 of 18 third-year pharmacy students participated in the pre/post surveys. There was a significant increase in student's confidence in their ability to prepare all sections of a drug formulary monograph. There was a 34% increase in the student's confidence to prepare medical literature and a 43% and greater increase in areas such as searching, analyzing, and citing medical literature.

Conclusion: The Formulary Management elective resulted in a positive change in students' perception of confidence to evaluate medical literature to compile and communicate a formulary drug monograph. This provides evidence that the assignment was a successful method of incorporating and learning how to evaluate the medical literature.

75 | Describing and comparing wellbeing among first- through third-year student pharmacists

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Introduction: The wellbeing of healthcare professional students has become a topic of interest and importance, but there is a lack of information in regards to the wellbeing of student pharmacists.

Research Question or Hypothesis: How can wellbeing be characterized and compared in first- through third-year student pharmacists?

Study Design: Cross-sectional survey study.

Methods: Investigators created an online survey instrument to assess student pharmacist wellbeing. Researchers conducted a literature review, leading to the integration of questions from the World Health Organization-5 Wellbeing Index (WHO-5, scored out of 25 points total with 0 being the worst and 25 being the best). Researchers also held focus groups with students to assess how student pharmacists interpreted wellbeing, which led to the incorporation of additional survey item domains: demographics, work/life balance, and spirituality. In Fall 2019, investigators distributed the survey to first- through third-year student pharmacists at one private college of pharmacy. Descriptive and inferential statistics were performed using IBM SPSS (Version #25). A Kruskal-Wallis H test was used to determine if there were any differences in wellbeing between the three classes.

Results: Approximately 64% (n = 248) of student pharmacists completed the survey, n = 72 first-year, n = 122 second-year, and n = 54 third-year students. The majority of respondents were female (64.8%), Caucasian or African American (30.4% each), and ranged in age from 24-29 years (53.1%). The first-year class had a mean rank score of 9.56 compared to 10.31 for the second-year students and 10.26 for the third-year students, out of a total score of 25. There was not a statistically significant difference in WHO-5 scores between the different classes, $P = 0.183$.

Conclusion: The WHO-5 scores for first- through third-year student pharmacists reveals an opportunity to enhance the wellbeing of student pharmacists through tailored interventions. Additionally, there was no difference in wellbeing between the three professional years.

76 | Perceptions of clinical pharmacist reliance by medical resident physicians at an academic medical center

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Introduction: Clinical pharmacist recommendations regarding medication use may negatively impact medical resident learning due to over-reliance for medication related decisions. The purpose of this study was to evaluate perceptions of medical residents' reliance on clinical pharmacists.

Research Question or Hypothesis: How do medical residents perceive their reliance on clinical pharmacists in an inpatient rounding environment?

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

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

Results: Sixty-three medical residents completed the survey. Respondents perceived they were significantly more likely to rely on clinical pharmacists for medication dosing (3.7 vs. 3.3, $P < 0.01$) and medication related literature updates (3.7 vs. 3.4, $P = 0.03$) compared to attending physicians. Overall, medical residents believed that clinical pharmacists positively impact their overall learning experiences (4.62, SD = 0.63). Sub-specialty medical residents perceived a greater reliance on clinical pharmacists for medication selection (3.6 vs. 3.0, $P < 0.01$), medication dosing (3.9 vs. 3.5, $P = 0.03$), and reported higher pharmacist impact on the resident learning experience (4.9 vs. 4.4, $P < 0.01$) compared to primary care medical residents. Sex did not impact perceptions.

Conclusion: Medical residents believed they rely on clinical pharmacist expertise and pharmacist involvement is ultimately benefiting them, with some differences between primary care and sub-specialty residents noted. Further evaluations at other academic medical centers are necessary.

77 | A comparison of clinical pharmacist perceptions by attending physicians, medical residents, and clinical pharmacists

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Introduction: Clinical pharmacist recommendations regarding medication use may negatively impact medical resident learning due to over-reliance on pharmacists for medication related decisions. The purpose of this study was to compare perceptions among different members of the healthcare team regarding reliance on clinical pharmacists and their impact on resident learning.

Research Question or Hypothesis: Are there differences in perceptions on the extent of reliance on clinical pharmacists and their impact on resident learning in an inpatient rounding environment?

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

Methods: Three discipline-specific 10-item, 5-point Likert-scale surveys were developed and delivered to evaluate perceptions of reliance on and learning impact of clinical pharmacists. The primary objective was to compare perceptions of reliance on clinical pharmacists among the three groups. Kruskal-Wallis and Dunn's Multiple Comparisons tests were utilized due to the ordinal nature of the data. Statistical significance was set at a *P*-value of <0.05.

Results: Seventy-three attending physicians, 63 medical residents, and 30 clinical pharmacists completed the survey. Clinical pharmacists perceived that attending physicians and medical residents were significantly more likely to rely on them for medication selection, drug dosing, and information on adverse effects (each $P < 0.05$) compared to perceptions of both attending physicians and medical residents. Additionally, clinical pharmacists perceived more reliance of attending physicians for drug information compared to attending physicians ($P = 0.01$). Lastly, although medical residents and attending physicians perceived that clinical pharmacists positively impacted overall resident learning experience, residents were significantly more likely to perceive this ($P < 0.01$).

Conclusion: Clinical pharmacists perceived their benefits to be more significant than medical residents and attending physicians on a multitude of pharmacotherapy related issues. All three groups believed that clinical pharmacists were positively impacting medical residents learning experiences.

78 | Incorporating a wellness initiative into a general medicine advanced pharmacy practice experience

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Introduction: Wellness is an active process of becoming aware of and making choices toward a healthy and fulfilling life. Pharmacy educators are in a unique position to bring awareness, engage in discussion, and provide initiatives to improve student wellbeing. In a recent study, postgraduate year 1 pharmacy residents most frequently reported the following coping mechanisms: 1) spending time with family and friends; 2) staying optimistic; 3) engaging in enjoyable activities; 4) exercising/sports; 5) sleep. As result, 5 wellness initiatives (faith, fitness, family/friends, fun, food) were incorporated into a 5-week advanced pharmacy practice experience (APPE).

Research Question or Hypothesis: To determine the impact of a wellness initiative on fourth year pharmacy students' overall wellness during a general medicine APPE

Study Design: Prospective, anonymous, electronic survey

Methods: A survey was created, pilot-tested, and distributed to 15 pharmacy students completing a general medicine APPE at one community hospital from July 2019 to March 2020. Survey results were analyzed using Wilcoxon Signed Rank test (SPSS Inc., Version 26) and descriptive statistics.

Results: A total of 10 surveys were completed (67% response rate). On a scale of 1 to 10, participants reported improved satisfaction with their overall wellness as a result of the rotational activities (median [IQR]: 6 [4.75-10] vs 8.5 [7-10]; $P = 0.027$). Faith discussions were reported as having the greatest impact on student wellness while healthy eating habits had the least. Respondents reported fasting from social media had the most positive impact on their wellness, while budgeting had the least positive impact. Ninety-percent of participants strongly agreed the wellness initiatives contributed to a positive learning environment during the APPE and moreover were better prepared to cope and find balance during the COVID-19 pandemic.

Conclusion: Incorporating a wellness initiative into a fourth-year pharmacy APPE had a positive impact on students' overall wellness.

79 | Impact of advanced pharmacy practice experience on student pharmacist metacognition

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Introduction: Metacognition is vital in critical thinking and self-regulated learning for student pharmacists for continued advancement of pharmacy practice. However, there is limited evidence on enhancing student metacognition within experiential education.

Research Question or Hypothesis: What factors during the advanced pharmacy practice experience (APPE) year are associated with change in student pharmacist metacognition?

Study Design: Repeated quantitative cross-sectional study

Methods: A 42-item anonymous, voluntary electronic survey was administered at the beginning (May 2019) and end (April 2020) of the APPE year for students at five schools of pharmacy. Survey items collected demographics, co-curricular activities, APPE learning activities and performance (post-survey only), and a validated modified metacognition assessment inventory (MAI). The modified MAI utilized a 5-point Likert scale to assess 19 items, resulting in an overall metacognition score as well the sub-components of metacognitive knowledge (8 items) and metacognitive regulation (11 items). Unique survey identifiers were used to pair responses from the pre- and post- surveys. Paired t-tests were used to analyze change between pre- and post-scores for the overall as well as MAI sub-components. Spearman's correlation was conducted on the paired data to evaluate associations with the change in MAI. The survey was deemed IRB exempt by affiliated institutions.

Results: Of the 560 eligible participants, 245 completed the pre-survey (44% response rate), 257 completed the post-survey (46% response rate), and 139 completed both (25% response rate). There was a significant change in the pre- to post-MAI scores overall and for each sub-component ($P < 0.01$). Significant positive correlations with the change in MAI overall were pre-APPE MAI scores ($r_s = 0.54$, $P < 0.01$), pharmacy work experience ($r_s = 0.18$, $P = 0.04$), and professionalism journal clubs ($r_s = 0.21$, $P = 0.02$).

Conclusion: Enhancement in metacognition was noted over the APPE year for student pharmacists at five institutions. The improvement was multifactorial as individual factors had minimal association with the change in metacognition.

80 | Personality: A potentially untapped resource in the selection of pharmacy residents

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Introduction: Residency programs must screen a growing number of applicants annually. Personality testing based on the five-factor model (FFM) is used for selection in other fields and is more valid than methods commonly used in resident selection (e.g., reference letters). However, its utility for selecting residents is unknown.

Research Question or Hypothesis: Can personality testing aid in the selection of postgraduate year 1 (PGY1) and/or postgraduate year 2 (PGY2) pharmacy residents?

Study Design: Cross-sectional survey followed by prospective observation

Methods: Applicants were invited to complete an FFM-based personality test derived from the International Personality Inventory Pool, but programs were blinded to the results (i.e., traditional screening and interviewing processes were used). After the Match, personality scores were compared to screening, interview, and rank/match outcomes. The primary endpoint of interest was the odds of receiving an interview offer, which was assessed using logistic regression. Linear regression was used to compare personality scores and screening/interview scores. Statistical significance was defined as $P < 0.05$ and data were analyzed using SPSS v.25.

Results: A total of 137 PGY1 applicants (69.5%) and 56 PGY2 applicants (53.3%) completed personality testing. Personality scores predicted PGY1 interview offers, $\chi 2(5) = 18.043$, $P = 0.003$ (26.9% of variability explained), with extraversion, conscientiousness, and openness to experience being significant predictors in multivariable analysis ($P < 0.05$). When combined with biodata (e.g., awards, leadership), extraversion remained a predictor in some but not all analyses. Among PGY2s, the overall model was not significant ($\chi 2(5) = 9.387$, $P = 0.095$), but conscientiousness alone uniquely predicted interview offers. Personality scores did not predict final rank or likelihood of matching.

Conclusion: Personality scores independently predicted interview offers until combined with more labor-intensive methods (e.g., review of biodata, interviews). These results suggest that personality testing, based on traits desired by individual programs, could be used as a pre-screening tool to reduce the number of applicants requiring more detailed review.

81 | Impact of transitioning to an online course during a pandemic on student pharmacist performance in a required course

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Introduction: Spring 2020 brought a host of challenges associated with the COVID-19 pandemic. One challenge was continuing education in the midst of social distancing, isolation and closures of learning institutions. Many schools quickly transitioned from in-person to an online instruction. Due to the ongoing nature of this pandemic, the impact of switching course delivery in this environment is not yet known. The aim was to study the grade impact of switching a required pharmacy course that is traditionally taught in person to full online administration.

Research Question or Hypothesis: What is the impact of transitioning to an online course due to the COVID pandemic on performance on various assessments in a required course?

Study Design: Retrospective, quantitative review of student performance

Methods: This study included 333 third professional year pharmacy students enrolled in a required five week, three credit-hour course over two years. In the first traditional year (2019), all assessments were administered electronically, but all lectures and proctoring were in person (n = 101). In the second online year (2020), all lectures, assessments and proctoring were administered exclusively online (n = 232). Following IRB approval, the change in mean overall assessment scores, and final grade distribution between the two years were analyzed using a student t-test and chi-square test, respectively.

Results: The primary outcome of performance on online exams was significantly higher than traditional exams (80.1% vs 76.1%, $P < 0.001$, respectively). No difference was observed in mean quiz scores (75.4% vs. 77.6%, respectively). The percentage of A's (24%, 16%), B's (64%, 63%), and C's (12%, 21%) did not differ between the traditional vs. online course, respectively.

Conclusion: Examination scores were improved in the online course, although overall quiz and course grades did not differ from the traditional course. Additional factors related to the pandemic may have contributed and should be addressed in future studies.

82 | Evaluation of burnout among pharmacy residents in Ohio

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Introduction: In 2019, the World Health Organization defined burnout as an "occupational phenomenon" that may negatively influence an individual's health status. While studies have evaluated burnout in clinical and distributive pharmacists, student pharmacists, and pharmacy faculty, data evaluating burnout in pharmacy residents is lacking.

Research Question or Hypothesis: What is the incidence of burnout among pharmacy residents in Ohio over the 2019-20 residency year?

Study Design: Prospective, observational, cohort

Methods: In August 2019, an email providing a research overview and a link to a Qualtrics^{XM} survey was distributed to Ohio pharmacy residency program directors requesting they forward it to their residents. Subsequent email requests with survey links were distributed in October, January, April, and June directly to residents who completed the August survey. The survey included the Oldenburg Burnout Inventory, a validated tool evaluating disengagement and emotional exhaustion, both factors determining burnout. The primary outcome was to evaluate the incidence of burnout while secondary outcomes evaluated disengagement and exhaustion over the residency year. Participants completing the August survey were included in the intention-to-survey analysis with last response carried forward. Participants completing all five surveys were included in the per-protocol analysis. Outcomes were analyzed using Cochran's Q test in SPSS Version 26.0.

Results: Intention-to-survey analysis included 26 participants with no difference in the incidence of burnout ($\chi^2(2) = 5.875$, $P = 0.209$) or disengagement ($\chi^2(2) = 3.067$, $P = 0.547$), but a difference in the incidence of exhaustion (62%, 81%, 85%, 77%, 77%; $\chi^2(2) = 11.556$, $P = 0.021$) over the year. Per-protocol analysis included 11 participants with no difference in the incidence of burnout ($\chi^2(2) = 8.222$, $P = 0.084$) or disengagement ($\chi^2(2) = 3.750$, $P = 0.441$), but a difference in the incidence of exhaustion (45%, 82%, 91%, 64%, 64%; $\chi^2(2) = 11.692$, $P = 0.020$) over the year.

Conclusion: No differences in burnout or disengagement were observed. The incidence of exhaustion was different over the residency year, peaking in January.

83 | A 20-year look at trends in pharmacist authorship across publications in the Journal of the American Medical Association Network

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Introduction: Research is an important component of professional training, postgraduate education, and practice; seven national pharmacy organizations include "research" in their mission statements. This emphasis, along with the shift in pharmacy to a patient-centered care model incorporating collaborative and interprofessional practice, supports greater involvement of pharmacists in research. However, there are no recent publications examining how pharmacist involvement in major research publications has changed over time. The purpose of this study was to investigate trends in pharmacist publication within the Journal of the American Medical Association (JAMA) network from the past 20 years.

Research Question or Hypothesis: With an increasing number of pharmacists with both research and clinical expertise, publications with pharmacist authors from 2010 to 2019 will exceed those from 2000 to 2009.

Study Design: Retrospective observational study of nine journals in the JAMA network that have been published for more than 20 years.

Methods: The JAMA Network website's advanced search function was used to identify publications categorized as "Research" with one or more pharmacist authors (denoted by a professional credential of Pharm.D., MPharm, BPharm, and/or RPh) for each year from 2000-2019 in each journal. The number of pharmacist first-authored or senior-authored articles was documented for each individual article. A chi-square test was used to examine differences in authorship comparing 2000-2009 to 2010-2019.

Results: Although all journals had an increase in the percentage of pharmacist authors, only five were statistically significant: JAMA (3.5% to 4.9%, $P = .020$), JAMA Dermatology (0.7% to 2.3%, $P < .001$), JAMA Neurology (0.9% to 2.2%, $P = .005$), JAMA Ophthalmology (0.7% to 1.6%, $P = .009$), and JAMA Surgery (0.8% to 1.7%, $P = .028$). There were no differences in the percentage of first- or senior-authored articles over the study period.

Conclusion: Pharmacists are increasingly involved in the conduct and publishing of clinical research across a number of practice areas. Further exploration is needed into barriers and facilitators to pharmacist participation in research.

84 | The relationship between sleep and memory retention in multiple healthcare programs

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Introduction: Sleep is essential for memory and academic performance. Deficiencies in quantity and quality of sleep are associated with poor memory retention in students. No study has been identified that assesses and compares the relationship between sleep and academic performance among students of multiple health care professions.

Research Question or Hypothesis: To assess and compare the relationship between sleep, memory retention, and academic performance among students in a Doctor of Pharmacy, Doctor of Optometry, and Physician Assistant program.

Study Design: Cross-sectional survey with assessment questions.

Methods: Fifty-two Marshall B. Ketchum University students filled out a survey in which they self-reported information including 1) amount of sleep the night before taking the survey and on a typical weeknight, 2) a perceptual sleep quality measure, 3) year in the academic program, and 4) grade point average (GPA). Memory retention was assessed by several quiz-style questions on topics drawn from mandatory first-year coursework common to all three academic programs.

Results: A multivariate analysis of variance (MANOVA) assessed differences in GPA and memory retention. Student gender and academic program were fixed factors and crossed. Random factors in the MANOVA were age, year in the program, number of hours slept last night, number of hours slept on a typical weeknight, and typical quality of sleep. Memory retention was positively associated with the amount of sleep last night, $F(1, 41) = 5.81$, $P = .02$. Students further along in their respective programs typically had lower GPAs, $F(1, 41) = 5.85$, $P = .02$. All other independent variables were nonsignificant.

Conclusion: Adequate sleep appears to be linked with memory retention in health care students. Students who slept more last night scored better on a quiz about first-year course content, regardless of whether students were in their first, second, third, or fourth year in the program. Results did not differ by program.

85 | The effect of providing credit/no credit grade option on student performance in a required course

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Introduction: The COVID-19 pandemic brought abrupt changes to many aspects of education mid Spring 2020 nationwide. Our institution announced a "credit" or "no credit" (CR/NC) grading option mid-course for courses completed after Spring Break 2020 with a student decision deadline after final grades were released. The impact of this or similar grading options on student performance in challenging times in largely unknown. We investigated how having the CR/NC grading option affected student pharmacist performance in a 5 week, 3 credit-hour course.

Research Question or Hypothesis: How does the introduction of a CR/NC grading option affect student performance?

Study Design: A retrospective, quantitative study of student performance in a required course.

Methods: Following IRB approval, mean overall scores on exams, top-drug quizzes, cases, and post-case quizzes were analyzed pre-post CR/NC option for students enrolled in the 2020 online only course (n = 232). Additionally, lecture recording accessions were compared pre-post CR/NC. The student performances were analyzed using paired t-test.

Results: The mean overall scores on exams, cases and case post-quizzes significantly decreased after the introduction of the CR/NC grading option (exams: 81.8% vs. 78.5%; cases: 90.1% vs 87.7%; case post-quizzes: 80.2% vs. 66.3%, respectively; $P < 0.001$) but not between the mean scores on top-drug quizzes (90.3% vs. 90.7%, $P = 0.6$). No difference was observed in recorded lecture average viewing minutes.

Conclusion: The availability of a CR/NR grading option in 2020 course may have led to reduced student performance on most major course assessments, but did not affect the time spent accessing and laying lecture recordings. Additional outside environmental factors related to the unprecedented times may have also contributed and should be addressed in future studies.

86 | Predictors of the pursuit and attainment of postgraduate residency positions by pharmacy students

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Introduction: Attainment of postgraduate pharmacy residency is highly competitive. Although several studies have reported

institutional characteristics associated with attaining a residency position, little is known about student-level predictors for residency match. This study aims to evaluate factors that predict the pursuit and attainment of pharmacy residency positions.

Research Question or Hypothesis: Which variables predict pharmacy students' pursuit and attainment of residency positions?

Study Design: Survey-based cross-sectional study

Methods: A web-based survey was administered in May 2020 to 396 students of the class 2019 and 2020 at University of the Pacific School of Pharmacy. The survey asked questions relating to students' characteristics (e.g., resilience, as measured by the Academic Pharmacy Resilience Scale [APRS-16]), academic performance and experiences in pharmacy school (e.g., GPA, leadership, research, patient care, etc.), and whether students applied to and matched with a residency program. Logistic regression modeling was used to evaluate whether students' responses to survey questions predicted their pursuit and attainment of residency.

Results: From 185 students that completed the survey (46.7% response rate), 129 applied to and 77 matched with a residency position. The logistic regression outcomes indicated that the model was a significant predictor of the residency pursuit (X2 [5, 185] = 55.4, $P < 0.0001$) and attainment (X2 [3, 185] = 77.66, $P < 0.0001$). Students with greater GPA, research experience, resilience scores and leadership in an organization or school committee were more likely to apply to a residency program (Odds Ratio > 1.06). Students with greater GPA, self-rated performance score in the residency interview and leadership experience on a school committee were more likely to match with a residency program (Odds Ratio > 5.31).

Conclusion: This study identifies several variables that predict students' application to and match with a postgraduate residency program, which could provide useful information to stakeholders, including students, educators, and residency program directors.

87 | Impact of postgraduate year 1 (PGY-1) residency training on pharmacy residents' philosophy of practice

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Introduction: A philosophy of practice (PoP) serves as the foundation for any patient care practice. It is a set of professional values and beliefs that guides a practitioner's actions and decisions in practice. It remains unknown how PoPs change over time, particularly as pharmacy students transition into pharmacists.

Research Question or Hypothesis: How does one year of PGY-1 residency training change pharmacy residents' philosophy of practice?

Study Design: Qualitative comparative analysis of PGY-1 residents' PoP at the start of residency versus the end of residency.

Methods: In July 2019, 23 incoming ambulatory care PGY-1 residents at the University of Minnesota were asked to articulate their PoPs. In April 2020, the same cohort was asked to revisit their PoPs making any necessary revisions based on their experiences and reflections. Baseline PoPs were coded inductively to create a standard codebook. The codebook was applied to final PoPs to assess for any changes or new codes that emerged.

Results: Three new codes emerged in the final PoPs compared to the baseline PoPs: improving the health of the community, educating the future generation of pharmacists, and professional advocacy and service. Some codes, such as "providing patient-centered care" and "roles and responsibilities in the patient-pharmacist therapeutic relationship", were included in residents' baseline and final PoPs. However, one of the largest differences that occurred was the frequency of the code "interprofessional team collaboration," with only five residents including this in their baseline PoP compared to 16 in the final PoPs.

Conclusion: After one year of residency training, concepts such as interprofessional collaboration became more prevalent in residents' PoPs suggesting that this may be a concept residents understand and appreciate more during residency. Additionally, the emergence of new codes, such as professional advocacy and service, may also be reflective of the professional identity development that occurs during residency.

88 | The impact of using simulated interprofessional medical scenarios to teach advanced cardiovascular life support concepts to prelicensure pharmacists and physician assistant learners

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Introduction: Simulation-based interprofessional education (sim-IPE) is a unique form of active learning that provides a hands-on opportunity to collaborate with other professions in applying didactic knowledge and patient skills in an educational, risk-free environment that mimics a real-life patient setting. Studies evaluating sim-IPE have reported positive impacts on interprofessional (IP) communication, teamwork, participant satisfaction and perceptions of IP collaboration.

Research Question or Hypothesis: We hypothesized that participation in ACLS-related sim-IPE would positively impact student perceptions of IP collaboration and retention of ACLS content.

Study Design: This was a prospective, observational study evaluating the impact of simulated interprofessional medical scenarios (SIMS) on second-year pharmacy and first-year PA students' perceptions of IP collaboration and ACLS knowledge retention.

Methods: Once weekly for 7 weeks during Fall 2017 and 2018, IP teams of 4-5 pharmacy and PA students participated in an ACLS SIMS and faculty-facilitated debrief sessions to discuss the team's IP communication, teamwork, and clinical pearls of the SIMS. Validated IP surveys and a knowledge test on ACLS concepts before and after the course, and 150-days post- SIMS.

Descriptive statistics and a mixed effects linear regression model were used to describe the cohorts and compare the exam scores and survey responses, respectively. A Waldi chi-square test was used to perform significance tests on the fixed effects, with pairwise comparisons using a Tukey adjustment for post hoc analysis.

Results: Twenty-eight pharmacy and sixty PA students completed the course. Post-hoc comparisons showed a significant improvement in knowledge retention between pre- and post-tests ($P < 0.0001$), pre-test and 150-day follow-up ($P < 0.0001$), and post-test and 150-day follow-up ($P < 0.0001$) for both cohorts. The Attitudes Toward Health Care Teams and Interprofessional Collaboration surveys showed an increase in scores from pre- to post-course ($P = 0.0002$, $P < 0.0001$, respectively).

Conclusion: Sim-IPE provides health professional students with an innovative, hands-on experience that improves knowledge retention and perceptions of IP collaboration.

89 | Pharmacy students' receptiveness of virtual reality and perception of its impact on curriculum

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Introduction: Virtual reality (VR) uses advanced technology to create an immersive, interactive, and hands-on experience. Published research has demonstrated that the use of VR in the classroom may enhance academic achievement by increasing learner engagement; however, the literature did not include pharmacy students. Understanding pharmacy student receptiveness and acceptance of VR is important to understand how to incorporate to maximize impact.

Research Question or Hypothesis: To determine pharmacy student receptiveness and acceptance of VR as an educational tool within the pharmacy curriculum.

Study Design: Cross-sectional study utilizing matched response analyses for pre and post exposure.

Methods: The survey was administered to all first-year pharmacy students (n = 95) enrolled at the University of South Florida Taneja College of Pharmacy. Qualtrics was used to administer the pre/post surveys with rating scale questions, students were emailed the link to complete. The six-question pre-survey measured students' baseline understanding of beta-blockers, familiarity, perceptions, and understanding of VR. The nine-question post-survey assessed the level of receptiveness, perceived engagement, and utility of the VR activity. Descriptive statistics, Pearson correlation and matched analyses were undertaken.

Results: A total of 45 pre-activity (47% response rate) and 22 post-activity surveys (23% response rate) were completed. Eighty-six percent (86%) of participants either agreed or strongly agreed that they would be interested in having more VR sessions in the classroom and 82% would recommend the use of VR to other pharmacy students. Overall, 50% of participants responded that VR enhanced their learning and understanding, while no students indicated a worsening of learning or understanding. A significant negative correlation was observed between self-reported technology proficiency and comfort with VR, suggesting a need for additional training prior to the activity.

Conclusion: Pharmacy students appear receptive to the use of VR in the classroom. Further investigation of the value of VR in pharmacy education should be explored.

90 | Effectiveness of a targeted medication adverse effect assessment process by pharmacy students

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Introduction: Several studies have shown that patients know few of the potential adverse effects of their medications. Health care providers, including pharmacists, are trained to utilize open-ended questioning when assessing potential adverse effects of medications. The patient knowledge gap combined with open-ended questioning could lead to less reporting of medication-related adverse effects.

Research Question or Hypothesis: Does the use of a targeted method of questioning by pharmacy students, as compared to a traditional, open-ended questioning method, increase the amount of medication-related adverse effects detected, or increase student-prescriber interactions?

Study Design: Modified cross-over study. The student participants alternated their questioning process based upon even or odd days, which was blinded from the preceptor.

Methods: Fourth-year pharmacy student participants utilized two different adverse effect questioning methods: the standard, open-ended process, and a targeted process in which common adverse effects of home medications were asked of the patient. The questioning was performed as part of a comprehensive medication review process, which the students practiced for 2-4 weeks prior to starting the study. The participants input data directly into an online database to maintain preceptor blinding.

Results: Over two school years (2018-2020), five students consented to participate. Thirty-six patient encounters were documented (18 = targeted, 18 = standard). Students identified an adverse effect associated with a medication more often using the targeted process

(33% vs 22%). There was greater prescriber interaction when using the targeted process, both related to identified medication related adverse effects (17% vs 6%), and more general medication-related issues (22% vs 17%).

Conclusion: Adding a targeted questioning method may increase the amount of medication-associated adverse effects identified by students, and increase the amount of student-prescriber interactions. This questioning method could benefit both patients and student learners.

91 | Evaluation of an introductory pharmacy practice experience to reinforce student learning and increase student confidence immediately prior to advanced pharmacy practice experiences Amid a COVID-19 pandemic

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Introduction: Preparing pharmacy students with practice skills necessary for entry into Advanced Pharmacy Practice Experiences (APPEs) is essential. Responding to an internal survey indicating 85% of third-year students did not feel prepared for APPEs, an Introductory Pharmacy Practice Experience (IPPE IV) was designed to provide 16-hours of clinical case-based on-site or virtual experiences with clinical faculty immediately prior to APPEs. The IPPE IV occurred April-May 2020 during the COVID-19 pandemic.

Research Question or Hypothesis: Will the IPPE IV increase third-year pharmacy students' confidence in APPE preparedness?

Study Design: Pre-test/post-test.

Methods: Students were administered a pre-post survey in Qualtrics around the IPPE IV. Surveys consisted of items assessing confidence and perceived ability in the Pharmacists' Patient Care Process, patient case presentations, professionalism, communication and electronic medical record (EMR) use. A Wilcoxon signed-rank test was used to examine differences pre- and post-IPPE IV.

Results: A total of 122 students completed the surveys. Post IPPE IV, students were significantly more confident in their ability to: collect information to identify patient's health-related problems ($P = .013$), analyze information to identify medication-related problems ($P < .001$), analyze information to prioritize patient's health-related needs ($P < .001$), create an evidence-based patient care plan ($P < .001$), create a cost-effective patient care plan ($P < .001$), create a patient care plan in collaboration with the patient, caregiver(s), and/or other health professionals ($P = .007$), and follow-up/monitor a patient care plan ($P = .015$). Students were significantly more confident in their ability to work up a patient ($P = .006$) and in presenting patient cases ($P = .005$). Additionally, students were significantly more confident in demonstrating self-awareness ($P = .041$), effectively communicating with patients and/or caregivers ($P = .016$) and health care providers ($P = .010$) and using an EMR to detect medication-related problems ($P = .010$).

Conclusion: An IPPE IV immediately prior to APPEs had a positive impact on students' confidence in areas important for APPE success. Future research should examine how these improvements in confidence manifest in actual APPE performance.

92 | 'What just happened?' Pharmacy students' perspective on the impact of COVID-19 lockdown on their learning

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Introduction: COVID-19 pandemic has affected educational systems worldwide. Whether prepared or not, lockdown to curb the pandemic and suspension of on-campus activities in the universities in Saudi Arabia forced all teaching and assessment to move online.

Research Question or Hypothesis: How was pharmacy students' learning affected during the lockdown and what have they learnt from this experience?

Study Design: Qualitative.

Methods: A one-hour Twitter chat was organized on three consecutive days, after the final exams, inviting all pharmacy students in Saudi Arabia to participate. Day 1 chat included 11 questions regarding learning and assessment, Day 2 chat included six questions about online exams and six questions about technology use, Day 3 chat included six questions related to lessons learnt from the experience. The questions were validated by faculty members and piloted with some students prior to the chat. At the end of each day, responses were downloaded, reviewed to remove any confidential information, and thematically analyzed using inductive method by two teams of research students independently.

Results: During the three-day chat, a total of 790 responses were received. Thematic analysis generated 944 codes which were categorized into 43 subthemes. These subthemes were further categorized into six main themes: 'facilitators for online education', 'barriers for online education', 'online versus on-site education', 'role of technology in online education', 'suggestions for improving online education' and 'long-term impact of online education during lockdown'.

Conclusion: Participants highlighted several facilitators and barriers which affected their online education during lockdown, and pros and cons of technology involved. They compared online education with on-site education and provided suggestions for improving online education based on their experience during lockdown. They also provided an insight into what impact the online education during lockdown

may have on their professional development and future career. We expect that the lessons learnt from students' experience during lockdown will help shape pharmacy education in future.

93 | Information gap regarding the accessibility of ASHP-accredited PGY-1 residency programs to international students studying pharmacy in the United States

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Introduction: Completing an American Society of Health-System Pharmacists (ASHP) accredited Postgraduate Year One (PGY-1) residency enhances clinical pharmacy practice knowledge and skills. Many programs may not consider international graduates from Accreditation Council for Pharmacy Education (ACPE) accredited programs applying for residency positions. International students with F1 visas are eligible to complete PGY-1 trainings without sponsorship but the information available to these students is limited.

Research Question or Hypothesis: How many PGY-1 programs provide eligibility criteria to international graduates with F1 visas from ACPE accredited programs?

Study Design: Review of the ASHP Residency Directory.

Methods: All US-based PGY-1 programs on the directory were included. The following sections of the directory were reviewed: special requirements for acceptance, residency special features, and the site special features for every program. Each description was reviewed to identify essential information related to eligibility/visa/sponsorship/citizenship. Programs were classified as eligible, non-eligible and no information. Descriptive statistics were used to summarize the data.

Results: There were a total 1,457 ASHP-accredited PGY-1 programs included in the analysis. Of these programs, 993 (68.2%) did not indicate the visa/citizenship requirements of applicants, and 90 (6.2%) had no information on special requirements for acceptance, residency special features, or site special features. Of those with information available, 271 (18.6%) stated they only accepted applications from US citizens/permanent residents, and 103 (7.1%) provided requirements for international students. Among those 103 programs, 87 (84.5%) required applicants to be eligible to work in the United States or stated that visa sponsorship was not available. Less than 10 programs provided eligibility criteria to international students holding F1 visas and accepted applications.

Conclusion: Most PGY-1 residencies do not provide eligibility criteria to international students on the ASHP Residency Directory. For those programs that do provide information, most state that they do not sponsor visas or require applicants with work authorizations. Only a few programs accept applications from international students.

94 | Summary of performance in a first-year, integrated, doctor of pharmacy course using on-campus versus on-line instruction: A curricular comparison in response to COVID-19

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Introduction: In March of 2020, many on-campus, didactic health professional courses transitioned to an on-line format within a matter of weeks in response to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; COVID-19) pandemic. Both faculty and students were required to swiftly adapt to remote strategies of instruction and learning. Prior to COVID-19, many colleges of pharmacy implemented revised curricula to include more integrated courses and active learning methods. These revised courses and delivery methods may have been more difficult to deliver via remote learning compared to traditional, lecture-style instruction. Thus, student performance may have been affected.

Research Question or Hypothesis: Were there significant differences in student performance in a required, first-year, integrated, doctor of pharmacy course from 2019 (on-campus instruction) to 2020 (on-line instruction)?

Study Design: This study was a retrospective, quantitative review of a first-year doctor of pharmacy course.

Methods: Course assessments (exams, cases, written assignments) and course evaluation data for two iterations (2019 and 2020) of an Integrated Pharmacotherapy-Endocrinology course were compared using independent sample t-tests. The primary difference in the iterations was method of delivery (2019 on-campus; 2020 on-line).

Results: No significant differences in student performance existed between years 2019 and 2020.

Conclusion: The COVID-19 pandemic did not significantly affect student performance in this first-year, integrated doctor of pharmacy course. Additional areas exist for quality improvement research in student performance with specific course instructor lecture objectives.

95 | Impact of Online Supplemental Objective Structured Clinical Experiences (OSCEs) on student competency and confidence in the pharmacists' patient care process

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Introduction: Simulation-based teaching has been associated with improved outcomes in student learning. Based on the current climate, online learning and telehealth is anticipated to play a more prominent role in the pharmacy profession, but the effectiveness of teaching simulation via online platforms remains unclear.

Research Question or Hypothesis: Does online simulation improve student competency in the Pharmacists' Patient Care Process (PPCP) and communication skills?

Study Design: A pilot program including three supplemental Objective Structured Clinical Experiences (OSCEs) in anticoagulation, pain and depression was offered online to students as a supplement in a required skills laboratory course.

Methods: Fifty supplemental OSCEs were administered to 21 third-year students (32.8% of the class). Overall and domain-based scores were compared to required OSCEs. Student self-assessment of PPCP/communication skills and perceptions of online OSCEs were collected via online surveys. The primary endpoint was the overall score for supplemental OSCEs versus required OSCEs. Secondary endpoints included performance in individual PPCP domains and communication, overall OSCEs scores in pilot participants versus non-participants, and student self-assessment of PPCP/communication skills and perceptions of OSCE format.

Results: The primary endpoint of overall OSCE scores improved in students who participated in supplemental OSCEs (67.9% vs 78.9%, $P < 0.05$). Domain-based scores in Collect, Assessment/Plan and Communication improved ($P < 0.05$), but no difference was observed in the Implement/Follow-up domain. Students who completed supplemental OSCEs self-reported increased confidence in all areas of the PPCP and communication skills ($P < 0.05$). Overall scores for required OSCEs were similar between participants versus non-participants (81.2% vs 82.2%, $P = 0.93$). In a voluntary survey, 93.8% of students (n = 16) strongly agreed/agreed that online OSCEs were a reasonable alternative to in-person OSCEs, but 81.3% preferred in-person OSCEs.

Conclusion: Implementing a supplemental OSCE program to required simulation curriculum may improve student competency and confidence in the PPCP for patient care delivery in traditional and telehealth settings.

96 | The impact of remote learning on faculty workload and stress management: A case study in the setting of COVID-19

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Introduction: In response to the COVID-19 pandemic, many educational institutions have been forced to transition to remote learning. While the impact of remote learning on students has been well studied, few studies have examined the impact of the switch to distance learning on the workload and stress management of pharmacy educators and researchers.

Research Question or Hypothesis: The rapid transition to remote learning necessitated by the COVID-19 pandemic adversely impacted pharmacy educators.

Study Design: Cross-sectional qualitative survey.

Methods: To assess the perceived levels of stress and workload of educators and researchers, a 28-question survey was developed. The survey was sent to the Academic Section of the International Pharmaceutical Federation (FIP) and the pharmacy faculty of St. Louis College of Pharmacy. Data was anonymously collected via SurveyMonkey. Demographic data (area of practice, time to transition to remote learning, time spent in the academic practice setting, and baseline use of remote classrooms) was collected and utilized to create cohorts (transition time < 7 days versus >7 days) that assessed the impact of time for remote learning transition on burnout and practice setting burden. One-tailed t-tests were conducted and results were interpreted at the $\alpha = 0.05$ level.

Results: The data demonstrated that the transition time to remote learning and practice discipline had a significant impact on aspects of stress and workload for pharmacy educators. Educators in the <7-day transition cohort displayed significant perceived increases in workload ($P < 0.001$) and emotional burden ($P = 0.03$). Further, pharmacy practice educators displayed significant perceptions in decrease in community connection ($P = 0.003$), unequal expectations ($P < 0.001$), and increased stress from clinical positions ($P = 0.002$).

Conclusion: Faculty workload and perceived stress was adversely impacted by the transition to remote learning, with significant findings observed in educators with the shortest amount of transition time and concurrent positions as pharmacy practice educators or researchers.

97 | Incorporation of Entrustable Professional Activities (EPAs) into an inpatient medicine advance pharmacy practice experience (APPE) through a student-driven transitions-of-care (TOC) process

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Introduction: Medication errors can occur during transitions of care. Student pharmacist involvement in this process facilitates accountability for direct patient care and plays a role in reducing

errors. In 2016, the American Association of Colleges of Pharmacy (AACP) endorsed core Entrustable Professional Activities (EPAs) that graduates from Pharm.D. programs must be able to perform independently. We assessed student perceptions of a novel transitions-of-care (TOC) process in the development of selected EPAs.

Research Question or Hypothesis: Will a student-driven transitions-of-care process promote student-perceived development of entrustability?

Study Design: Single center, retrospective cohort

Methods: An anonymous online survey was administered to student pharmacists who completed the Medicine APPE from January-November 2019. Survey statements encompassed three EPA domains (patient care provider, interprofessional team member and population health promoter). Students rated their confidence levels at the start and completion of the rotation on six core EPA statements within the three domains using a Likert scale (1 = lacking confidence, need continuous guidance; 5 = fully confident, no guidance required). Wilcoxon signed-rank test was used for analysis.

Results: Ninety percent of students completed the survey (n = 18). Students' perceived level of confidence, reflecting their entrustability, increased for all six core EPAs evaluated ($P < 0.001$). For the patient care provider domain, there was an increase in confidence with identifying medication-related needs (2.94 ± 0.082 vs 4.33 ± 0.594, $P < 0.001$), establishing patient-centered goal with the team (2.67 ± 1.085 vs 4.06 ± 0.539, $P < 0.001$), and creating/implementing a collaborative care plan (2.67 ± 0.840 vs 4.22 ± 0.548, $P < 0.000$; 2.56 ± 0.922 vs 4.28 ± 0.575, $P < 0.000$). An increase in confidence occurred within the interprofessional team member domain, which included the ability to collaborate with a team (2.78 ± 0.647 vs 4.56 ± 0.616, $P < 0.000$), as well as the population health promoter domain, which included ensuring appropriate immunizations (3.17 ± 0.924 vs 4.39 ± 0.608, $P < 0.000$).

Conclusion: Students' perceived level of confidence increased from the beginning to end of the rotation experience for the six core EPA statements. Similar patient care activities can assist student-perceived development of entrustability.

98 | An interprofessional approach to improve communication and patient safety awareness among pharmacy and physician assistant students

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Introduction: Effective interprofessional collaboration and communication are important skills for pharmacy students and physician assistant students to possess per the 2013 CAPE educational outcomes (3.4 and 3.6) and the Accreditation Standards for Physician Assistant Education (B2.10), respectively. The TeamSTEPPS® framework offers strategies to enhance healthcare team performance, patient safety, and interprofessional communication.

Research Question or Hypothesis: Will an interdisciplinary patient safety workshop improve students' value of interprofessional collaboration, proficiency in effective interprofessional communication and perception of their ability to apply medication error prevention principles?

Study Design: This study was an IRB approved, prospective study using a pre/post-survey to evaluate pharmacy and physician assistant students' perception of their medication safety and interdisciplinary communication skills.

Methods: An interdisciplinary workshop involving third-year pharmacy and second-year physician assistant students was conducted in the Spring of 2020. The workshop comprised of an animated presentation highlighting TeamSTEPPS® concepts and two interdisciplinary activities. Students utilized role-playing to apply the SBAR communication tool and addressed medication errors incorporated into a Jeopardy! ® game by team members that were prompted to provide false answers. A 17-item pre/post survey was administered after the activity and consisted of likert-scale questions modified from the Interprofessional Collaborative Competency Attainment Scale (ICCSAS) and the Teamwork Attitudes Questionnaire (T-TAQ). Pharmacy students completed a one-page reflection as a course required assignment. De-identified reflection responses were analyzed for themes.

Results: The workshop was attended by 159 students. One hundred and seven (67%) matched survey responses were reported and analyzed. There was statistically significant improvement in the survey items regarding students' perception of their interprofessional teamwork, communication and patient safety skills. Students also reported that their overall ability to collaborate interprofessionally was much better after the workshop.

Conclusion: An interdisciplinary workshop improved students' perception of their interprofessional collaboration, communication and ability to apply medication error prevention principles.

99 | Impact of COVID-19 on post-graduate training of pharmacy residents and fellows: Results from a national survey of post-graduate pharmacy trainees

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Introduction: Coronavirus disease 2019 (COVID-19) has impacted the activities of healthcare workers, including pharmacy post-graduate trainees. While shifts in practice are expected during a pandemic, quality training experiences must be maintained to produce competent pharmacy practitioners.

Research Question or Hypothesis: Describe and assess pharmacy resident/fellow perceptions of COVID-19's impact on their training experiences.

Study Design: We conducted an anonymous survey of pharmacy trainees in the U.S. to evaluate perceived alterations in experiences and describe practice changes following COVID-19.

Methods: Descriptive statistics were reported and responses were analyzed through thematic analysis. Nominal variables were compared via McNemar test or exact multinomial symmetry test, while continuous/ordinal variables were compared as paired data between groups via Wilcoxon Signed-Rank test. Analysis and data processing were conducted in R version 4.0.0.

Results: From 6/4/2020 to 6/22/2020, a total of 511 pharmacy trainees in 46 states with a median age of 26 (IQR, 25-28) years completed the survey. 277 PGY-1 residents (54%), 203 PGY-2 residents (40%), and 30 post-graduate fellows (6%) participated. Trainees reported less direct patient care (38.5% vs 91.4%, $P < 0.001$), less time with preceptors (2 vs 4 hr, $P < 0.001$), and increased work from home (31.7% vs 1.6%, $P < 0.001$) after COVID-19. Sixty-five percent of respondents expressed changes in planned rotation experiences, and 39% reported trainees at their site being asked to work in areas outside of their routine training experience. Only 11% of respondents stated that their training experience did not shift to focus on COVID-19. Most respondents reported either a "major (9.6%) or minor (52.0%) worsening in quality of experience," compared to a "major (5.5%) or minor (8.4%) improvement in quality of experience."

Conclusion: Pharmacy resident/fellow experiences were perceived to have been impacted by COVID-19 in varying ways. Our findings describe shifts in pharmacy training and may aid in the development of best practices for optimizing future experiences in the face of a pandemic.

100 | Perceptions of burnout among third- and fourth-year pharmacy students

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Introduction: The World Health Organization describes burnout as an "occupational phenomenon" and is developing guidance for future management. Burnout has been recognized in pharmacists and medical learners. The American Association of Colleges of Pharmacy reported a need for better understanding of burnout and available resources for pharmacy learners

Research Question or Hypothesis: To assess burnout symptoms in third and fourth-year pharmacy students, as well as comfort and knowledge with available resources for burnout.

Study Design: Cross-Sectional Survey

Methods: A 25-question survey via Qualtrics was distributed through class listservs Participation was voluntary and responses were recorded anonymously. The survey assessed basic demographics and study endpoints. Maslach Burnout Inventory (MBI) was used to assess burnout symptoms. It is broken into three categories: exhaustion (EX), cynicism (CY), and professional efficacy (PE). Statistical analysis was completed using IBM SPSS Statistics 26.

Results: The survey response rate was 45.9% (94 out of 205). Seventy-four students (78.7%) reported feeling symptoms of burnout at least "half the time" over a six-month period. MBI subscale median scores were: EX, 4.8 (IQR = 3.8-5.2); CY, 3.5 (IQR = 2-4.4); and PE, 4.3 (IQR = 3.83-5). Third-years reported higher rates of EX ($P = 0.035$) and CY ($P = 0.029$) than fourth-years. Students pursuing residency training had lower rates of EX ($P = 0.033$) and CY ($P = 0.022$), and higher rates of PE ($P = 0.016$) than peers seeking retail positions after graduation. Forty-eight (51%) students reported knowing resources were available on campus. Fifty-six (59.6%) reported being moderately or extremely uncomfortable reaching out for help.

Conclusion: Students who participated in this study indicated high levels of burnout, both self-perceived and indicated by MBI scores. Notably, based on subscale scoring, pharmacy students could be further classified as overextended based on EX and CY but highly engaged based on PE. Additionally, students noted they felt uncomfortable reaching out for help or resources, despite knowing resources were available to them on campus.

101 | Acceptance of supplemental instruction as an academic support mechanism in a cardiology course: A pilot study

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Introduction: Supplemental Instruction (SI) as an academic support mechanism has traditionally been utilized in undergraduate education. Unlike tutoring which focuses on high-risk students, SI provides support for high-risk courses. This approach removes the negative stigma associated with seeking academic support. While the value of SI in undergraduate education has been well established, its role in professional healthcare education has not been evaluated.

Research Question or Hypothesis: Will SI be accepted as a valuable instructional aid in a Doctor of Pharmacy course?

Study Design: Descriptive study.

Methods: An SI program was piloted in the cardiology course at Chapman University School of Pharmacy. Students that previously performed well in the course were selected as SI leaders to facilitate weekly guided sessions. SI leaders worked with course faculty to develop lesson plans. Guided sessions took the form of summarized lectures, cases, practice questions, and games. Students were administered a 10-item survey that assessed the students' acceptability, preferred teaching modalities, and suggestions for improvement of the SI program.

Results: A total of 62 out of 98 students enrolled in the course responded to the survey. Of the respondents, 100% stated that they *agree/strongly agree* that SI sessions reinforced lecture content and were a valuable use of time. All would recommend and would like to see it offered in other courses. Additionally, 96.6% either *agree/strongly agree* that SI sessions contributed to their success in the course. Cases and questions were the preferred teaching modalities. Reviewing in-class materials, practice questions, and further explanations were reported to be the most beneficial components of the SI sessions. Of the 24 students who provided feedback regarding improvements in SI sessions, 58% reported the desire for additional review questions.

Conclusion: Supplemental Instruction was widely accepted and perceived as valuable. Further studies to assess the role of SI sessions in improving academic performance is warranted.

102 | Impact of a web-based preceptor development program on Nigerian pharmacists' knowledge and attitudes toward effective precepting skills

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Introduction: With the new institution of the Doctor of Pharmacy degree as the terminal degree for pharmacy students in Nigeria, there is a need to ensure that pharmacy educators are trained on effective tools and techniques to be successful preceptors. Our program is the first web-based program developed to augment the training of Nigerian pharmacists to prepare them to be effective preceptors in the new Pharm.D.curriculum.

Research Question or Hypothesis: The web-based Preceptor Development Program will have a positive impact on Nigerian pharmacists' knowledge and attitudes toward effective precepting skills.

Study Design: Prospective, pre-post interventional study

Methods: A web-based preceptor development program was developed that included recorded webinars to support participants' preparation to precept Pharm.D. students. Surveys were administered to participants before and after participation in the web-based program to assess knowledge and attitudes toward effective precepting skills. The primary outcome of knowledge was assessed using multiple-choice and short-answer questions. Attitudes were ranked on a 4-point Likert scale (strongly disagree to strongly agree). Completion of the survey was voluntary, and informed consent was obtained before participation. Data were analyzed using descriptive and inferential statistics.

Results: Ninety-four participants from over 20 states in Nigeria successfully completed the program and surveys. Participants showed improvement in their knowledge of effective precepting skills from the pre- to post-surveys (51 ± 23% vs. 73 ± 21%, $P < 0.001$) Even though a majority of participants agreed or strongly agreed at baseline to survey items describing roles and responsibilities towards effective precepting, participants showed improvement in perceptions on items related to providing feedback to students, ensuring practice site is conducive to learning and preparing students for professional practice ($P < 0.05$).

Conclusion: A web-based preceptor development program was successfully delivered to pharmacy educators across Nigeria and contributed towards improvement in their knowledge and attitudes towards effective precepting.

103 | From start to finish: examining factors associated with higher likelihood of publication among abstracts presented at infectious diseases scientific meetings

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Introduction: Presentation of research outcomes at scientific meetings is often viewed by many as an intermediate step to the goal of timely publication in a peer-reviewed journal.

Research Question or Hypothesis: What are the proportion of abstracts published from Infectious Diseases Society of America (IDWeek) annual meetings and factors associated with higher likelihood of publication?

Study Design: Retrospective, observational study

Methods: An analysis of publicly available abstracts presented at IDWeek from 2017 and 2018 was performed. A random sample of abstracts was used for data extraction and analysis. The primary

endpoint was to determine the proportion of abstracts subsequently published as full papers. The study follow-up period was an average of 27 months post-presentation. Factors associated with successful publication were determined using a multivariate regression model. Categorical variables were compared using Fisher's exact or chi-square tests. Continuous variables were compared using Wilcoxon Rank Sum test. Univariate and multivariate regression analysis were performed.

Results: Among 886 abstracts reviewed, 240 (27%) were subsequently published an average of 13.2 months (± 6.5) after presentation. A Pharm.D.was an author on 28% of abstracts and the presenting author on 14%. Primary presenters were international in 56 (23%) of the published abstracts. Affiliation with an academic institution comprised 121 (50.4%) of published abstracts. Published abstracts more often included PhD authors (70% vs. 59%, $P = 0.0024$), were prospective (44% vs. 29%, $P = 0.0003$), and included more study subjects (432 vs. 254, $P = 0.025$) compared to non-published abstracts. In regression analysis, platform presentations (OR: 2.11, CI: 1.56-2.84), abstracts from 2017 (OR: 2.22, CI: 1.64-3.01), and abstracts with larger authorship (8 (5-10.5) vs. 6 (4-9), $P < 0.0001$) were more likely to be published.

Conclusion: Abstracts from IDWeek annual meetings were published at a lower proportion than anticipated based on published data. Published abstracts were frequently interprofessional, prospective, and presented as platform presentations with high numbers of authors.

104 | Relationship of learning style and perception of virtual patient simulation in pharmacy students

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Introduction: As per the Accreditation Council for Pharmacy Education and American Association of Colleges of Pharmacy, the future of pharmacy education should be centered on innovative, personalized instructional methods for the development of student pharmacists. Although virtual patient simulation is one such method, it is unknown if certain students benefit most from this type of learning activity.

Research Question or Hypothesis: This study evaluated if pharmacy students of a particular dominant learning style had the greatest perceived benefit of virtual patient simulation.

Study Design: This was a prospective, observational study that evaluated student learning style and perception of virtual patient simulation.

Methods: Student pharmacists in their third professional year were included in this study. Students completed the Pharmacists Inventory of Learning Styles assessment at the beginning of the semester to determine their dominant learning style. Students then completed three virtual patient simulation activities, utilizing DecisionSim™, as part of their course activities. Finally, students completed a nine-question survey regarding their perception of virtual patient simulation, using Likert scale response. These perceptions were grouped by dominant learning style and compared using descriptive statistics.

Results: Of 108 pharmacy students, the majority had a dominant learning style of Producer (50.9%) or Director (30.6%), while Enactor (4.6%), Creator (4.6%), or co-dominant learning styles (9.2%) made up the remainder. Students with the Creator learning style had the most positive perception of virtual patient simulation in four of the nine survey questions, followed by the Director group in three of the nine. Enactors had the lowest perceived benefit.

Conclusion: Students with a dominant learning style of Creator had the greatest perceived benefit of virtual patient simulation, while Enactors had the least. This information will be utilized to determine the impact of learning style on student performance and the overall benefit from virtual patient simulation in various groups.

105 | We are pharmily: Evaluation of pharmacy learning communities

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Introduction: Transitioning into a professional program can be overwhelming for students, resulting in academic struggles and wellness concerns. Learning communities have been shown to improve this transition in medical schools, creating a foundation for support through longitudinal student-faculty relationships. The UNC Eshelman School of Pharmacy implemented Pharmacy Learning Communities (PLCs) in Fall 2019. The PLCs were designed to foster faculty and student engagement. The PLCs included faculty coaches, first-year-student (PY1) advisees, and third-year-student (PY3) peer mentors. The study explored faculty and students perceptions of the PLCs' structure, interactions, and curriculum topics. An evaluation of the PLCs was conducted in Spring 2020 to inform best practices for PLCs in pharmacy education.

Research Question or Hypothesis: What are faculty and student perceptions of the PLC structure, interactions, and curriculum topics?

Study Design: Semi-structured focus groups

Methods: PY1 advisees, PY3 peer mentors, and faculty coaches involved in PLCs were invited to participate in 60-minute focus groups. Five separate focus groups were conducted in-person (n = 1) and virtually (n = 4) in order for participants to speak to their unique experiences in the PLCs. Focus groups were recorded and transcribed. Quotes were extracted, analyzed using inductive coding, and themes were identified across and within each of the three groups.

Results: A convenience sample of 9 PY1s, 2 PY3s, and 7 faculty coaches participated in focus groups. Overall, participants enjoyed the PLCs. All groups identified having multiple perspectives from both faculty and peer mentors as a strength of the PLC structure. Participants recommended structured 1:1 faculty/student advising interactions. Recommended PLC curriculum topics included professional development, wellness, and open forums.

Conclusion: Implementation of PLCs fostered connections between pharmacy faculty, upper-class students, and incoming students. These evaluation findings identified strengths and opportunities for consideration in PLC implementation as it relates to structure, interactions, and curriculum topics. Future research should investigate the longitudinal effects and best practices of PLCs.

106 | Attitudes of pharmacists toward intern immunizers

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Introduction: In 2015, New York State (NYS) passed legislation allowing certified pharmacists to administer immunizations. Additional legislation passed in 2018 allows certified pharmacy interns to administer immunizations under the direct supervision of a certified pharmacist immunizer. In order to address the potential demand to expand immunizations through pharmacies, especially in response to the COVID19 pandemic, pharmacy programs should consider requiring immunization training and certification for degree attainment. While pharmacist supervision is required for implementation of intern immunization practices, attitudes of pharmacist immunizers towards this legislation as well as willingness to supervise immunizations by pharmacy interns in NYS is unknown.

Research Question or Hypothesis: What are pharmacists' attitudes toward certified pharmacy intern immunizers in NYS and perceptions of pharmacy program responsibilities in immunization training?

Study Design: Descriptive research

Methods: A 45-question survey was designed via a web-based tool and distributed through listservs targeting NYS pharmacists from January to February 2020. Data collected included: demographic information, overall viewpoint on the legislation, and perceptions of training and certification responsibilities of pharmacy programs. Responses were collected anonymously and analyzed in the aggregate using SPSS. Exempt status was granted by IRB.

Results: Two hundred and sixteen pharmacists licensed in NYS participated in the survey . A majority of respondents (78.7%) support the new legislation and agree that pharmacy schools should be responsible for ensuring students are certified (84.2%) as well as require immunization administration as part of training (79.4%). Majority of respondents (74.6%) feel comfortable/very comfortable supervising intern immunizers. A significant correlation was found between respondents who agree immunization administration should be part of training and that it should be part of advanced pharmacy practice experiences (APPEs) ($r = 0.37$, $P < 0.01$)).

Conclusion: Overall, the sample of NYS pharmacists surveyed are supportive of the new legislation and feel comfortable supervising student immunizers during APPEs. Pharmacy programs should consider incorporating certification and practice during APPEs as a graduation requirement.

Emergency medicine

107 | Fluid resuscitation in suspected sepsis patients with heart failure and reduced ejection fraction

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Introduction: There are no published studies examining if 30 mL/kg of fluid should be utilized in patients with heart failure with reduced ejection fraction (HFrEF) presenting with sepsis.

Research Question or Hypothesis: To determine if differences in outcomes exist in suspected sepsis patients with HFrEF receiving <30 mL/kg or ≥ 30 mL/kg of fluid resuscitation.

Study Design: Single-center, retrospective cohort study.

Methods: Adults with HFrEF (EF ≤40%) presenting from July 1, 2010 to July 31, 2018 were included if they had a lactate ≥2 mmol/L or systolic blood pressure (SBP) <100 mmHg and cultures collected in the emergency department. Pertinent exclusion criteria were transfer from outside hospital or no fluids within three hours of presentation. The primary composite efficacy outcome was addition of vasopressors within 24 hours and in-hospital mortality. The primary composite safety outcome was addition of inotropes within 48 hours, need for BiPAP or intubation within 24 hours, and need for new renal replacement therapy within seven days. Groups were compared using Fisher's exact tests and Wilcoxon rank-sum tests.

Results: One-hundred patients were included; 92 patients received <30 mL/kg, and eight patients received ≥30 mL/kg. There were no differences in baseline SBP ($P = 0.10$) or lactate values ($P = 0.26$). The primary efficacy outcome occurred in 26.1% of <30 mL/kg patients compared to 50% of ≥30 mL/kg patients ($P = 0.15$). The primary safety outcome occurred in 20.7% versus 12.5% ($P = 0.50$), respectively. Thirteen patients experienced both primary outcomes. Patients receiving ≥30 mL/kg had a higher median [Q_1—Q_3] fluid balance at 24 hours (+4134 [2873—4461] mL versus +1348 [475—2464] mL, $P = 0.004$), but a similar balance at 72 hours (-183 [-898—455] mL versus +429 [-737—1656] mL, $P = 0.43$).

Conclusion: In this cohort, there was low utilization of ≥30 mL/kg of fluid. No significant differences in efficacy and safety outcomes were identified between resuscitation volumes.

108 | Appropriateness of tacrolimus therapeutic drug monitoring timing in the emergency department

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Introduction: Tacrolimus (TAC) is the most commonly used medication for post-transplant immunosuppression. Due to its narrow therapeutic window, trough concentrations are recommended to monitor therapy. However, inappropriately collected TAC serum samples for TAC measurement provide little clinical value and may result in unnecessary lab draws, increased healthcare costs and inappropriate regimen adjustments. The timing of last TAC dose can vary when presenting to the emergency department (ED), increasing the likelihood for inappropriately timed sample collection.
Research Question or Hypothesis: What is the incidence of inappropriately collected TAC serum samples in the ED?
Study Design: Retrospective, descriptive study at a large academic medical center.
Methods: Adult patients (≥18 years) with TAC concentration orders in the ED from September to October 2017 were identified through an electronic data inquiry. Those receiving extended-release TAC formulations or TAC regimens other than twice daily were excluded. The primary outcome was inappropriate sample collection (not collected 12 hours [± 2 hours; 10-14 hours] after the last dose, or within 2 hours of the next scheduled dose if time of last dose was unavailable). Additional outcomes included repeat TAC measurements within 24 hours of ED presentation (if initial was inappropriate), associated health care costs of inappropriate and repeat TAC measurements, and TAC regimen adjustments. Descriptive data are reported. Institutional review board approval was obtained.
Results: Sixty-two patients were included. Forty-eight (77%) TAC measurements were collected inappropriately in the ED and 39 patients (63%) required a repeat measurement within 24 hours of ED presentation. Laboratory costs associated with incorrectly collected and repeat TAC measurement were $3099.84 and $2518.62, respectively. This results in a total of $33,710.76 combined annual expenses. No TAC regimen adjustments occurred as a result of inappropriate concentration collection.
Conclusion: Inappropriate sample collection for TAC measurement was common in the ED, resulting in frequent repeat laboratory draws and increased health care costs.

109 | Characterization of the analgesic effect of low-dose intravenous push ketamine in an adult, tertiary care emergency department

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Introduction: Ketamine is a N-methyl-D-aspartate receptor antagonist that blocks potentiation of pain through delta and mu opioid receptors. A dose of 0.1 to 0.3 mg/kg is considered subdissociative and has been shown to be effective for management of acute pain in the emergency department (ED).
Research Question or Hypothesis:
This study evaluated the analgesic efficacy of subdissociative, low-dose intravenous (IV) push ketamine (LDK) for management of acute pain in trauma patients in the ED.
Study Design: This retrospective, single-center study included adult patients 18 years of age or older admitted to the ED for treatment of acute, trauma-related pain between September 2015 and August 2019.
Methods: Patients were separated into those who received LDK according to our institutional protocol or IV opioids. Propensity score matching was performed in a 2:1 fashion (2 opioid: 1 LDK) to control for Injury Severity Score (ISS), weight, and age between treatment arms. Data were collected to determine the difference in IV morphine equivalents (IVME) as rescue analgesia two hours post-administration of the initial analgesic dose, change in numeric rating scale (NRS) pain score, and incidence of adverse effects.
Results: A total of 165 patients (55 LDK; 110 opioids) met inclusion criteria. The most common traumatic injury was motor vehicle crash in the LDK and opioid groups (35 [63.6%] vs 67 [60.9%], $P = 0.865$). Median rescue analgesia was similar between groups (LDK, 6.7 [5.0-10.0] vs opioids, 6.7 [5.0-7.7] mg IVME; $P = 0.212$). The difference in median NRS scores from baseline to between 15-120 minutes were similar (LDK, 0 [0.0-1.9] vs opioids, 0 [0.0-3.0]; $P = 0.542$). No differences in incidence of adverse events were observed.
Conclusion: Administration of LDK as an adjunctive analgesic agent in trauma patients did not reduce rescue opioid requirements compared to patients who received opioids when matching for ISS, weight, and age.

110 | Improvement in HIV screening follow-up with emergency department pharmacist dispensing of post-exposure prophylaxis

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Introduction: The Centers for Disease Control and Prevention classifies sexual assault as a substantial risk for Human Immunodeficiency Virus (HIV) acquisition. Patients presenting to the Emergency Department (ED) at Denver Health Medical Center (DHMC) within 72 hours after sexual assault are offered HIV non-occupational post exposure prophylaxis (nPEP). Prescribed nPEP is effective in reducing HIV seroconversion in the setting of rigorous adherence rates and patient follow-up at 1, 3, and 6 months. Due to low rates of compliance and follow-up, the DHMC ED pharmacy team began dispensing no-cost 28-day nPEP regimens and providing bedside education prior to patient discharge with support from a Victims of Crime Act (VOCA) grant.

Research Question or Hypothesis: Pharmacist involvement in dispensing nPEP and patient education will improve patients' rates of recommended follow-up HIV screening.

Study Design: This single center, retrospective analysis compared rates of patient follow-up prior to and following initiation of pharmacist dispensed nPEP.

Methods: Sexual assault victims prescribed nPEP in the ED between 01/01/2016 – 12/31/2016 (Pre-group) and 01/01/2017 – 12/31/2019 (Post-group) were reviewed. Charts were reviewed for HIV screening follow-up and/or HIV seroconversion documentation within 6 months of nPEP prescribing. All internal and external clinic records linked to the electronic medical record were reviewed. Patients received telephone follow-up 3 months after discharge to assess compliance and reinforced patient education regarding follow-up.

Results: The chart review included 369 unique patients prescribed nPEP. Patients presenting for follow-up within 6 months of nPEP initiation increased from 4 (4.3%) in the pre-group to 55 (19.8%) in the post-group (*P*-value <0.001). The post-group follow-up rate increased with subsequent years ranging from 12% (2017) to 26% (2019) (*P*-value 0.039). Two patients seroconverted in the pre-group while no post-group patients had documented seroconversion.

Conclusion: Pharmacist bedside engagement and patient education improves HIV screening follow-up and seroconversion rates following nPEP therapy dispensed at DHMC ED.

111 | Methicillin-Resistant *Staphylococcus aureus* (MRSA) nasal screen in the emergency department effect on duration of general medicine patient exposure to anti-MRSA antibiotics for pneumonia

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Introduction: Methicillin-resistant *Staphylococcus aureus* (MRSA) pneumonia prevalence in hospitalized adults is approximately 10%. Guidelines recommend MRSA coverage in certain populations, but do not provide recommendations regarding de-escalation prior to respiratory culture results. Negative MRSA nasal screens have high negative predictive value for infection. Data support using MRSA nasal screens for de-escalation of antibiotics in critically ill patients. Screening has not been thoroughly evaluated in general medicine patients.

Research Question or Hypothesis: To determine if performing a MRSA nasal screen in the emergency department (ED) decreased general medicine patient exposure to anti-MRSA antibiotics for pneumonia.

Study Design: This was a single-center, retrospective study evaluating patients who had a diagnosis of pneumonia and were initiated on anti-MRSA therapy (vancomycin or linezolid) in the ED and subsequently admitted to a general medicine floor.

Methods: Patients were divided into two groups: 1) did not receive a MRSA nares screen in the ED (No MRSA screen group) or 2) received a MRSA nares screen in the ED (MRSA screen group). The primary outcome was anti-MRSA antibiotic duration. Secondary outcomes included vancomycin level evaluation, hospital survival, and acute kidney injury.

Results: Of the 116 patients included, 37 patients received a MRSA nares screen in the ED and 79 patients did not. Median duration of antibiotic exposure was similar for both groups (No MRSA screen, 30.5 hours [interquartile range (IQR) 20.5-52.5] vs. MRSA screen, 24.5 hours [IQR 20.6-40.3]; $P = 0.28$). Of patients who were screened, 35 were negative and 2 were positive. Secondary outcomes were similar.

Conclusion: Performing a MRSA nares screen in the ED for patients diagnosed with pneumonia, initiated on anti-MRSA antibiotics, and admitted to a general medicine floor did not decrease duration of anti-MRSA antibiotics. At this time, providers do not need to consider a MRSA nasal screen in the ED for patients being admitted to general medicine floors, although larger studies could be considered.

112 | Evaluation of antimicrobial prescribing at emergency department discharge

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Introduction: Infectious disease-related complaints are common in the emergency department (ED) and empiric treatment is often necessary; however, current literature has cited inappropriate discharge treatment in up to 23% of cases.

Research Question or Hypothesis: Do specific, pharmacist-led interventions improve the rate of appropriate outpatient antimicrobial prescribing in the ED?

Study Design: Single-centered, retrospective, pre/post-intervention cohort study

Methods: Patients with a positive culture result and an ED discharge prescription admitted between July-September 2019 and May-June 2020 before and after a pharmacist-led intervention were included. The intervention included revising hospital outpatient prescribing recommendations, updating outpatient antibiotic orders, and educating prescribers. Patients with positive blood cultures were excluded. The primary outcome was to assess differences in dose and duration of outpatient antimicrobial prescribing. Secondary outcomes included susceptibility to prescribed antimicrobial and use of recommended therapy. Discrete and continuous data were analyzed using Chi-Squared and t-tests, respectively.

Results: One hundred patients were enrolled: 50 pre and 50 post-intervention. Groups were similar in age (41 vs. 49 years, $P = 0.09$), ED diagnosis ($P = 0.125$), and culture source ($P = 0.605$) with more females in the pre-intervention group (84% vs. 58%, $P = 0.004$). There was no difference in susceptibility to prescribed agent (86% vs. 78%, $P = 0.298$) or use of recommended antimicrobial (82% vs 76%, $P = 0.461$). Appropriate antimicrobial dosing increased from 78% to 98% after the intervention ($P = 0.002$). Recommended duration of treatment remained consistent at a mean of 8.4 days in both groups ($P = 0.961$), but prescribed duration decreased from a mean of 9.4 to 8.7 days ($P = 0.031$).

Conclusion: The study is limited by its small sample size and single-centered nature. In a pragmatic ED setting, it appears that pharmacist-led interventions led to an improvement in appropriate antimicrobial dosing and duration at ED discharge. Further research is planned to evaluate the impact of prospective pharmacist evaluation of antimicrobial discharge prescriptions in the ED.

113 | MAGraine: Magnesium compared to conventional therapy for treatment of migraines

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Introduction: Due to the healthcare burden associated with migraines, prompt and effective treatment is vital to improve patient outcomes and ED workflow.

Research Question or Hypothesis: Is intravenous magnesium more efficacious for treating migraines compared to conventional metoclopramide or prochlorperazine?

Study Design: prospective, randomized, double-blind

Methods: Adults who presented to the ED with a diagnosis of headache or migraine from August of 2019 to March of 2020 were included. Pregnant patients, patients with an allergy to study drugs, or history of renal impairment were excluded. Patients were randomized to receive one of three study drugs. Magnesium 2 g, prochlorperazine 10 mg, or metoclopramide 10 mg were each placed in 50 mL of D5W and administered as an IV infusion over 20 minutes. The primary outcome was change in pain from baseline on a numeric rating scale (NRS) evaluated at 30 minutes after initiation of infusion of study drug. Secondary outcomes included NRS at 60 and 120 minutes, ED length of stay, necessity for rescue analgesia, and adverse effects.

Results: A total of 157 patients were analyzed in this study. Sixty-one patients were randomized to receive magnesium, 52 received prochlorperazine, and 44 received metoclopramide. Most patients were white females, and the median age was 36 years. Hypertension and migraines were the most common comorbidities, with a third of the patients reporting an aura. There was a median decrease in NRS at 30 minutes of three points across all three treatment arms. The median decrease in NRS (IQR) at 60 minutes was -4 (2-6) in the magnesium group, -3 (2-5) in the metoclopramide group, and -4.5 (2-7) in the prochlorperazine group ($P = 0.27$). There were no statistically significant differences in ED length of stay, necessity for rescue analgesia, or adverse effects. Reported adverse effects were dizziness, anxiety, and akathisia.

Conclusion: No significant difference was observed in NRS at 30 minutes between magnesium, metoclopramide and prochlorperazine.

114 | Rocuronium vs succinylcholine in the traumatically injured brain: A prospective, pilot study

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Introduction: Patients presenting with traumatic brain injuries (TBI) often require rapid sequence intubation (RSI) for airway protection. Succinylcholine or rocuronium are the paralytics of choice due to their rapid onset and relatively short duration. Two recent retrospective studies suggested potential harm with the use of succinylcholine in severe TBI patients including an increase in ventilated days and mortality. The limited data available has led to further investigation into the safety of rocuronium and succinylcholine in TBI patients.

Research Question or Hypothesis: The purpose of this study was to assess the safety of rocuronium versus succinylcholine in TBI patients undergoing RSI in the emergency department (ED).

Study Design: Prospective, observational study

Methods: Patients were identified for study inclusion between September 1, 2018 and June 30, 2020. Individuals assessed in the study presented to the ED with a TBI requiring RSI receiving succinylcholine or rocuronium. Patients were excluded if a surgical airway was placed, patient was pregnant, cardiac arrest occurred prior to intubation, or intubation was attempted prior to arrival. Primary outcome measured was the incidence of in-hospital mortality. Secondary outcomes included in-hospital and intensive care unit (ICU) length of stay (LOS).

Results: Sixty patients met inclusion criteria,18 in the rocuronium cohort and 42 in the succinylcholine group. There were no differences in baseline characteristics. Average Glasgow Coma Score in the rocuronium and succinylcholine groups were 5.7 and 6.5 respectively. There was no statistically significant difference in mortality between the two study arms (27.8% vs 33.3%, P = 0.67). No difference was found for secondary outcomes of in hospital LOS (9.5 days vs 12.9 days, P = 0.43) or ICU LOS (5.7 days vs 7.3 days, P = 0.39).

Conclusion: This study found no difference in mortality, in-hospital, or ICU LOS in TBI patients administered rocuronium vs succinylcholine during RSI. These results are inconclusive as additional subjects must be enrolled.

115 | Efficacy and safety of tranexamic acid in civilian pediatric trauma patients receiving transfusion

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Introduction: Tranexamic acid (TXA) has shown mortality benefit in adult trauma patients in CRASH-2 and MATTERS trials, but evidence in pediatric trauma is limited. PED-TRAX reported decreased mortality and improved neurologic status with TXA in combat pediatric trauma. This study evaluates generalizability of TXA efficacy and safety in civilian pediatric trauma patients requiring transfusion in an urban Level 1 trauma center. This is the first study of TXA in civilian pediatric trauma to record whole blood use.

Research Question or Hypothesis: Does TXA improve mortality in civilian pediatric trauma patients receiving blood product transfusion?

Study Design: Single-center, retrospective chart review

Methods: This study compared pediatric trauma patients requiring transfusion who did and did not receive TXA at a large academic hospital from January 2013 – July 2019. Patients were identified by the institutional trauma registry; compared in a 1:3 ratio, TXA to no TXA; and matched on age, gender, injury severity score (ISS), and abbreviated injury scale. Primary outcome was in-hospital mortality.

Results: Twenty patients were included (TXA, n = 5; no TXA, n = 15). Baseline demographics were similar. Median age was 17 years; 70% were male. Median ISS was 12 (10 – 16.3). The TXA group received prehospital TXA 1,000 mg IV (13.9 [12.0 – 17.6] mg/kg). In-hospital mortality was not significantly different (0% vs. 6.7%, P = 1.00). Secondary outcomes of definitive bleeding control and hospital length of stay (LOS) were similar. Numerically fewer TXA patients received whole blood (1 vs. 5 patients). Return to operating room was an independent predictor of hospital LOS in a multivariate regression analysis (JMP Pro 14). No thromboembolic events or seizures occurred.

Conclusion: TXA did not significantly decrease mortality or transfusions in civilian pediatric trauma patients. Limitations included small sample size, older population, and low baseline ISS. Large, randomized studies should further evaluate TXA efficacy and safety in pediatric trauma.

116 | Comparison of sustained rate control in atrial fibrillation with rapid ventricular rate: Metoprolol vs. diltiazem

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Introduction: Atrial fibrillation (AF) with rapid ventricular rate (RVR) requires immediate treatment to prevent rapid decompensation. Studies show similar rate control efficacy between diltiazem and metoprolol at 30 minutes with select evidence showing improved early effectiveness for diltiazem. However, studies have not investigated rate control greater than 30-60 minutes, which is important factor for AF maintenance.

Research Question or Hypothesis: The purpose of this study was to compare sustained rate control with intravenous (IV) diltiazem vs. IV metoprolol in acute treatment of AF with RVR in the emergency department (ED).

Study Design: Retrospective chart review at large, academic medical center in San Antonio, Texas.

Methods: Emergency department patients with AF with RVR diagnosis were cross-referenced with billing data for IV diltiazem or IV metoprolol. The primary outcome was sustained rate control defined as heart rate (HR) < 100 beats per minute without need for rescue IV medication for 3 hours following initial rate control. Secondary outcomes included time to initial rate control, time to oral dose, and safety outcomes.

Results: Between January 1, 2016 and November 1, 2018, 51 patients met inclusion criteria (diltiazem n = 32, metoprolol n = 19). No difference in sustained rate control was found (diltiazem 87.5% vs. metoprolol 78.9%, P = 0.45). Time to rate control was significantly shorter with diltiazem compared to metoprolol (15 minutes

vs. 30 minutes, respectively, $P = 0.04$). No difference in median time to oral dose was found (diltiazem 168 minutes vs. metoprolol 80 minutes, $P = 0.33$). Neither hypotension nor bradycardia were significantly different between groups.

Conclusion: Choice of rate control agent for acute management of AF with RVR did not significantly influence sustained rate control success. Safety outcomes did not differ between treatment groups.

Endocrinology

117 | In-depth analysis of pharmacist-endocrinologist collaborative care in the treatment of diabetic patients

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Introduction: Diabetes management requires complex medication regimens and highly coordinated care. Primary care providers often refer patients to specialty diabetes clinics for more focused management. It is well established that pharmacists improve diabetic patient outcomes in primary care practice. However, there is limited data on collaborative pharmacist-endocrinologist diabetes management (PEDM), especially in underserved patient populations.

Research Question or Hypothesis: The purpose of this study is to examine clinical outcomes and access to care for diabetic patients under collaborative PEDM in comparison to management by endocrinologists alone (EDM).

Study Design: Single center, retrospective quality improvement project

Methods: Diabetic patients ≥18 years old were referred to endocrinology at a safety net medical center from January 1, 2019 to December 31, 2019. Patients with A1c ≥ 9% or A1c <9% with hypoglycemia, poly-pharmacy, and/or non-adherence were subsequently referred to a clinical pharmacist for management. Patients using insulin pumps were excluded. The primary and secondary endpoints were to examine clinical outcomes and time to care, respectively. Statistics were analyzed with SPSS.

Results: Seventy one patients were studied in each group (mean age of 50 years, mean baseline hemoglobin A1c of 10%). A1c reduction was 1.1% and 1.0%, respectively ($P = 0.398$). A similar number of patients met A1c goal (22.5% and 25.4%, $P = 0.846$). Patients in the PEDM group had an average of 12 days to initial visit compared to 116 days in the EDM group ($P < 0.001$).

Conclusion: Pharmacists are effective in partnering with endocrinologists to manage patients at our medical center. This supports the feasibility of a collaborative practice with pharmacists and endocrinologists to help complex patients achieve glycemic control and access to care. We conclude that this protocol can serve as a model for improving clinical outcomes in diabetic patients. Further larger studies will be necessary to confirm our findings.

118 | Effectiveness of automated short messaging service on glycemic control in type 2 diabetes: A retrospective quasi-experimental feasibility study

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Introduction: Short Messaging Service (SMS) has the potential to be an ideal platform for delivering diabetes education material due to its simplicity and ease of access. An effective SMS delivery strategy is not well established in the literature.

Research Question or Hypothesis: What is the impact of diabetes education material delivered through non-tailored, one-way automated SMS on hemoglobin A1c (HbA1c) in patients with uncontrolled type 2 diabetes (T2DM)?

Study Design: A retrospective quasi-experimental feasibility study.

Methods: A convenience sample of patients who received diabetes care from 11/27/2017 to 5/3/2018 at an academic medical center endocrinology clinic was screened for eligibility. English-speaking adults (≥18y) with uncontrolled T2DM, defined as HbA1c ≥8%, who received diabetes education material via SMS (intervention) and those who did not (control) were included. A mixed-design repeated measures ANOVA evaluated the difference in HbA1c reduction between groups and over time. Significance was set at $\alpha < 0.05$.

Results: A total of 69 patients (intervention n = 34; control n = 35) were included for analysis. The mean (±SD) baseline HbA1c values were 10.2% (±1.9%) and 9.9% (±1.7%) in intervention and control arms, respectively ($P = 0.673$). Median post-intervention follow-up was 3.3 months (IQR = 3-4.2). Mean HbA1c reduction from baseline was −1.1% (95%CI = −1.8 to −0.4) in the intervention and – 0.3% (95%CI = −0.7 to 0.1) in the control arm. While the mean HbA1c reduction within each arm was significant ($P = 0.001$), these reductions were not statistically different between arms ($P = 0.84$) and over time ($P = 0.06$).

Conclusion: The results of this study suggest that non-tailored, one-way automated SMS is possibly effective in reducing HbA1C when added to routine care; however, when accounting for the control group it is uncertain if the HbA1C reduction was solely explained by

the intervention. This simple interventional strategy of delivering diabetes education material needs to be further evaluated in larger studies.

119 | Impact of a clinical pharmacist on clinical inertia for patients with type 2 diabetes

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Introduction: Clinical inertia leads to poor outcomes in the treatment of type 2 diabetes (T2DM). A team-based approach including clinical pharmacists reduce clinical inertia and improve diabetes control but more data is needed to support this conclusion.
Research Question or Hypothesis: Do clinical pharmacists reduce clinical inertia and hemoglobin A1c (A1c) when co-management of patients with T2DM in a Family Medicine Clinic.
Study Design: Retrospective cohort study
Methods: Two 3-month periods separated 6 months apart were used to identify patients age 18 to 90 with T2DM and an A1c ≥ 8%. Patients completing a pharmacist encounter within 1 month of the index A1c they were assigned to the pharmacist co-management group and where propensity-score matched on age and sex to a cohort who did not receive pharmacist care (usual care). Medication and A1c changes up to 6 months after index A1c were collected. The primary outcome was clinical inertia within 6 months of an uncontrolled A1c, defined as a lack of treatment intensification. Clinical inertia was analyzed with chi-square test and change in A1c with t-test.
Results: After matching, 66 patients were included in the pharmacist cohort and 67 in the usual care cohort out of 232 patients with an A1c ≥ 8% during the index periods. The median index A1c was 10% in the pharmacist cohort and 8.9% in the usual care cohort (*P*-value 0.014). Patients in the pharmacist cohort were less likely experience clinical inertia compared to usual care (18.2% vs 47.8%, $P = 0.001$). The mean change in A1c was -1.82% in the pharmacist cohort vs. -1.03% in the usual care cohort, $P = 0.004$.
Conclusion: Clinical pharmacists involved in management of patients with uncontrolled T2DM helped reduce clinical inertia compared to a similar cohort of non-pharmacist management patients. This may have led to greater reductions in A1c.

120 | Insulin NPH for steroid-induced hyperglycemia: Predictors for success

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Introduction: Corticosteroids are prescribed for a variety of conditions with up to 86% of patients experiencing at least one episode of steroid-induced hyperglycemia (SIH). Due to similar pharmacodynamic profiles, insulin NPH is an ideal treatment option for SIH caused by intermediate-acting steroids. Existing research has not evaluated the relationship between NPH and steroid dose or patient characteristics that impact success of this practice.
Research Question or Hypothesis: What is the efficacy and predictors of success of current practice using NPH for SIH caused by intermediate-acting steroids?
Study Design: Retrospective, single center, cohort analysis
Methods: Adult patients who received an intermediate-acting steroid and NPH for at least three days were considered for inclusion in this study. The primary outcome was the percentage of patients who achieved euglycemia 12 hours after administration of these agents on day three of combination therapy. Characteristics of euglycemic and dysglycemic patients were compared. Additional safety analysis was performed to evaluate for differences in hypoglycemia between these two cohorts. JMP Pro was used for statistical analysis with Chi-squared, Fisher's exact, or Mann-Whitney U test as appropriate.
Results: There were 142 patients included, of which 50 (35.2%) were euglycemic on day three of combination therapy. When comparing euglycemic to dysglycemic patients, there was a significant difference in NPH dose on day 1 (0.5 vs 0.4 units/mg prednisone, $P = 0.046$) and blood glucose prior to therapy on day 3 (111 vs 136 mg/dL, $P = 0.008$). Safety analysis did not demonstrate a statistically significant difference for hypoglycemia or severe hypoglycemia.
Conclusion: Current practice at our center demonstrates a 35.2% success rate using NPH for corticosteroid-induced hyperglycemia. Euglycemic patients were found to have higher day 1 NPH doses with no difference in occurrence of hypoglycemia. Data will be used to develop an algorithm for our center to help manage this common side effect from a widely used medication class.

121 | Comparison of usability, accuracy, preference, and satisfaction between three once weekly GLP-1 receptor agonist pen devices in patients with type 2 diabetes

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Introduction: GLP-1 receptors agonists (GLP-1 RAs) are widely used in the treatment of type 2 diabetes (T2D). Design varies among GLP-1 RA pen devices, which impacts usability and ultimately patient satisfaction, dosing accuracy, and medication adherence.
Research Question or Hypothesis: How do three once-weekly GLP-1 RA pen devices compare with respect to usability, accuracy, satisfaction, and patient preferences?

Study Design: Multi-center, prospective cohort study

Methods: GLP-1 RA pen devices were compared for time and accuracy of administration, user satisfaction, and preference ratings as primary outcomes. Study participants had T2D and were GLP-1 RA naïve. Health literacy was assessed during intake using Newest Vital Sign. Participants watched instructional videos for each pen, demonstrated administration of each device, then provided feedback after each demonstration. Order of device demonstration was randomized using 3x3 Latin squares. Investigators tracked both errors and omissions of steps for accuracy as well as time. Differences in outcomes across devices were compared using univariate mixed models, adjusting for multiple comparisons.

Results: Of the 60 study participants, half were male, a majority were Caucasian (65%), and had adequate heath literacy (63%). Participants rated dulaglutide pen easier to use than exenatide XR BCise or semaglutide pen ($P < 0.001$ for each). Participants rated higher satisfaction with dulaglutide pen compared to exenatide XR BCise or semaglutide pen ($P < 0.01$ for each). Most participants preferred dulaglutide pen overall (75%), however participants preferred the size and portability of semaglutide pen (61%). The dulaglutide pen took less time to use compared to exenatide XR BCise or semaglutide pen (69 vs. 126 vs. 146 seconds respectively, $P < 0.001$ for each). However, participants were less accurate when using dulaglutide pen ($P < 0.001$).

Conclusion: Most patients preferred the dulaglutide pen based on usability and satisfaction. While the dulaglutide pen took less time to demonstrate, this could be a result of inaccurate administration.

122 | The effect of a remote diabetes management program (RDMP) on oral medication proportion of days covered (PDC) and the associated impact on self-monitoring blood glucose values: a real-world data longitudinal analysis

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Introduction: Increased adherence to antihyperglycemics is associated with glycemic control, improvement in health outcomes, and reduced medical costs. Interventions utilizing health coaching and self-monitored blood glucose (SMBG) devices are thought to improve adherence. Livongo for Diabetes, a remote diabetes monitoring program (RDMP) with cellular-enabled glucose meters, unlimited checking supplies, and coach interactions, has been associated with short-term improved PDC and glycemic control.

Research Question or Hypothesis: The purpose of the study is to test whether RDMP improves PDC up to two years and evaluate the relationship between PDC and SMBG values among RDMP participants.

Study Design: This is a retrospective observational study using pharmacy claims data aggregated at the month level before (12mo, Y0) and Y1 and Y2 after program launch.

Methods: RDMP members (n = 870, age = 51.9, 48% female) and non-members (n = 479, age = 52.3, 50% female) with at least 180 days of claims per yearly period of data were included in the study. T1Ds with non-insulin antihypertensive claims were included, and injectables were excluded when calculating PDC. Adherence was defined as having > = 80% PDC for a given month. Mixed models were used to test the interaction of membership and time period on adherence, and the relationship between PDC and BG, controlling for demographics, risk score, diabetes type, and insulin use.

Results: There was a significant interaction between membership and time ($z = 2.58$, $P < 0.01$), such that adherence across RDMP members increased from 77% to 80% over 24 months but decreased for non-members from 78% to 69%. Among RDMP members, a 10-day increase in days covered resulted in a 1 mg/dL decrease of BG per month ($z = -2.54$, $P < 0.05$).

Conclusion: RDMP members had improved PDC at two years relative to non-members, and demonstrated reduction in BG for months with greater PDC.

123 | Evaluation of clinical improvement with extended follow-up for diabetes management in a pharmacist-run telehealth clinic

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Introduction: Literature has documented the benefits that pharmacists have when involved with diabetes management. Recent literature highlighted the positive impact of a pharmacist-led telehealth clinic on hemoglobin A1c (HbA1c) lowering over 6 months. Evidence with pharmacists in telehealth for diabetes management with extended follow-up or differing telehealth modalities is limited.

Research Question or Hypothesis: To determine if there is a difference in clinical improvement between patients managed on the phone versus patients managed with phone and clinical video telehealth (CVT) encounters. A secondary research aim includes the assessment of clinical parameters with extended follow-up in a pharmacist-run telehealth clinic.

Study Design: Single center retrospective chart review

Methods: Veterans were included with at least one pharmacy telehealth encounter (phone or CVT) from November 2014 through September 2017. Baseline data was collected. Subsequent HbA1c values, low-density lipoprotein (LDL) values, and medications were collected. Primary objectives included the change from baseline to subsequent and recent values of HbA1c, blood pressure, and LDL cholesterol. Medication changes and encounters were tabulated. Data was divided into two groups (CVT + phone and phone only) and compared to investigate for a difference between groups. Descriptive statistics were collected, and t-tests were used to assess for differences between groups.

Results: One hundred patients were included. There was a statistically significant reduction in HbA1c of 1.2% from baseline to the recent HbA1c obtained ($P < 0.0001$). There was a statistically significant reduction in LDL cholesterol from baseline ($P = 0.0067$). The pharmacist initiated insulin in 28 patients, and a statin in 27 patients. There was no difference noted in the change from baseline to recent HbA1c with CVT + phone versus phone-only patients ($P = 0.99$).

Conclusion: These results provide further evidence that pharmacists in a telehealth clinic may effectively assist with clinical improvements in diabetes management. The inclusion of CVT visits with phone calls did not assist with significant improvements in HbA1c values.

Family medicine

124 | Family medicine residency practice collaboration with community pharmacists to augment prescription writing education

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Introduction: Outpatient prescription writing education is often not a focal part of medical school training. Prescribing errors lead to reduced efficiency for physician practices and community pharmacists, and delay medication fill-time for patients.

Research Question or Hypothesis: By identifying the most common reasons for prescription clarification calls, are we able to create and evaluate the effectiveness of an educational resource on resident awareness of preventable prescription errors?

Study Design: This is a two-phase quality improvement project with a quasi-experimental design done at an academic family health center (FHC) and local pharmacy that cares for over 1,600 FHC patients

1. Phase One: Local pharmacy collected data regarding each prescription clarification call made to FHC.
2. Phase Two: Clinical pharmacists presented this data to an interprofessional team to collaborate and created an educational resource for residents.

Methods: The resource was evaluated via a "pre-" and "post-intervention" survey administered to residents, to assess the change in knowledge and awareness of healthy prescribing habits. Data is descriptively reported.

Results: Sixteen residents participated in the survey, majority medical (81%) and non-intern (63%). The primary outcome found a positive change in test score (average percent change 26%) irrespective of training year or field. Highest score improvement were seen on questions testing pharmacy laws governing product interchangeability. 94% of residents agreed this presentation increased their awareness of pharmacy regulations. 75% of residents agreed they would use this resource daily and it should be introduced early in residency. 88% of residents agreed that pharmacists at FHC improved their prescribing habits.

Conclusion: Identifying real-world causes of communication burden between physician offices and community pharmacies can improve the way we teach residents how to prescribe and may have long-term implications as residents go into practice. This educational resource will be incorporated in each year of our resident's training, to allow for a longitudinal approach to build positive prescribing habits.

125 | *Patient perceptions of interprofessional teams and medication management in an interprofessional teaching clinic*

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Introduction: Interprofessional collaborative practice is becoming more common in healthcare. However, there is a paucity of literature evaluating patients' perceptions of team-based care. As medications are a large focus in disease-state management, it is also important to evaluate patients' perceptions on medication-use.

Research Question or Hypothesis: What are patients' perceptions surrounding interprofessional care and medication management?

Study Design: Single-center, prospective, observational study

Methods: Patients completed a voluntary survey focused on the perception of interprofessional teams and medication-use after visiting with an interprofessional student team. The survey included twelve questions, utilizing a 5-point Likert-scale from strongly disagree to strongly agree. Additionally, the survey included two open-ended questions regarding team-based care and medications. The data was analyzed using descriptive statistics. Some questions were positively and negatively worded to allow for comparison and was analyzed using Wilcoxon Signed-Rank Test via SPSS®.

Results: Fifty patients completed the survey in its entirety: 51% were African American, they had a mean age of 51 years old (28% were 65 years or older) and were taking a mean of 8.7 medications (68% met criteria for polypharmacy defined as patients taking five or more medications). Majority of patients (72%) agreed/strongly agreed that meeting with a team improved their care and 72% agreed/strongly agreed meeting with a team allowed for more of their concerns to be addressed. When comparing if patients felt like a team improved their care or if they preferred being seen by only one doctor, patients significantly preferred team-based care ($P = 0.00$). Sixty-six percent of patients agreed/strongly agreed that medications help them to live a healthier life.

Conclusion: When comparing patient preference for care provided by a single physician or a team, patients significantly preferred team-based care. Patients generally believed that their medication allows them to live a healthier. Overall, patients felt that having team-based care improved their care and more concerns were addressed.

126 | Prescribing patterns of direct oral anticoagulants in a patient-centered medical home

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Introduction: There is a wide gap in the literature that does not directly address reasons for improper dosing of direct oral anticoagulants (DOACs) specifically between primary care providers (PCPs) and cardiology prescribers. DOACs have limited clinical data regarding dosing in the obese and therefore are not currently recommended in extreme obesity.
Research Question or Hypothesis: What factors are associated with the inappropriate dosing of DOACs in PCPs and cardiologists and are there dosing trends found in obese subjects?
Study Design: Retrospective single-center chart review.
Methods: Medical records were reviewed for general demographics, DOAC name, dose, duration, prescriber and other antithrombotic/antiplatelets.
DOAC dose was classified as appropriate, high, or low based on FDA approved labeling. Weight classification was based on BMI measurements and organized according to NHLBI guidelines.
Logistic regression was performed to identify association of independent variables with high or low dosing. Variables demonstrating trend (defined as $P < .2$) were then integrated to standard backward stepwise multiple regression analyses. The alpha was set at .05.
Results: 716 patients were included. High dosing was significantly associated with the concurrent prescribing of clopidogrel (OR, 4.69; 95% CI, 2.01-10.92; $P < .0001$). Low dosing was significantly associated with subject age (OR, 1.08; 95% CI, 1.05-1.12; $P < .0001$), SCr (OR, 3.11; 95% CI, 1.52-6.38; $P = .002$) and female gender (OR, 0.55; 95% CI, 0.33-0.92; $P = .022$). There was no statistically significant differences found in prescribing patterns between PCPs and cardiology prescribers. Obesity was not a main factor contributing to inappropriate dosing.
Conclusion: Prescribing inappropriately higher than recommended DOAC doses was only associated with concurrent clopidogrel use, while inappropriate underdosing was associated with age, renal function and female gender. The type of prescriber and the presence of obesity was not a factor contributing to inappropriate dosing.

Gastroenterology

127 | Expert definition of retreatment in hepatitis c infection

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Introduction: Globally, 71 million people are estimated to be chronically infected with hepatitis C virus (HCV), with 2.4 million people infected in the United States. Treatment of chronic HCV has changed drastically over the last 10 years, but definitions of treatment experience, previously used to describe a patient's exposure/response to peg-interferon and ribavirin, have not been updated. Early directly acting antiviral (DAA) treatment experience studies had varying definitions.
Research Question or Hypothesis: How do experts in the field define treatment experience in patients with chronic HCV who have been exposed to combination DAA therapy?
Study Design: A Delphi process of physician and pharmacist experts was administered.
Methods: Experts were identified based on participation in HCV guideline development or high profile publications. The Delphi consisted of three rounds administered using an online survey tool. Consensus was achieved when 70% of surveyed experts agreed.
Results: A total of 59 personal emails were sent for each round of the survey. The number of responses and rates for rounds 1, 2 and 3 were 20 (34%), 21 (36%), and 19 (32%), respectively. The panel agreed that patients who were re-infected should be treated as naïve. Expert consensus for the definition of treatment experienced was reached and maintained when a patient had been exposed to ≥4 weeks of DAA therapy (table). In terms of resistance mutation impact on the definition; 60% and 80% of the panel, respectively, agreed that they would be more likely to consider a patient treatment experienced if they had a Y93 mutation or 2 resistance mutations, including a Y93.
Conclusion: Using this expert consensus definition for HCV treatment experience may allow for increased consistency in the treatment of patients who do not complete a full course of DAA therapy.

128 | A trough is worth a thousand words: therapeutic drug monitoring in patients on infliximab or adalimumab for management of inflammatory bowel disease

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Introduction: Significant interpatient variability can be seen in response to anti-TNFα agents used for inflammatory bowel disease (IBD), in part due to the development of anti-drug antibodies. In 2017, the American Gastroenterological Association (AGA) published guidelines on the use of therapeutic drug monitoring (TDM) in IBD. The guidelines recommend anti-TNFα TDM be drawn as a trough level for patients previously in remission with a new suspected flare (reactive TDM) to help guide therapeutic management.
Research Question or Hypothesis: To evaluate an institution's adherence to the AGA TDM guidelines including limiting use to reactive TDM, proper trough timing (within 20% of dosing interval prior to the next scheduled dose), and therapy modifications consistent with TDM results.

Study Design: Retrospective chart review from January 1, 2013 – August 1, 2019.

Methods: Patients were included if they had an ICD9/10 code for IBD and underwent TDM while on infliximab or adalimumab for IBD; only their most recent TDM episode was included in the review.

Results: 51 patients met inclusion criteria with a median age of 49 years, 84% male, and 84% Caucasian. 96% (49/51) of the evaluated TDM episodes were for patients previously in remission; however, only 51% (26/51) were performed reactively during a suspected flare. 45% (22/49) of patients in remission had their TDM drawn at the time of a confirmed trough. 62% (16/26) of patients with reactive TDM were in concordance with guideline recommendations for treatment changes.

Conclusion: There was variability in the use of TDM for patients with IBD including potentially unnecessary lab and treatment escalation costs related to alternative uses of TDM. Another issue our review identified is difficulty interpreting if adalimumab levels were troughs given lack of documentation regarding administration times. Further research is needed to identify strategies to increase adherence to evidence-based application of TDM.

129 | Shifting microorganism incidence in cirrhotic patients with ascites: A 5-year retrospective cross-sectional analysis

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Introduction: Historically, microbiologic studies in spontaneous bacterial peritonitis (SBP) have shown a predominance of gram-negative bacteria. In recent years, the incidence of gram-positive and multi-drug resistant bacteria has become a rising concern. Due to known regional differences in microbial incidence and recent reports of shifting bacterial etiology in SBP, it is of utmost importance for clinicians to know their regional or local microbial incidence in order to select the most appropriate empiric antibiotic therapy

Research Question or Hypothesis: What is the incidence and antimicrobial susceptibility patterns of microorganisms in hospitalized cirrhosis patients with ascitic fluid absolute polymorphonuclear count ≥250 cells/mm3?

Study Design: Retrospective cross-sectional study

Methods: A retrospective cross-sectional study was performed in 88 patients with a culture of ascites fluid and discharge diagnosis of spontaneous bacterial peritonitis from 2013-2018 in a single academic hospital in north central Florida. The incidence and antimicrobial susceptibility patterns of microorganisms in blood and ascitic fluid cultures were measured.

Results: Spontaneous bacterial peritonitis and culture negative neutrocytic ascites were found in 25% and 75% of patients, respectively. Overall, the incidence of gram-positive bacteria was higher than gram-negative bacteria in spontaneous bacterial peritonitis patients (50% vs 34.6%). A year over year increasing incidence of gram-positive bacteria was observed. Moreover, multi-drug resistant bacteria was found in 13.6% of included spontaneous bacterial peritonitis patients.

Conclusion: The microbiologic incidence of SBP and culture negative neutrocytic ascites patients in our study shifted over the 5-year study period towards a predominance of gram-positive bacteria over gram-negative bacteria. Multi-drug resistant bacteria are more commonly cultured in patients with hospital acquisition of SBP. Application of these findings may guide empiric antibiotic selection in cirrhotic patients.

130 | Pain management among patients with inflammatory bowel disease

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Introduction: Pain is a prevalent and debilitating symptom among patients with inflammatory bowel disease (IBD); however, there is limited knowledge and guidance for best practices of pain management in IBD. This is significant because both opioids and nonsteroidal anti-inflammatory drugs (NSAIDs) have known deleterious effects on patients with IBD despite frequent use.

Research Question or Hypothesis: What are the frequency and distribution of medications prescribed for pain management among patients with IBD on discharge from an acute care medical center?

Study Design: Cross-sectional study of adult (age ≥ 18 years) inpatients with a diagnosis code for IBD discharged from Oregon Health & Science University Hospital between January 1, 2017, and December 31, 2019.

Methods: Study data were collected from a repository of electronic health record data. Patients were included with an ICD-10 code for Crohn's disease or ulcerative colitis on the index admission. Patients with a documented surgical diagnosis related group (DRG) during the index admission or within the previous 30 days were excluded. We collected data on demographics and IBD classification. Pain management agents include opioids, NSAIDs, acetaminophen, and GABA

analogs (i.e., pregabalin and gabapentin). Opioid dosages were converted into morphine milligram equivalents (MME).

Results: Among 464 adult patients with IBD discharged during the study period, 55% had Crohn's disease and 49% had ulcerative colitis. Mean (standard deviation) age was 50 (18) years, 54% were female, and 93% were white race. The distribution of pain medications prescribed on discharge was: opioids (37%), NSAIDs (14%), acetaminophen (25%), and GABA analogs (14%). The most frequently prescribed opioids were oxycodone (65%), and hydrocodone (11%) and the median (interquartile range) MME was 60 (30-90).

Conclusion: Patients with IBD were frequently prescribed opioids and NSAID despite known contraindications. These results suggest opportunities to improve pain management in IBD patients.

Geriatrics

131 | Effectiveness of hospital-based comprehensive medication reviews including post-discharge follow-up on older patients' healthcare utilisation (the MedBridge trial): pragmatic cluster-randomized crossover trial

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Introduction: Evidence on hard clinical outcomes regarding the effects of comprehensive medication reviews (CMRs) in secondary care is scarce.

Research Question or Hypothesis: To study the effects of hospital-based CMRs, including post-discharge follow-up, on older patients' healthcare utilization compared to usual care.

Study Design: Pragmatic, multicenter, cluster-randomized crossover trial.

Methods: The trial was conducted at eight wards with a multiprofessional team including a clinical pharmacist within four hospitals in Sweden. Patients were eligible if they were 65 years or older and admitted to one of the study wards. Exclusion criteria: Palliative stage; not residing in the hospital's county; medication review within the last 30 days. Each ward participated in the trial for six consecutive eight-week periods. The wards were randomized to provide one of three treatments during each period: 1, CMR; 2, CMR plus post-discharge follow-up; 3, usual care without a pharmacist. The primary outcome measure was the incidence of unplanned hospital visits (admissions plus emergency department visits) after 12 months.

Results: In total, 2644 participants enrolled between February 2017 and November 2018, and 7 participants withdrew after inclusion. The median age was 81 years and the median number of prescribed medications was 9. In a modified intention-to-treat analysis, 922 CMR, 823 CMR plus post-discharge follow-up, and 892 usual care patients were included. The overall incidence of unplanned hospital visits was 1.77 per person-year. The primary outcome did not differ in the intervention groups compared to usual care: rate ratio 1.04 (95% confidence interval: 0.89-1.22) for CMR, and rate ratio 1.15 (95% confidence interval: 0.98-1.34) for CMR plus post-discharge follow-up.

Conclusion: In this study in older hospitalized patients, CMRs with or without post-discharge follow-up did not decrease the incidence of unplanned hospital visits. Alternative medication review formats aimed to improve older patients' health outcomes should be considered and subjected to randomized controlled trials.

132 | Proton pump inhibitor prescribing trends in medicare part D beneficiaries

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Introduction: Proton pump inhibitors (PPIs) are highly and often inappropriately prescribed in older adults. With older adults being more susceptible to adverse effects, targeted deprescribing efforts are needed. Quantifying PPI prescribing trends in Medicare beneficiaries may aid in deprescribing.

Research Question or Hypothesis: How many Medicare beneficiaries are prescribed PPIs? Which prescriber specialties prescribe PPIs? What are the regional trends in PPI prescribing? What are the aggregate costs for PPI claims in Medicare Part D?

Study Design: Descriptive observational study using secondary database.

Methods: Medicare Provider Utilization and Payment Data: Part D Prescriber for years 2013-2017 were utilized. Descriptive statistics were used to summarize the trends.

Results: Overall, 29.9% of Medicare Part D beneficiaries over 65 years had a PPI claim in 2013. This increased to 30.2% in 2015 and decreased to 28.2% in 2017. Omeprazole was the most prescribed PPI. The number of standardized 30-day claims increased from 63,402,981.8 in 2013 to 76,700,647 in 2017, but the number of claims per 1,000,000 has slightly decreased from 41,558.9 to 40,351.9. Total aggregate costs for PPI claims decreased from $3,061,746,058 in 2013 to $1,965,363,715 in 2017. Almost 93% of gastroenterologists prescribed a PPI all five years and had almost 10 times the number of PPI claims per 1000 than general practitioners. The South region had the highest number of standardized 30-day PPI claims per 1000 claims, but prescribers in Other region had the highest percentage of providers prescribing a PPI.

Conclusion: PPIs were prescribed for about 30% of all Medicare Part D beneficiaries from 2013-2017. Gastroenterologists and the South region had the highest rate of PPI claims and may be targeted for deprescribing PPI interventions. Despite the increase in number of PPI

claims, the cost of PPIs decreased which is likely due to generic PPIs made available.

133 | Prevalence of deficiencies in pharmacy services in nursing homes across the United States

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Introduction: Nursing homes (NHs) are required to comply with specific pharmacy service standards per the Centers for Medicare and Medicaid Services (CMS). However, the extent of such compliance among NHs is currently unknown. The purpose of this study is to determine the prevalence of pharmacy service deficiencies (PSDs) in NHs across the U.S. during 2014-2020.

Research Question or Hypothesis: What are the prevalence of and changes in PSDs in NHs across the U.S. between 2014 and March 2020?

Study Design: A descriptive study extracting data from CMS databases for NHs in all 50 states and Washington D.C.

Methods: Using two CMS databases, Nursing Home Provider Info and Health Deficiencies, all reported PSDs from NHs were collected, including the location, scope and severity of PSDs, and deficiency description. Data were analyzed for the number of NHs with at least one PSD per year, the most common deficiency in each state and region, and the prevalence and trend of PSDs over time.

Results: A total of 75,139 PSDs were reported among 15,420 NHs during 2014-2020. The prevalence of PSDs varied from 2014 to 2020, and the most common PSD overall was "Maintain drug records and properly mark/label drugs and other similar products according to accepted professional standards." From 2014 to 2019, the number of reported PSDs increased by 35%, with the largest increase per year in 2017-2018 (14%). The Western region has the highest percentage of NHs with at least one PSD in 2014 and 2019 (58% and 68%, respectively). Washington had the highest percentage of NHs with at least one PSD for 4 consecutive years (2016-2019).

Conclusion: The number of NHs across the U.S. with at least one PSD was prevalent and remained on an upward trend. The Western region consistently had the highest percentage of NHs. More robust study is needed to determine medication safety and vigilance in these NHs.

Health services research

134 | Vizient pharmacy research support survey: Establishment of a National benchmark

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Introduction: Active engagement in research and scholarly output may be more challenging for pharmacists following residency training, despite its inherent value to their work environment and personal satisfaction. This survey was conducted to identify barriers and benchmark best practices regarding institutional and departmental support for pharmacy involvement in research.

Research Question or Hypothesis: What is the current structure of support for pharmacy research, and what are the barriers to increasing staff research support and scholarly output?

Study Design: Multi-center, descriptive, national survey.

Methods: A national survey was developed and distributed by the Vizient Pharmacy Research Committee to the Vizient Consortium Director of Pharmacy listserv. The survey was conducted between 10/2/19 and 1/31/20 using Qualtrics to record responses. This survey incorporated 38 questions assessing seven domains: financial support, study design/conduct support, interdisciplinary support, staff incentives, pharmacy research oversight, best practices, and barriers to research support. Survey responses were limited to one per institution. This survey was exempt from the Northwestern University Institutional Review Board.

Results: The survey was distributed to 253 hospitals from which 49 distinct responses were obtained, yielding a 19% response rate. Most responders (71%) reported less than 25% of clinical staff are involved in research. Responses indicated most departmental research is driven by residents, with 43% reporting residents drive at least 75% of research projects. The greatest barriers to conducting research included time (72%), funding (33%), and knowledge/experience of staff (32%). Research support included access to statisticians for data analysis (63%) or study design (57%), development of a pharmacy research committee (55%), and financial support or stipends (45%).

Conclusion: Despite noted financial and educational support from institutions, the most commonly reported barriers to conducing pharmacy research are time, funding, and knowledge or experience of staff pharmacists. This highlights the increased need for focused resources allocated to pharmacy research.

135 | Association between polypharmacy and patients' attitudes towards deprescribing

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Introduction: Polypharmacy has doubled over the last decade and is associated with adverse consequences including medication non-adherence and increased mortality. Deprescribing has been proposed to combat polypharmacy and refers to clinician-supervised withdrawal or reduction of potentially harmful medications. Understanding a patients' attitude and willingness to consider deprescribing is critical for intervention development especially as attitudes may differ based on medication burden.

Research Question or Hypothesis: Patients' attitudes towards deprescribing (PATD) differ based on individual medication burden.

Study Design: Cross-sectional study using data from the Medication Attitudes module of the National Health and Aging Trends Study.

Methods: The survey participants are representative of Medicare beneficiaries ≥65 years. Polypharmacy was defined as ≥6 medications. Four questions were analyzed from the Patients Attitude Towards Deprescribing validated questionnaire, each representing a different deprescribing factor. The responses were converted to binary outcomes (agree vs. disagree), and were analyzed using logistic regression models.

Results: Among respondents (n = 1,981), polypharmacy was present in 831 (40%). In adjusted models, polypharmacy respondents had a greater odds of agreeing that they were taking a large number of medicines (aOR, 9.73; 95% CI, 7.33-12.91) and may be taking one or more medicines that they no longer needed (aOR, 2.33; 95% CI, 1.70-3.20). Older adults on polypharmacy felt they had a good understanding of the reasons they are taking each of their medications (aOR, 3.18; 95% CI, 1.61-6.29). Most non-polypharmacy respondents (70%) were only comfortable taking a maximum of four pills daily whereas 42% of those on polypharmacy were comfortable with ≥12 medications daily ($P < 0.0001$).

Conclusion: Polypharmacy was associated with PATD. While those on polypharmacy had a higher level of comfort with an increasing medication burden they were also more likely to recognize opportunities for deprescribing. Deprescribing interventions need to account for differences in patient-level factors and attitudes in order to successfully reduce medication burden.

136 | The use of research evidence in pharmacist prescriptive authority

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Introduction: An expanding body of literature shows that pharmacists' interventions improve health outcomes and are cost-saving. However, diverse state regulations of pharmacists' scope of practice prevent pharmacists from being able practice at the top of their license. Utilizing research evidence supporting advanced pharmacist care may be a potential tactic in expanding scope of practice.

Research Question or Hypothesis: By understanding how state policymakers' and pharmacist advocates' used research evidence while making autonomous prescribing authority policy, researchers can identify ways to increase research utilization in scope of practice policy.

Study Design: Qualitative analysis of literature and interviews

Methods: Using autonomous prescriptive authority to represent general pharmacist scope of practice, a state policy document analysis was performed. A systematized review and semi-structured interviews were conducted to explore how identified states utilized evidence during the policy making process. Investigators analyzed findings through thematic analysis using codes grounded by the SPIRIT Action Framework. Resulting codes were summarized across themes, and recommendations were crafted.

Results: Sixteen states with 27 prescriptive authority policies were identified. The systematized review yielded 7 news articles, but no relevant peer-review literature. Fourteen interviews were conducted, and qualitative analysis revealed that public health need and safety considerations motivated evidence engagement. Themes from respondents highlighted factors that influenced overall capacity to utilize research, how research was engaged and applied, and barriers to using research evidence in policy-making. Recommendations for how researchers can influence pharmacy policy will be presented.

Conclusion: Overall, alignment of researcher's goals and legislative priorities, coupled with timely communication, may help to increase research evidence engagement in pharmacist scope of practice policy. By addressing factors identified in this study, researchers can increase the impact of their work through influencing the policymaking process, which can help to improve patient outcomes, contain costs, and provide pharmacists with the legal infrastructure to practice at the top of their license.

137 | Clinically integrated community pharmacy network approach to delivering enhanced clinical services

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Introduction: There is a growing interest in measuring pharmacy performance with a focus on preventative care and chronic disease state management. Community Pharmacy Enhanced Services Networks (CPESN) have been established throughout the U.S. to incorporate high-performance pharmacies providing enhanced services for high-risk patients. However, literature evaluating the readiness of these pharmacies to deliver enhanced service s is currently absent.

Research Question or Hypothesis: To assess the readiness of community pharmacies within CPESN-New York to deliver enhanced clinical services.

Study Design: Cross-sectional electronic survey conducted from November 2019 through February 2020.

Methods: A team of investigators developed a 70-item survey instrument measuring pharmacy access to clinical information, clinical servicers being offered, and perceived barriers towards implementing clinical services. The questionnaire was pilot tested for readability, length, and relevance of specific items. Survey invitations were sent to 145 pharmacies within CPESN-NY and respondents were included if they were involved in the provision of clinical services within their pharmacy. Descriptive statistics were used to assess survey responses.

Results: Among CPESN-NY pharmacies, 84 responses were received (58%). Majority of pharmacies collected health information via pharmacy dispensing software (71%), however only 33% had access to health information exchanges and 21% did not have access to any clinical information about their patients. More than half of participating pharmacies (55%) reported they were currently offering training to pharmacy staff on clinical services. Common services offered at CPESN pharmacies included face-to-face access (98%), medication reconciliation (95%), and clinical medication synchronization (94%). Barriers pharmacies faced include a lack of collaboration with health professionals (54%), proper training of pharmacy personnel (49%), and insufficient marketing strategies (53%).

Conclusion: Implementing enhanced clinical services at community pharmacies necessitates greater collaboration with healthcare professionals, adequate training of personnel, and improved marketing strategies to reach their patients.

138 | Community pharmacists' perceptions of acceptability, appropriateness, and feasibility of a regional health plan's value-based care model for comprehensive medication management

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Introduction: HealthPartners is an integrated health plan offering a blended value-based care model for comprehensive medication management (CMM) called Partners in Excellence (PIE). In PIE, healthcare providers are incentivized to conduct CMM visits and to achieve certain patient-focused quality and engagement metrics. Greater opportunity exists for community pharmacies to engage in PIE. Implementation science, specifically the assessment of implementation outcomes, provides key insights into the uptake of patient-care services, such as CMM, into practice.

Research Question or Hypothesis: How do community pharmacists perceive the implementation outcomes of acceptability, appropriateness, and feasibility of the PIE program?

Study Design: Qualitative case study

Methods: Semi-structured, one-on-one qualitative interviews were conducted with a group of 14 pharmacists and pharmacy managers participating in the PIE program. Interviews were coded inductively and then codes were mapped to the implementation outcomes of acceptability, appropriateness, and feasibility.

Results: A total of 12 codes emerged from the interviews. Four codes (targeted conditions of PIE, achieving PIE metrics, comprehensiveness of PIE, confusion and barriers) were mapped to acceptability, three codes (CMM documentation and billing, fitting CMM into limited time with patients, community pharmacy's role in patient care) were mapped to appropriateness, and one code (collecting clinical patient information) was mapped to feasibility. Four codes (financial sustainability, targeting patients for CMM, personnel for CMM, and patient/provider buy-in of CMM) were considered a combination of more than one outcome.

Conclusion: While the acceptability, appropriateness, and feasibility of the PIE program was generally positive, participants cited a number of challenges related to documentation and producing a financially sustainable CMM model, among others. The results shed light on how a blended value-based care model is perceived within community pharmacies and could inform the development and implementation of similar quality-based CMM programs.

139 | Positive deviants for medication therapy management: A mixed-methods comparative case study of community pharmacy practices

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Introduction: To optimize medication use in older adults, the Centers for Medicare & Medicaid Services launched Medication Therapy Management (MTM) services as part of Medicare Part D policy; however, strategies for achieving high quality MTM outcomes are not well understood.

Research Question or Hypothesis: What strategies contribute to community pharmacies' high performance on policy-relevant MTM quality measures?

Study Design: Mixed-methods comparative case study

Methods: This study was guided by the Positive Deviance approach and Chronic Care Model. The study population consisted of pharmacy staff employed by a Midwestern division of a national supermarket-

community pharmacy chain. MTM quality measures used to evaluate participant pharmacies' MTM performance mirrored select 2017 Medicare Part D Plans' Star Rating measures. Data consisted of demographics and qualitative data from semi-structured interviews. Qualitative and quantitative data were analyzed deductively and inductively or using descriptive statistics, respectively. Select participants member-checked the generated-hypotheses.

Results: Thirteen of 18 selected case pharmacies (72.2%) participated in this study, of which 5 were categorized as high performers, 4 moderate performers, and 4 low performers. Eleven pharmacists, 11 technicians, and 3 student interns participated in interviews. Eight strategies were hypothesized as contributing to MTM performance: Strong pharmacy staff-provider relationships and trust, Inability to address patients' social determinants of health (negatively contributing), Technician involvement in MTM, Providing comprehensive medication reviews in person vs. phone alone, Placing high priority on MTM, Using available clinical information systems to identify eligible patients, Technicians using clinical information systems to collect/document information for pharmacists, Faxing prescribers adherence medication therapy problems (MTPs) and calling on indication MTPs. Member-checking indicated agreement with the generated-hypotheses.

Conclusion: Eight strategies were hypothesized as contributing to community pharmacies' performance on MTM quality measures. Findings from this work can inform MTM practice and Medicare Part D MTM policy changes to positively influence patient outcomes. Future research should test hypotheses in a larger representative sample of pharmacies.

140 | Impact of clinical pharmacy services on the achievement of diabetes- and hypertension-related quality measures

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Introduction: Bon Secours Mercy Health comprises 63 primary care practices in Virginia. Seventeen practices employ pharmacists who provide annual wellness visits (AWV), comprehensive medication reviews (CMR), and diabetes care (DC).

Research Question or Hypothesis: What clinical pharmacy services are associated with quality measure achievement for blood pressure (BP) control, glycemic control, and annual eye/foot exams?

Study Design: Retrospective, observational study of electronic health records.

Methods: Data were abstracted for all new patients (N = 778) seen by a pharmacist in 2017. HEDIS/Medicare quality measure achievement was based on the last 2017 measurement. Multiple logistic regression models were used to identify pharmacy services (AWV, CMR, DC) associated with BP control (<140/90 mmHg) among patients with hypertension, and glycemic control (HbA1c < 9%), completion of eye/foot exams among patients with diabetes, controlling for demographics (age, gender, race, insurance), number of medications and Charlson comorbidity index.

Results: Patients' mean age was 67 years; 63% were female, 53% White, and 44% Black. Most (77%) were Medicare beneficiaries, 75% had hypertension, and 60% had diabetes. Of visits, 57% were AWVs, 13% CMRs, and 37% DC. AWVs and CMRs were neither associated with BP or glycemic control nor completion of eye/foot exams. DM was negatively associated with glycemic control (OR = 0.16, 95%CI 0.06-0.45) but not BP control or eye/foot exams. Patients with initial pharmacist visit in first 6 months were more likely to achieve glycemic control (OR = 1.83, 95%CI 1.10-3.06) compared to those in last 6 months. Age (OR = 1.04, 95%CI 1.02-1.07) was positively, while medications (OR = 0.92, 95%CI 0.86-0.99) and being male (OR = 0.58, 95%CI 0.34-0.96) were negatively associated with HbA1c < 9%. Blacks (versus Whites) were less likely to achieve BP control (OR = 0.47, 95%CI 0.30-0.73).

Conclusion: Pharmacists are referred complex patients, potentially explaining the negative association between DC and glycemic control. Patients seen in first 6 months had additional time to achieve HbA1c < 9%. Future work will compare quality measure achievement in practices with and without pharmacists.

141 | Impact of the present on admission indicator on ICD-10 code accuracy for acute bleeding and thromboembolic hospitalizations in anticoagulated patients

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Introduction: Using International Classification of Disease (ICD) diagnosis codes within administrative claims databases is an efficient method for identifying bleeding and thromboembolic events but has been associated with high false-positive and false-negative rates depending on the methodology used to apply codes to a given dataset.

Research Question or Hypothesis: Does a present on admission (POA) indicator impact the accuracy of ICD-10 codes to identifying bleeding and thromboembolic events using administrative claims data in anticoagulated patients?

Study Design: Retrospective, cross-sectional study of all inpatient hospitalizations during the last quarter of 2017 for patients who were using an outpatient anticoagulant prior to the hospitalization.

Methods: Chart reviews established the reason for admission; categorized as bleeding, thromboembolism, or other. After completing chart reviews, hospitalizations were linked to associated ICD-10 codes. Validated events were used as gold standard to calculate sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The analysis was repeated using ICD-10 codes associated with a POA indicator, signifying the diagnosis was present at time of admission.

Results: Of the 661 hospitalizations in 487 patients, a POA indicator was present in 462 (69.9%). We found 71 bleeding and 27 acute thromboembolic events. Restricting the analysis to codes with a POA indicator reduced the number of false positives for both thromboembolic (149 [22.5%] to 32 [4.8%]) and bleeding (59 [8.9%] to 21 [3.1%]) events, but increased the number of false negative events (2 [0.3%] to 8 [1.2%] and 7 [1.1%] to 32 [4.8%]) for thromboembolic and bleeding events, respectively. Applying the POA indicator decreased sensitivity and NPV, while increasing specificity and PPV ($P < 0.001$).

Conclusion: Limiting potential bleeding and thromboembolic events to include only ICD-10 codes with a POA indicator reduced false positives but increased false negatives, decreasing the utility of using the POA indicator to increase the accuracy of administrative claims research.

Hematology/anticoagulation

142 | Anticoagulation quality assessment and risk evaluation in patients with nonvalvular atrial fibrillation (NVAF) at a midwest internal medicine practice

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Introduction: Nonvalvular atrial fibrillation (NVAF) affected an estimated 6.4-7.4 million Americans in 2018 increasing stroke risk five-fold. According to National NVAF practice guidelines (American Heart Association/American College of Cardiology) NVAF patients should be anticoagulated to mitigate this risk unless their stroke risk is very low. A close look at oral anticoagulant utilization by CHADS2 score (e.g. PINNACLE Registry) indicates an under-use of oral anticoagulants with 30-40% of patients at high risk of stroke (CHADS2 >/= 2) receiving aspirin alone or no anticoagulation therapy.

Research Question or Hypothesis: In the Internal Medicine population, is the NVAF patient's risk of stroke appropriately addressed with anticoagulant therapy based on CHA2DS2-VASc criteria?

Study Design: Retrospective cohort study

Methods: Data were randomly collected from Feb-April 2020 at an Internal Medicine Clinic. Inclusion criteria consisted of NVAF patients, 18-90 years of age. Data items collected were age, gender, AF pattern, years with diagnosis, most recent INR, CHA2DS2-VASc scores, current NVAF anti-thrombotic therapy and reasons if not anticoagulated. Collected data were de-identified and imported into Microsoft Excel/Access for evaluation.

Results: Data were collected on 529 individuals (average age = 74.4 years). The most common CHA2DS2-VASc risk characteristics were hypertension (91.3%), female gender (60.1%) and age > 75 years (54.6%). Overall mean CHA2DS2-VASc score was 4.5 ± 1.8. Ninety-five percent of patients were identified as high risk (score > 2) per CHA2DS2-VASc score. Per ACC/AHA 2019 Guidelines and CHA2DS2VASc scores, 452 (85.4%) patients were treated based on recommendations. No recurrent AF (23.3%), past bleeds history (23.3%) and patient refused (22.2%) were common reasons for no treatment.

Conclusion: The CHA2DS2-VASc score (ideally gathered electronically at a system level) helps providers stratify stroke risk and should guide anti-thrombotic therapy for their NVAF patients. A majority of patients were treated per guidelines, but interventions should be designed to address identified barriers to guideline adherence.

143 | A comparison of direct acting oral anticoagulants in combination with dual antiplatelet therapy

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Introduction: Dual antiplatelet therapy with aspirin and a P2Y12 inhibitor is standard of care for patients receiving intracoronary stents, and a subset of these patients requires additional therapy with anticoagulation, termed 'triple therapy.' Largely, these combination regimens have not been compared to determine which may be associated with the lowest risk of bleeding.

Research Question or Hypothesis: How do bleeding rates vary between patients receiving triple therapy regimens with different individual agents?

Study Design: Retrospective cohort study

Methods: Adult, hospitalized patients were included if they were discharged on triple therapy between April 1, 2011 and September 1, 2017. Patients were excluded if they were on this regimen prior to admission, if triple therapy was discontinued or changed, or if dabigatran was the anticoagulant used in the triple therapy regimen. The primary outcome was bleeding rates during hospitalization or upon readmission within 90 days. Bleeding was classified according to the international society of thrombosis and hemostasis criteria. Institutional review board approval was obtained.

Results: There were 372 patients who met inclusion. Patients were approximately 70 years old, 60% male, and two-thirds receiving anticoagulation for atrial fibrillation. Sixty-four percent of patients received warfarin, 19.1% apixaban, and 16.9% rivaroxaban. The rate of bleeding was 12.1% in this cohort overall, and there was no statistically significant difference based on oral anticoagulant used (P = 0.7335). Bleeding differences were observed between P2Y12 inhibitor used: clopidogrel 11.2%, ticagrelor 12.8%, and prasugrel 36.4% (P = 0.0422). Past medical history of bleeding was also associated with increased bleeding rates (13.3% vs 5.2%; P = 0.0336).

Conclusion: In patients requiring triple therapy, no difference in bleeding events were determined based on the oral anticoagulant included in the regimen, but patients receiving prasugrel had a higher risk of bleeding.

144 | Comparative utilization and efficacy of thrombopoietin receptor agonists (TPO-RAs) in relapsed/refractory immune thrombocytopenic purpura (ITP)

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Introduction: Thrombopoietin receptor agonists (TPO-RAs) stimulate the production of platelets and offer an effective treatment option in relapsed/refractory ITP. Recently published 2019 ITP guidelines recommend the TPO-RAs as second line considerations following corticosteroids, however little data offers insight into comparative efficacy and tolerability. Given developments in ITP therapeutic options, clinicians should review available agents to determine optimal patient-specific sequencing in practice.

Research Question or Hypothesis: Is there a difference identified in practice in the efficacy of romiplostim versus eltrombopag?

Study Design: Single institution retrospective chart review of patients with a diagnosis of ITP and treatment with romiplostim or eltrombopag.

Methods: Patients with a diagnosis of ITP treated with romiplostim or eltrombopag from January 1, 2012 through December 31, 2019 were included. The primary objective assessed the comparative response between TPO-RAs, defined as platelets greater than 50,000/uL in more than 66% of clinic visits over a 6-month period. Secondary objectives sought to evaluate response to and tolerability of TPO-RAs.

Results: The study included 107 patients, 67 (63%) on romiplostim and 40 (37%) on eltrombopag. Most patients were female (54%) and white (70%), with a median age of 60 years old, with no significant demographic differences between groups. Prior corticosteroids and rituximab were used in 95% and 50% of patients, respectively. There was no difference identified in platelet response between the TPO-RAs, 72% romiplostim versus 65% eltrombopag (P = 0.520). Additionally, no differences were identified in secondary measures of response. Thromboembolic events were rare and without significant difference between groups.

Conclusion: After 6 months of therapy on romiplostim and eltrombopag for ITP, we did not identify a difference in the efficacy between these agents. Further larger and prospective evaluations should be considered, however at this time we found no evidence to suggest clinical favorability between TPO-RAs, indicating that selection may be determined by patient-specific variables.

145 | Evaluation of intensified low molecular weight heparin or unfractionated heparin for venous thromboembolism prophylaxis in critically ill patients with COVID-19

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Introduction: Initiation of prophylactic anticoagulation is standard of care for severely ill patients, including coronavirus disease 19 (COVID-19) patients who may be hypercoagulable. Determining an optimal prophylactic regimen is crucial to limit the number of in-hospital venous thromboembolism (VTE) and bleeding events.

Research Question or Hypothesis: What is the proportion of COVID-19 patients on a COVID-19 intensive care unit (ICU) VTE prophylaxis protocol who develop in-hospital VTE or bleeding events?

Study Design: Retrospective cohort study

Methods: Hospitalized, COVID-19 positive adult patients who were initiated on intensified and renally-adjusted heparin or enoxaparin VTE prophylaxis were included. The primary endpoint was to determine the proportion of patients on COVID-19 ICU VTE prophylaxis

who had an in-hospital VTE event, and secondary endpoints assessed international society of thrombosis and hemostasis bleeding events, other ischemic outcomes including myocardial infarction and stroke, and 30-day readmissions for VTE. Institutional review board approval was obtained.

Results: This study included 41 patients who were approximately 57 years old and 65.9% female. This population included 3 patients with a history of VTE and 2 with a history of cancer. The median ICU length of stay was 6 days. No patient experienced an in-hospital VTE event. The median Improve Bleed Score was a 6, and bleeding events occurred in 5 patients (12.2%) with 3 defined as major bleeds and 2 as minor bleeds. An ischemic event (ST-elevation myocardial infarction) occurred in one patient (2.4%) and readmission to a Kaleida Health facility within 30 days of discharge for a new VTE event occurred in 1 patient (2.4%).

Conclusion: In patients with COVID-19 who received the Kaleida COVID-19 ICU VTE prophylaxis protocol, no in-hospital VTE events occurred, but 12.2% experienced a bleeding event. Use of this protocol in an expanded population may decrease VTE events, with a potential to increase bleeding rates.

146 | Accuracy of venous thromboembolism (VTE) risk assessment and appropriate use of pharmacological VTE prophylaxis in a community hospital

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Introduction: Patients who are hospitalized for acute medical illness are at increased risk for developing VTE's. Pharmacological VTE prophylaxis have been shown to reduce the incidence of VTE's in hospitalized patients, yet rates of pharmacological VTE prophylaxis remain low. Appropriate risk stratification for VTE by using the Caprini risk assessment is essential to provide appropriate thromboprophylaxis. This study will review the accuracy of nursing calculation of VTE risk score and the appropriateness of pharmacological VTE prophylaxis in a community hospital setting.

Research Question or Hypothesis: To determine the accuracy of nursing assessment of the Caprini VTE risk score and the appropriateness of pharmacological VTE prophylaxis in a community hospital setting.

Study Design: Retrospective Chart Review.

Methods: From October 2019 until February 2020 we reviewed the electronic medical records of currently hospitalized medical patients at a large regional hospital in Appalachian Kentucky. Exclusion criteria included any patient currently receiving anticoagulation for any other medical condition and any being treated in the surgical or intensive care units.

Results: A total of 248 patient charts were reviewed and 213 met inclusion criteria and were eligible for analysis. Of the 213 patients 75 (35.2%) had the Caprini score calculated correctly and 138 (64.8%) calculated incorrectly. A total of 158 (74.2%) had a Caprini score of ≥3. Of the 158 only 27 (17.1%) received pharmacological VTE prophylaxis. Of the 131 patients that did not receive pharmacological VTE prophylaxis 2 patients (1.5%) had an absolute contraindication for anticoagulation. It is unclear why the other 129 patients did not receive pharmacological VTE prophylaxis.

Conclusion: This study showed an inaccurate calculation of the Caprini VTE score in the majority of hospitalized patients and may have contributed to inappropriate VTE prophylaxis. Further nursing education and supervision will be essential in improving the appropriate assessment of VTE risk stratification.

147 | Direct acting oral anticoagulants for the treatment of heparin-induced thrombocytopenia

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Introduction: Heparin-induced thrombocytopenia (HIT) is an acquired, potentially fatal procoagulant disorder that results from heparin or low molecular weight heparin exposure. While HIT has traditionally required treatment with a non-heparin parenteral anticoagulant with transition to warfarin, recent studies have suggested direct oral anticoagulants (DOACs) are alternative treatment options.

Research Question or Hypothesis: Are DOACs safe and effective for treatment of HIT?

Study Design: Single center retrospective cohort study.

Methods: Adult patients diagnosed with HIT who received treatment with a DOAC between January 1, 2013 and January 1, 2020 were included. The diagnosis was confirmed with an intermediate or high pretest probability for HIT (4 T score ≥ 4) and a positive anti-PF4/heparin complex assay or serotonin release assay. Patients taking a DOAC prior to admission were excluded. Baseline demographics; pertinent lab values; anticoagulant therapy; thromboembolism, gangrene, or amputation within 90 days of therapy initiation; major bleeding or clinically relevant non-major bleeding (CRNMB) within 90 days of therapy initiation; length of stay; and 30- and 90-day mortality were collected. This study was approved by the Wake Forest University Institutional Review Board.

Results: Five patients met inclusion criteria. Indications for heparin-based anticoagulation included coronary artery bypass grafting (n = 3, 60%), heparin flush (n = 1, 20%), and arterial or venous thromboembolism (n = 1, 20%). Apixaban and rivaroxaban were utilized for 1 (20%) and 4 (80%) patients, respectively. Four patients (80%) received initial treatment with argatroban prior to transition to DOAC therapy. One (20%) patient experienced a major bleeding event and 1 (20%)

experienced a CRNMB event within 90 days of DOAC initiation. No patients experienced venous or arterial thromboembolism, gangrene, amputation due to critical limb ischemia or death within 30- or 90-days of therapy initiation.

Conclusion: Although the sample population was small, DOACs may be considered an alternative treatment option for HIT.

148 | Risk factors analysis of venous thrombosis induced by immunomodulatory drug in multiple myeloma patients

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Introduction: There is a significant difference in the epidemiology of immunomodulatory drug (ID)-induced venous thrombosis between Asian multiple myeloma (MM) patients with European and American people, thus whether to use or not and the thromboprophylaxis regimen remains controversial.

Research Question or Hypothesis: To investigate the incidence and risk factors of venous thromboembolism (VTE) caused by IDs in Chinese MM patients in order to provide reference for the establishment of VTE prevention regimen.

Study Design: Retrospective study

Methods: Clinical data were retrieved from MM patients who received IDs (thalidomide or lenalidomide) from January 2017 to February 2019, including basic demographic characteristics, baseline laboratory examination results, combined medication and the presence of VTE. The incidence of VTE was evaluated and risk factors were discussed.

Results: A total of 185 cases were included, among which five occurred VTE events (2.70%), including one pulmonary embolism and four lower extremity VTE. Logistic regression analysis represented no risk factor. According to tumor patient VTE risk assessment model, we stratified the risk. 136 patients with high-risk should be given low-molecular-weight heparin (LMWH) or warfarin, but the actual preventive application were six and ten patients (one was given both) separately, meanwhile aspirin alone was used for prevention in 159 cases. Five patients with VTE events were all high-risk status, of which one got no preventive measures with another four received aspirin alone, suggesting generally inadequate thromboprophylaxis.

Conclusion: As common adverse reactions of IDs, Although the VTE incidence of in Asia MM patients is significantly lower than that in Western countries, VTE can affect the prognosis of patients, enough attention should be paid to VTE prevention. Present relevant models and regimens are based on the epidemiological characteristics of Western people. It is necessary to establish the risk assessment model of VTE in Chinese MM patients, so as to provide reference for the development of VTE prevention guidelines for them.

149 | Evaluation of low fixed-dose of four factor prothrombin complex concentrate for urgent reversal of warfarin

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Introduction: The four-factor prothrombin complex concentrate (4-factor PCC) is FDA approved for warfarin reversal in patients with acute major bleeding or in need for an urgent surgery or invasive procedure with recommended dose based on patient's weight and INR. Recent retrospective studies show that smaller fixed doses of 4-factor PCC are equally effective while reducing the risk of thrombotic events. In 2018, Pharmacy and Therapeutics committee approved the use of low fixed-dose of 1500 units of 4-factor PCC for warfarin reversal in non-intracranial hemorrhages as an available dosing option.

Research Question or Hypothesis: The primary objective of the study is to assess the efficacy of low fixed-dose 4-factor PCC for the urgent reversal of warfarin by evaluating the change in INR after drug administration.

Study Design: A multicenter retrospective chart review of patients who received 4-factor PCC for warfarin reversal from March 2019 to March 2020 was conducted. Patients with the intracranial hemorrhage were excluded from the study.

Methods: The pre and the post treatment INR were used as a marker for the warfarin reversal. Number of patients achieving INR less than 2 after low fixed dose versus FDA approved dosing regimen was also assessed. The Wilcoxon signed-rank test was used to assess the difference with significance defined as a P-value <0.05.

Results: In the preliminary analysis, a total of ten patients received 4-factor PCC for warfarin reversal from March to August 2019, with six patients receiving low fixed-dose and 4 patients receiving FDA approved dose. In the low fixed-dose group, the pre and post treatment INR mean difference was 5.81 (P-value <0.05), with 83.3% achieving INR less than 2. All patients who received FDA approved dosing regimen were able to achieve INR less than 2.

Conclusion: The low fixed-dose of 1500 units of 4-factor PCC was effective for the reversal of warfarin.

150 | Evaluation of outcomes after receipt of intravenous iron at a tertiary academic medical center

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Introduction: Iron administrations replenish iron stores and enhance hemoglobin synthesis across many indications. Parenteral iron is utilized when patients cannot tolerate oral iron or if a shorter treatment course is desired. Given the different dosing schedules of available agents, combined with a drug shortage, a drug utilization review was performed.

Research Question or Hypothesis: Is one iron product more effective in achieving a hemoglobin increase of >1 g/dL?

Study Design: An IRB-approved, retrospective, single-center chart review.

Methods: Adult patients who received at least one dose of parenteral iron at Lahey Hospital & Medical Center's (LHMC) between 01/2018-05/2019 were included. The primary outcome was achievement of hemoglobin increase by >1 g/dL.

Data collected from the electronic medical records included indication for use, baseline and post-infusion iron and red blood cell indices, and renal function. Descriptive statistics were used to analyze results.

Results: Of the 496 patients reviewed, 201 received a full course of parenteral iron and were included in the analysis. The median age was 58, 72.6% were female (N = 146), and iron deficiency (56.2%) and chronic blood loss (17.9%) were the most common indications for use. Of those receiving a full course, 67.2% (N = 135) demonstrated a change in hemoglobin of >1 g/dL, with 23.8% (N = 48) receiving iron sucrose; 8.4% (N = 17) receiving iron dextran; and 51.9% (N = 70) receiving ferumoxytol. The mean hemoglobin change was 1.81 (iron sucrose, SD 1.48); 1.75 (iron dextran, SD 1.42); and 1.81 (ferumoxytol, SD 1.46).

Conclusion: There is no difference between iron sucrose, iron dextran, and ferumoxytol in achieving a hemoglobin increase of >1 g/dL. Iron sucrose may be effective even when patients do not receive the full course. Due to the COVID-19 pandemic limiting office visits, iron dextran, ferumoxytol or an incomplete iron sucrose course may be preferred.

Herbal/complementary medicine

151 | Effects of red clover fractions on cell viability and pro-inflammatory cytokine secretion

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Introduction: Recent results from our laboratory have identified plant extracts with anti-colitis activity [1]. Red Clover derived extracts have received recent attention due to anti-inflammatory effects. Therefore, we were highly interested in examining the pharmacological actions of red clover in macrophage and colonic epithelial cell lines, which have some applicability to human Inflammatory Bowel Disease (IBD).

Research Question or Hypothesis: The anti-inflammatory effect of red clover reduces the production of inflammatory cytokines in colonic epithelial (HT-29) and murine macrophage cell lines.

Study Design: Randomized Controlled Trial.

Methods: The obtained residue from the red clover extract methanol mixture was chromatographed, which yielded five fractions containing different amounts of red clover components. Then, the anti-inflammatory effect of the red clover crude extract and fractions were examined by pre-treating colonic epithelial (HT-29) and murine macrophage (RAW 264.7) cell lines with these derivatives (10, 30, and 300 μg/mL concentration range). In these studies, LPS (1 μg/mL) was used to stimulate RAW-264 cells and TNF-α (10 ng/mL) to stimulate HT-29 cells. Commercially derived Diadzein and Genistein were used as positive control drugs with the macrophage cell line. In conjunction with these studies, we quantitatively measured the amount of secreted TNF-α (macrophage cell line) and IL-8 (colonic epithelial cell line) with commercially available ELISA kits. We also performed MTT assays to determine the viability of HT-29 cells after red clover treatment.

Results: Significant reductions in IL-8 and TNF-α secretion were obtained with crude Red Clover extract and tested fractions, but only at a concentration of 300 μg/ml. Diadzein and Genistein (1 μM) also blocked TNF-α secretion by macrophages. Red Clover derivatives (300 μg/ml) had no effect on colonic epithelial cell viability.

Conclusion: Red Clover crude extract, and its fractions at 300 μg/ml reduced pro-inflammatory cytokine secretion in cell lines applicable to IBD.

HIV/AIDS

152 | The effect of tenofovir alafenamide or tenofovir disoproxil fumarate on renal function of HIV-infected patients

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Introduction: The nucleoside reverse transcriptase inhibitors (NRTIs) tenofovir alafenamide (TAF) and tenofovir disoproxil fumarate (TDF) are both considered to be first line backbone agents in the management of HIV.

Research Question or Hypothesis: This study sought to investigate the impact of TAF and TDF on estimated glomerular filtration rate (eGFR) using real-world data in a rural patient population.

Study Design: Single center, exploratory, observational study.

Methods: This sub-study included fifty-four subjects recruited in a larger IRB-approved study at East Tennessee State University (ETSU). Nearly 83.3%, or 45 subjects, were male with a median age of 53 years (IQR, 46.0-59.0 years). Individuals received care from the ETSU Center of Excellence for HIV/AIDS Care. Subjects received

either TAF (n = 25) or TDF (n = 29) as part of their antiretroviral therapy. The eGFR means of the two groups were compared by a student's t-test with significance ascertainment being set a $P < 0.05$.

Results: Our data showed eGFR values below the conventional normal range of 90-120 ml/min/1.73 m^2. The mean eGFR values for TAF and TDF groups were reported to be 63.96 ± 15.92 ml/min/1.73 m^2 and 66.28 ± 18.04 ml/min/1.73 m^2, respectively. A student's t-test revealed no statistical significance ($P = 0.622$) between the two groups. The mean value for the comprehensive group was also below the normal range, 65.20 ± 16.97 ml/min/1.73 m^2.

Conclusion: Although patients receiving TAF or TDF showed abnormal eGFR values, there was no statistically significant difference between groups. In order to reflect real-world settings, additional studies are needed to confirm the results of this study that might be influenced by several confounding factors such as diabetes and pre-existing kidney disease.

153 | Differentiation of CD4 lymphocyte levels following tenofovir alafenamide or tenofovir disoproxil fumarate dosing

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Introduction: Tenofovir alafenamide (TAF) has emerged as a safer alternative to tenofovir disoproxil fumarate (TDF), in combination with emtricitabine, in terms of certain physiological parameters. Concerning HIV treatment, both drugs allow easier dosing schedules in hopes to reduce transmission, especially in rural patient populations.

Research Question or Hypothesis: The purpose of this study was to compare CD4 T-cell levels in patients receiving either TAF or TDF as part of their respective regimen.

Study Design: Single center, exploratory, observational study.

Methods: This sub-study included fifty-four patients (median age 53.0 years; interquartile range, 46.0-59.0 years) from a larger IRB-approved integrase strand transfer inhibitor study conducted at East Tennessee State University. Enrolled patients received TAF (n = 25, 84.0% male) or TDF (n = 29, 82.8% male) as part of their antiretroviral treatment regimens. The mean absolute CD4 lymphocyte (ACD4) count and mean percentage of CD4 lymphocytes (CD4POS) of the two groups were examined by a two-tailed t-test with significance ascertainment being set a $P < 0.05$. Data values below are reported as mean ± SD.

Results: The TAF group reported a mean of 812.84 ± 380.48 cells/mm^3; while TDF displayed 662.10 ± 387.52 cells/mm^3 in terms of ACD4 cell count. The two-tailed t-test revealed lack of statistical significance ($P = 0.157$) assuming equal variances. Further, TAF and TDF groups were analyzed for mean CD4POS yielding 35.88 ± 9.60% and 31.25 ± 12.14%, respectively. The CD4POS means, assuming equal variances, were not statistically significant ($P = 0.131$). Of note, most viral loads were below detection levels.

Conclusion: Although patients receiving TAF exhibited elevated CD4 lymphocytes in comparison to TDF, the difference was not found to be statistically significant. The data collected is aggregated from multiple individuals at one time point which allows for CD4 nadir to be a potential confounder. Additional studies are needed to confirm clinical significance.

154 | Prevalence of INSTI DRMs in patients living with HIV on Biktarvy

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Introduction: Integrase strand transfer inhibitors (INSTI) are a mainstay of antiretroviral therapy to treat human immunodeficiency virus (HIV). Bictegravir is a second generation INSTI with a high genetic barrier to resistance and a component of Biktarvy, a common treatment for patients living with HIV.

Research Question or Hypothesis: To retrospectively identify patients on Biktarvy with any INSTI drug resistan mutations (DRMs), and evaluate the effectiveness of Biktarvy in the presence of these DRMs by assessing viral load suppression and improvements in CD4 counts.

Study Design: Retrospective chart review

Methods: This retrospective patient chart review included adults 18 years and older, living with HIV on Biktarvy within the Temple University Hospital System. Patients were excluded if they were not currently on Biktarvy or did not have any documented INSTI DRMs. Data was collected from October 2019 to February 2020. Information compiled from each patient's electronic medical record included the current HIV treatment regimen, documented DRMs, allergies, hepatitis B status, most recent viral load, CD4 count and percentage, and demographic information. Bictegravir susceptibility was analyzed by reviewing drug resistance interpretation results within Stanford University HIV Drug Resistance Database.

Results: Of 300 patients analyzed, 7 (2.3%) had an INSTI DRM, and only 1 of these 7 patients had intermediate resistance predicted to Biktarvy when compared against the HIV Drug Resistance Database.

Conclusion: Although there was a small percentage of patients with INSTI DRMs, most patients on Biktarvy with DRMs had an undetectable viral load and high CD4 counts. Few INSTI mutations

found were predicted to confer any resistance to Biktarvy. This potentially shows the efficacy of Biktarvy in the presence of INSTI resistance mutations.

155 | Guideline adherence to diabetes diagnosis in patients living with HIV

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Introduction: In 2019, the American Diabetes Association (ADA) officially recommended using blood glucose (BG) criteria for diagnosis of type 2 diabetes (T2DM) in patients with altered hemoglobin A1c (HgbA1C)/glycemia relationships, including people living with HIV (PLWH). There are no studies assessing adherence to this recommendation in PLWH.

Research Question or Hypothesis: Do the University of Illinois Health Infectious Diseases clinics appropriately screen PLWH for T2DM?

Study Design: Retrospective comparative analysis

Methods: A retrospective comparative analysis was conducted to compare the appropriateness of T2DM diagnosis in PLWH at our clinics before/after the 2019 ADA guidelines. The primary outcome was appropriate BG screening, defined as the percentage of patients with a random BG (RBG) ≥126 mg/dL and a confirmatory fasting BG (FBG) test within 4 weeks in the pre-guideline group (4/2018–12/2018) vs the post-guideline group (4/2019–12/2019). Patients were included if they had at least one RBG value ≥126 mg/dL within 4 weeks of a clinic visit. Exclusion criteria included having a prior diabetes diagnosis or another condition with an altered HgbA1c/glycemia relationship. Data was analyzed using descriptive and comparative analyses.

Results: Of the 1,992 patients screened, there were 63 and 76 included in the 2018 and 2019 cohorts, respectively. 85% of the patients excluded were because they did not have an RBG ≥126 mg/dL during the study period. Of the 139 patients total, median age was 50 ± 12 years, 63% were black, and 73% were male. Groups were well matched, except more patients were on integrase inhibitors in 2019. The percentage of patients with appropriate screening for T2DM using FBG criteria was 0% in 2018 and 3% in 2019 (P = 0.407).

Conclusion: There was a non-significant difference from 2018 to 2019 in the percentage of patients that were screened for T2DM using FBG criteria. This study shows room for improvement in T2DM screening in our clinics. Other clinics may benefit from reviewing their screening procedures.

156 | Antiretroviral drug-drug interactions: Comparison of online drug interaction databases

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Introduction: Antiretrovirals (ARVs) are known for their high interaction potential, which may lead to additional toxicities. Previous studies with older ARVs, and our preliminary analysis with newer ARVs, reported discrepancies between online interaction databases.

Research Question or Hypothesis: Are there reporting discrepancies between online drug interaction databases for ARVs and concomitant medications?

Study Design: Cross-sectional review

Methods: Investigators performed interaction evaluations between ARVs and concomitant medications using LexiComp®, Clinical Pharmacology®, Micromedex®, Epocrates®, University of Liverpool, and University of Toronto. Databases were selected to represent subscription vs. open-access and general vs. HIV-specific. Concomitant medications were selected from the DrugStats Database "Top 200 of 2019" list of the most frequently prescribed medications in the US. ARVs were selected by HIV-trained pharmacists to represent the most common ARVs in each class. The primary outcome was interaction identification and risk classification.

Results: There were 1,520 potential interaction pairs between the first 100 of the "Top 200" drugs, after removing duplicates, and the 16 prespecified ARVs. The overall rate of actual or potential interactions was 14-19% with Epocrates®, University of Liverpool, Clinical Pharmacology®, University of Toronto, LexiComp®, and Micromedex® warning of 283, 280, 276, 274, 271, and 211 interactions, respectively. LexiComp® and University of Toronto used 5- and 3-point scales to rate interaction risk, respectively, with the others utilizing 4-point scales. After adjusting for differences in scales, the majority of interactions across the databases were of a moderate risk (monitor and/or possible therapy modification).

Conclusion: Although the overall number and risk of interactions were similar across databases, there were discrepancies for specific drugs, which, along with differences in risk scales, could impact clinical care. We conclude online drug interaction checkers do not identify or classify ARV drug interactions consistently. Thus, we recommend cross-referencing databases when evaluating ARV drug interactions and a future investigation into which database best characterizes these interactions.

157 | Evaluating the uptake of tenofovir alafenamide use at an urban, academic HIV clinic

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Introduction: Tenofovir disoproxil fumarate (TDF) is a nucleotide reverse transcriptase inhibitor (NRTI) prodrug of tenofovir (TFV) and commonly prescribed as part of antiretroviral therapy (ART). Tenofovir alafenamide (TAF), a newer TFV prodrug, has been proven to be equally efficacious with reduced risk of renal and bone toxicities, however, many patients have remained on TDF.
Research Question or Hypothesis: The primary objective of this study was to analyze the uptake of TAF use in patients previously prescribed TDF. The secondary objective was to determine common reasons why patients did not switch from TDF to TAF.
Study Design: This was an observational, retrospective study of patients prescribed TDF between January 2017 and May 2019 at an urban HIV clinic affiliated with an academic medical center.
Methods: Patient charts were evaluated to determine if patients on TDF were switched to TAF by May 2019, and if not, why they were not switched. Reasons not to switch could have included insurance issues, patient lost to follow-up (LTFU), medication error, patient preference, discussed but not yet switched, or lack of documentation. Bivariate analysis was performed using Chi-square test or Fisher's exact test and t-test or Wilcoxon rank sum test to detect any associations between each possible predictor and the outcomes.
Results: Of 1529 total patients, 1166 (76%) were switched to TAF, 235 (15%) were still prescribed TDF, and 128 (9%) switched to an NRTI- or TFV-sparing regimen. The most common reasons for not switching were LTFU (31.5%) and discussed but not yet switched (17.8%). Chronic kidney disease on hemodialysis and the patient's provider were the only significant predictors for not switching in the bivariate analysis.
Conclusion: Uptake of TAF was high, and insurance issues did not appear to be a primary barrier to access. Provider education could help increase uptake rates of switching patients from TDF to TAF.

158 | Baseline evaluation of an interdisciplinary mental health (MH) screening program in a human immunodeficiency virus (HIV) clinic at a federal health care center

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Introduction: Depression is among the most common comorbidities in HIV-positive patients with prevalence up to 39% in the United States. Non-adherence is the primary reason for treatment failure and depression is a barrier to adherence of antiretroviral therapy (ART). Additionally, depression has been linked to poor clinic appointment attendance, accelerated HIV progression, and higher mortality rates. Identifying and treating patients with co-existing MH conditions, especially depression, can optimize adherence and prevent treatment failure.
Research Question or Hypothesis: Are patients living with HIV adequately screened for depression and connected with MH care services?
Study Design: This study is a retrospective, single-center, qualitative cohort study.
Methods: HIV-positive veterans, active duty military, and dependents (>18 years old) were screened for depression during outpatient visits as part of an interdisciplinary, pharmacist-run pilot program at the Captain James A. Lovell Federal Health Care Center (FHCC) between 10/15/2018 and 02/06/2020. Exclusion criteria included patient refusal to participate. The primary endpoint was the proportion of patients exhibiting depressive symptoms as defined by a patient health questionnaire (PHQ-9) score of >5. Secondary endpoints included proportion of patients with previous depression diagnosis, currently prescribed antidepressants, and pharmacist interventions. Additional demographic and disease state data were collected. Descriptive statistics were utilized to analyze data.
Results: A total of 44 patients were screened and 43 patients were included for analysis, of which 16 (37%) exhibited depressive symptoms. Nine of the 16 patients (56%) had a pre-existing depression diagnosis, of which 5 (56%) were prescribed an antidepressant. There were 11 pharmacist interventions made including 7 MH consults, 2 warm hand-offs to walk-in MH clinic, and 2 antidepressant medication changes.
Conclusion: Amongst HIV-positive patients at FHCC, comorbid depression prevalence is similar to national averages. We identified a need to incorporate MH screenings into routine HIV care and that pharmacists may play an important role in improving quality of care and patient outcomes.

Infectious Diseases

159 | Evaluation of initiation and de-escalation of anti-MRSA therapy with vancomycin in patients with suspected community-onset infections at a VA Medical Center: An opportunity for antimicrobial stewardship

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Introduction: Empiric vancomycin use for methicillin resistant *Staphylococcal aureus* (MRSA) has increased dramatically despite decreases in frequency of MRSA identification in clinical specimens. A focus of antimicrobial stewardship is reducing inappropriate antibiotics for MRSA. Our site collaborated in a VA Center for Medication Safety and Antimicrobial Stewardship Task Force (ASTF) national medication use evaluation (MUE) to evaluate the appropriateness of initiation and de-escalation of vancomycin in hospitalized patients with suspected community-onset infections.

Research Question or Hypothesis: Is the initiation and de-escalation of therapy directed against MRSA with vancomycin in hospitalized patients with suspected community-onset infections consistent with practice guidelines from the CDC, VA ASTF and the Infectious Diseases Society of America?

Study Design: A retrospective chart review of hospitalized veterans prescribed intravenous vancomycin from June 1, 2017–May 31, 2018.

Methods: The MUE utilized a database extraction and a multi-site retrospective chart review. Our site evaluated 200 patients to determine eligibility. The proportion of vancomycin courses unnecessarily initiated, the proportion of vancomycin courses in which vancomycin therapy was inappropriately continued beyond day four and the proportion of all days of vancomycin therapy considered "excess" were captured.

Results: Seventy-nine patients, a total of 227 days of vancomycin therapy, at our site were eligible and included in the multi-site MUE (N = 1,320 patients). Unjustified empiric courses of vancomycin were initiated in 42 (53.2%) patients. The number of vancomycin courses inappropriately continued beyond day four was 11 (13.9%) patients. The number of days of vancomycin considered "excess" was 95 (41.8%) days, with 78 (82.1%) days primarily due to unnecessary vancomycin initiation.

Conclusion: There are opportunities for improvement with appropriate use of vancomycin therapy. Inappropriate vancomycin accounts for majority of empiric cases and correlates with excess use.

160 | Evaluation of procalcitonin in the modern stewardship setting

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Introduction: Procalcitonin (PCT) protocols reduced duration of antibiotic therapy (DOT) for sepsis and respiratory infections in randomized studies. Data is limited on whether this benefit is conferred in non-controlled settings. UMass Medical Center (UMMMC) has an established antimicrobial stewardship program (ASP). A formal PCT guideline is in place to guide ordering and interpretation in pneumonia and sepsis. Use is discouraged outside of these diagnoses. The modern role of PCT in hospitals with active ASPs is unclear.

Research Question or Hypothesis: The purpose of this study is to describe the use of PCT and determine its impact on DOT in patients with sepsis and pneumonia at our institution.

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

Methods: Patients admitted between July 2018 and April 2019 who had a PCT measurement and/or ICD-10 code for sepsis or pneumonia were included. The primary end-point was DOT. Data were analyzed using descriptive statistics and the Mann-Whitney U test.

Results: Of the 2378 PCT assays obtained, 1575 (66.2%) were collected in patients without a diagnosis of sepsis or pneumonia. There were 1267 patient encounters with an ICD-10 code for sepsis, of which 288 (22.7%) had ≥1 PCT measured. Median [IQR] DOT was shorter in patients with an initially negative PCT compared to patients with an initially positive PCT (2 [1-5] vs. 3[1-6] respectively, $P = 0.02$). There were 1258 patient encounters with an ICD-10 code for pneumonia, of which 332 (26.4%) had ≥1 PCT measured. There was no difference in median [IQR] DOT between patients with an initially negative PCT compared to patients with an initially positive PCT (3 [1-5] vs. 3[2-5] respectively, $P = 0.18$).

Conclusion: Despite guidance on PCT use, most assays were obtained outside of institutional guidelines. Regardless of PCT test results, DOTs were within guideline recommendations and likely impacted by other ASP strategies. Based upon these results UMMMC eliminated PCT testing.

161 | Beta-lactam-induced platelet drop in critically ill patients

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Introduction: Thrombocytopenia is common in critically ill patients. Many drugs contribute to thrombocytopenia including beta-lactams.

Research Question or Hypothesis: Cefepime and piperacillin exposures are associated with lower platelet counts.

Study Design: Retrospective cohort.

Methods: Adult patients admitted to the ICU at UF Health between 2016 and 2018, received cefepime or piperacillin, and had trough concentration measured were included. Data collected were demographics, Continuous Veno-Venous Hemofiltration (CVVH), SOFA score, platelet count, disseminated intravascular coagulation (DIC) scores, highest beta-lactam trough concentrations, and received medications including anticoagulants, antiplatelets, anticonvulsants, antibiotics, and chemotherapy. Multiple regression (LASSO) analysis was performed including platelet drop during therapy compared to baseline as an outcome.

Results: A total of 285 patients included and 42% were females. The mean (SD) age was 54 years (19), SOFA score 5 (4), and DIC score 1.6 (1.4). 79% were septic, 5% received CVVH, and 7% received ECMO. The majority (76%) received cefepime. The mean (SD) trough concentration was 29 mg/L (25.4) and therapy duration was 14 days (12). The percentage of patients on other relevant medications were: heparin 85%, vancomycin 83%, H2-blocker 45%, antiplatelets 29%, cotrimoxazole 14%, linezolid 10%, phenytoin 5%, chemotherapy 4%, valproate 4%, and carbamazepine 2%. The mean (SD) baseline platelet count was $221x10^3$/mL (156), minimum platelet count during beta-lactam therapy $161x10^3$/mL (113), and platelet drop from baseline was $60x10^3$/mL (104). 59 patients had ≥50% platelet drop. The final predictors included in the model were SOFA, ECMO, CVVH, sepsis, therapy duration, baseline platelet count, DIC score, and receiving cotrimoxazole and antiplatelet overlapping with beta-lactam therapy. Cefepime was significantly associated with further platelet drop compared to piperacillin (beta = $27x10^3$/mL, 95%CI 3-51). For each day of beta-lactam therapy, patients were more likely to have platelet drop ≥50% (OR 1.18, 95%CI 1.10-1.28).

Conclusion: Beta-lactam therapy duration was a significant predictor of platelet drop, but trough concentration was not. Other parameters (e.g. AUC) should be investigated.

162 | Daptomycin therapy for vancomycin-resistant Enterococcal faecium bacteremia in intensive care unit of a tertiary hospital in Taiwan: A retrospective cohort study

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Introduction: Vancomycin-resistant *Enterococcus faecium* (VRE-fm) bacteremia causes significant mortality in hospitalized patients. Treatment options for VRE-fm bacteremia are limited. Daptomycin exhibits concentration-dependent activity vs VRE *in vitro*, yet the clinical effect of daptomycin in ICU patients remains unclear.

Research Question or Hypothesis: We sought to investigate clinical characteristics and treatment outcomes of daptomycin for VRE-fm bacteremia in ICU patients.

Study Design: A retrospective cohort study was conducted and included 129 adult patients between January 1, 2015 and December 31, 2019.

Methods: ICU patients were included if they received daptomycin and had a blood culture positive for VRE. Patient-related, microbiological, and outcomes data were abstracted from clinical databases. The primary outcome was 14-day mortality and multivariate logistic regression analysis was used for outcome analysis. All statistical analyses were performed using SAS Enterprise Guide version 7.1 (SAS Institute Inc., North Carolina, USA).

Results: One hundred and twenty-nine patients (median age 61 yrs, range 18-94 yrs, 60% male, 74% in medical ICU) who received daptomycin for the treatment of VRE-fm bacteremia were included. On multivariable logistic regression, all-cause 14-day mortality was higher in the patients of MICU group than in SICU group (OR, 2.14; 95% CI, 1.035 - 4.432). The proportion of antimicrobial combinations (carbapenems, gentamicin, fosfomycin or ceftriaxone) with daptomycin was 54.3%. Combination therapy had lower mortality as compared with monotherapy (OR, 0.355; 95% CI, 0.195-0.644. Log-rank test, P = 0.0001). However, as compared with standard-dose daptomycin (< 10 mg/kg), high-dose daptomycin (≧10 mg/kg) did not improve clinical outcomes (OR, 1.049; 95% CI, 0.552-1.996). No difference in the risk of daptomycin MICs and onset of VRE fm bacteremia in ICU was observed between the treatment groups.

Conclusion: Our findings suggest that daptomycin combination therapy was associated with survival benefit in VRE-fm bacteremia; however, the impact on optimal dosing of daptomycin needs further investigation.

163 | Appropriateness of outpatient fluoroquinolone and clindamycin prescriptions

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Introduction: The National Action Plan for Combating Antibiotic-Resistant Bacteria has a goal to reduce inappropriate antibiotic prescribing by 50% in the outpatient setting. Stewardship in outpatient settings is critical due to antibiotic expenditures, and incidence of treatment-resistant bacteria. Two commonly prescribed, but misused, antibiotics in the outpatient setting are fluoroquinolones and clindamycin. The inappropriate use of these agents puts patients at risk for *Clostridioides difficile* infection. There is a need to better understand the frequency of inappropriate fluoroquinolone and clindamycin prescriptions.

Research Question or Hypothesis: We hypothesize that less than 50% of fluoroquinolone and clindamycin prescriptions will be appropriate.

Study Design: This is a retrospective chart review of fluoroquinolone and clindamycin prescriptions at three outpatient clinics.

Methods: The primary outcome is to evaluate appropriateness of these prescriptions. Four factors will be identified: indication and preference for the condition; appropriateness of the dose and dose schedule; accuracy of treatment duration; and incidence of adverse events within 30 days of the prescribed antibiotic. The secondary objective of this study is to develop and implement education to reduce inappropriate antibiotic prescribing. Data will then be gathered to assess the impact of this intervention. A Fisher-s exact test will be utilized. All analyses are conducted at $\alpha = 0.05$.

Results: Between January – March 2019, only 36 of 142 prescriptions (25.3%) were appropriate. The most common error was indication and preference for use with urinary tract infections accounting for 50 of the 142 prescriptions (35.2%). For the clinic at which education and post-intervention analysis were conducted, there was a statistically significant difference in the appropriateness of the dose and dose schedule (31.8% versus 64.3%, $\alpha = 0.005$).

Conclusion:

This is the first study at this health system evaluating outpatient antibiotic use; based on these results, the hypothesis was accepted. This study offers a novel, but simple, approach to the assessment of outpatient antibiotic prescriptions.

164 | Assessing the impact of race on direct-acting antivirals (DAAs) in achieving sustained virologic response (SVR) in hepatitis C virus (HCV) in a telemedicine prison population

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Introduction: HCV prevalence among United States prisoners is 12%–35%, compared to 1.3% in the nonincarcerated population, a disproportion that encourages studying HCV in prisoners. Issues like nonadherence and access to care are not as prevalent in the prison population, thus such traditional study confounders are minimized. Correctional facilities often lack HCV specialists and telemedicine bridges inmates to HCV treatment. DAAs are the standard of care for HCV, however some studies observed differences in SVR rates across racial groups. This study examines if race impacts SVR rates with DAAs in a telemedicine prison population.

Research Question or Hypothesis: What impact will race have on SVR in incarcerated HCV patients treated with DAAs?

Study Design: Retrospective chart review.

Methods: A retrospective chart review was conducted for incarcerated patients receiving DAAs through the Telemedicine Liver Clinic from 10/01/2016 to 01/01/2019 after IRB approval. Achievement of SVR was compared among whites, blacks, and Hispanics. Data were categorical and statistical analysis was completed using Fischer's exact test.

Factors previously associated with inferior response	*P* values
Blacks vs. Whites	0.23
Hispanic vs. Whites	0.43
Blacks vs. Hispanics	1.00

Results: There were 142 patients included in the study. Overall, 97.2% (n = 138) were male, the average age was 53.6 (± 9.5), and 81.7% (n = 116) were genotype 1. Between races, 52.8% (n = 75) were white, 36.6% (n = 52) were black, and 10.6% (n = 15) were Hispanic. Treatment regimens included sofosbuvir/velpatasvir (51.4%), sofosbuvir/ledipasvir (38.0%), glecaprevir/pibrentasvir (8.5%), elbasvir/grazoprevir (1.4%), and sofosbuvir/velpatasvir/voxilaprevir (0.7%). SVR was achieved in 97.3%, 92.3%, 93.3% of whites, blacks, and Hispanics, respectively.

Conclusion: Despite previous studies showing an association between race and SVR, this study shows no difference in SVR rates between races with DAA therapy. This incarcerated telemedicine population provides valuable data as HCV rates are disproportionally high in this population and traditional study confounders are minimized.

165 | Evaluation of the appropriate use of beta-lactam alternatives as surgical prophylactic agents in a pediatric population

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Introduction: Beta-lactams (BL) are first-line antimicrobial prophylactic agents for most pediatric patients in surgical procedures. Alternative agents, such as clindamycin and vancomycin, are frequently used despite evidence in adults recommending against their use.

Research Question or Hypothesis: What was the appropriateness and rationale for the use of BL alternatives as surgical prophylaxis in pediatric patients?

Study Design: Retrospective cohort study

Methods: Pediatric inpatients (<18 years) who underwent surgery at our facility and received surgical prophylaxis with a BL alternative antibiotic typically used for resistant gram-positive bacteria (per CDC) between 8/1/2017 and 7/31/2018 were included. Prophylaxis was

evaluated for appropriateness based on duration, history of methicillin-resistant *Staphylococcus aureus* (MRSA) infection, and allergy. Incidence of 30-day surgical site infection (SSI) was also collected.

Results: A total of 164 encounters of 154 distinct patients were assessed with vancomycin being the most widely used agent (90% vancomycin, 10% clindamycin). A total of 10 (6.1%) encounters received an extended duration of therapy (>24 hours), though 3 (30%) were due to presence of an active systemic infection. BL allergies were documented in 22 (13%) encounters; a history of MRSA infection was documented in 1 (10%) of the 10 encounters with extended duration BL. Of these 10 encounters, 7 of them underwent neurosurgery, compared to 3 for all other surgical types ($P = 0.7$). Additionally, the administration of intra-wound vancomycin powder was identified in 45 (27%) patients. Thus, among the 119 encounters in which patients received IV or oral prophylaxis, 79% had no clear rationale for use of the BL. Only 1 (0.6%) patient developed an SSI.

Conclusion: A large proportion of BL alternatives used as surgical prophylaxis in this patient population was potentially inappropriate. Comparative effectiveness data are needed to better direct use of alternate prophylactic agents in pediatric patients.

166 | MeRIT Project: Evaluating the impact of expanding antimicrobial stewardship to hospital discharge

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Introduction: Only 30-50% of discharge antimicrobials are appropriate. Limited data exist on how to improve antimicrobial prescribing practices at hospital discharge. While pharmacists may review culture results to improve antimicrobial coverage after discharge, to our knowledge no study has assessed the impact of a comprehensive pharmacist-led antimicrobial stewardship intervention at the time of discharge.

Research Question or Hypothesis: A pharmacist-led antimicrobial stewardship intervention will improve antibiotic prescribing at discharge compared with prescriber education alone.

Study Design: Quasi-experimental, pre-post intervention study.

Methods: A biphasic intervention on two medicine units took place from November 2019 to May 2020 at a community hospital. Phase-1 provided both units with prescriber education on antimicrobial appropriateness, including a pocket guide for antibiotic dosing and duration. Phase-2 included a pharmacist-led intervention to one unit, with another unit prespecified as the referent. The primary outcome is appropriateness of antimicrobial prescribing at the time of discharge, defined by spectrum of activity, dosing, and duration of therapy. The analytic dataset includes adults on these units receiving an oral antimicrobial prescription at discharge, excluding those pregnant, immunocompromised, discharged on intravenous antimicrobials, or experiencing a recurrent infection. The primary outcome was assessed using Pearson Chi-squared.

Results: Pre-intervention, pilot data included 105 discharge antimicrobial prescriptions, of which 28% (n = 29) were appropriate. Phase-1 included 51 antimicrobial prescriptions, of which 22% (n = 11) were appropriate. Phase-2 included 43 antimicrobial prescriptions, 47.8% (n = 11) were appropriate in the intervention group compared with 35% (n = 7) in the control. In the intervention group, from baseline to Phase-2, the overall appropriateness of antibiotics prescribed at discharge increased from 30.8% to 47.8% ($P = 0.141$). Following the pharmacist-driven intervention, duration of therapy, dosing, and antimicrobial selection based on spectrum of activity improved.

Conclusion: Congruent with previous literature, one-time education alone may be insufficient for improving antimicrobial stewardship. However, a pharmacist-led intervention may improve appropriateness of antimicrobial therapies prescribed at the time of hospital discharge.

167 | Evaluation of clinical and cost outcomes of the antimicrobial stewardship program in a Tertiary Referral Hospital in Perak, Malaysia

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Introduction: The antimicrobial stewardship (AMS) program has been implemented in most public healthcare facilities in Malaysia to promote judicious use of antimicrobials and to minimize antimicrobial resistance. Routine AMS ward rounds are one of the activities in the AMS program. This study aimed to evaluate the clinical outcomes among patients under the AMS program of a Malaysian tertiary hospital, with the antimicrobial cost savings consequential to the recommendations provided by the AMS team during the routine AMS ward rounds.

Research Question or Hypothesis: Would accepting recommendations provided by the AMS team during the routine AMS ward rounds bring positive impact in terms of clinical outcomes and result in antimicrobial cost savings?

Study Design: This is a retrospective review of the AMS database in Hospital Raja Permaisuri Bainun from 1st January 2019 to 30th June 2019.

Methods: The AMS clerking forms filled during ward rounds were reviewed and relevant data were collected. Cases with incomplete information or recommendations that had no direct impact on patients' clinical and cost outcomes were excluded.

Results: A total of 200 cases were referred to the AMS team for recommendations. Of those recommendations, 167 (83.5%) were accepted by the primary team. Most of the cases (76.0%) were discharged well. There was no association between duration of antimicrobial therapy (P = 0.147), length of stay (P = 0.849), 30-day infection-related mortality (P > 0.95) and 30-day infection-related readmission (P = 0.329) with acceptance of those recommendations. However, accepting the recommendations contributed to a total antimicrobial cost saving of RM9579.82 while rejection resulted in cost wastage of RM1332.18 over the study period (P < 0.001).

Conclusion: Recommendations provided by the AMS team resulted in cost savings without compromising other clinical outcomes. Future studies should focus on the sustainability of those outcomes and to evaluate the potential beneficial long-term effects of the AMS program in mortality and infection rates.

168 | Evaluation of risk factors, clinical presentation, and outcomes associated with extended spectrum beta-lactamase-producing Enterobacterales (ESBL-PE) infections in medically underserved patients

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Introduction: Characteristics associated with extended spectrum beta-lactamase-producing Enterobacterales (ESBL-PE) in underprivileged populations remain unknown.

Research Question or Hypothesis: What are the risk factors, clinical presentation, and outcomes associated with extended spectrum beta-lactamase-producing Enterobacterales (ESBL-PE) infections vs non-ESBL-PE infectious in medically underserved patients?

Study Design: Retrospective cohort study

Methods: Adult, hospitalized patients with Enterobacterales infections between 01/2019-01/2020 were screened. Patients were excluded if antibiotics were started >48 h from the first positive culture, had a polymicrobial culture, <24 h length of stay, or positive cultures deemed to be colonization, not requiring treatment. Patients were grouped by those who had ESBL-PE infections vs non-ESBL-PE infections (nESBL-PE). The primary outcome was 30d mortality. The secondary outcomes were 30d recurrence and hospital LOS. All statistical tests were performed using GraphPad Prism v 8.4.0 (San Diego, CA).

Results: Of 379 included patients, 41% had ESBL-PE infections. Mean age was 59y, 39% were male, and 58% were Hispanic. The most common source was urinary (67%). The ESBL-PE group had higher CCI (4 (2-6) vs 3 (1-5) P < 0.001) with significantly higher proportion of diabetes (50% vs 33%, P < 0.01) and chronic indwelling foley (10% vs 4.5% P < 0.05) compared with nESBL-PE group. Severity of illness assessed by the need for ICU admissions was similar between the groups (ESBL-PE 25% vs nESBL-PE26%, P = 0.9048). Most commonly utilized empiric therapy was ceftriaxone (35%) followed by meropenem (34%) in ESBL- PE group and ceftriaxone (51%) in nESBL-PE group. 30-d mortality rate (ESBL-PE 8% vs nESBL-PE 6%, P = 0.5323) and LOS were similar (ESBL-PE 7 (1-14) vs nESBL-PE 5 (3-10) P = 0.2522), but ESBL-PE group had higher 30d recurrence/reinfection rates vs nESBL-PE group (7.6% vs 2.7% P < 0.05).

Conclusion: ESBL-PE group had more comorbidities but similar severity of illness at presentation compared with nESBL-PE group. Clinical outcomes assess by mortality and LOS were similar except for higher percentage of recurrence in ESBL-PE group.

169 | Evaluation of risk factors, clinical presentation, and outcomes of non-elderly vs elderly patients with *Streptococcus pneumoniae* bloodstream infections

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Introduction: *Streptococcus pneumoniae* bloodstream infections (SP-BSI) in non-elderly populations are not well-described.

Research Question or Hypothesis: What are the risk factors, clinical presentation, and outcomes between non-elderly vs elderly patients with SP-BSI?

Study Design: Retrospective cohort study

Methods: Adult, hospitalized patients with SP-BSI during 06/2015-06/2017 in two medical centers were screened. Patients were excluded if they received <48 hr of antibiotics or antibiotics were started >48 hr from the first positive culture. Patients were grouped by those who were younger than 65y (non-elderly group) vs older than 65y (elderly group) and compared for risk factors, clinical presentation, and outcomes. Primary outcome was 30-day mortality and hospital LOS. All statistical tests were performed using GraphPad Prism software v 8.4.0 (San Diego, CA).

Results: Of 118 patients with SP-BSI, 79% were non-elderly with a mean age of 47y. Mean age for elderly group was 72y. Non-elderly group had higher proportion of male (71% vs 36%, P = 0.0013) and immunocompromised state (29% vs 10%, P = 0.3671), and significantly lower CCI (2 (0-4) vs 5 (4-6), P = 0.0001) with less ESRD on HD (6.5% vs 32%, P = 0.0005) and CHF (6.5% vs 24%, P = 0.01) compared with elderly group. Severity of illness at onset of infection assessed by

ICU admission was similar between the groups (38% in non-elderly group, vs 44% in elderly group, P = 0.5623). Most common empiric therapy for both groups was vancomycin (59% in non-elderly group vs 64% in elderly group, P = 0.6594) and ceftriaxone (75% in non-elderly group vs 52% ceftriaxone in elderly group, P = 0.0237). 30-day mortality rate (14% vs 12%, P = 0.7975) and LOS (7 (4-14) vs 7 (5-17), P = 0.8961) were similar between non-elderly vs elderly groups.

Conclusion: Non-elderly group had fewer comorbidities but similar severity of illness at presentation compared with elderly group. Clinical outcomes of mortality and LOS were similar between non-elderly and elderly patients with SP-BSI.

170 | Assessment of Meropenem Alternative Regimen (AMAR): A short interval, small dose regimen compared to standard therapy

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Introduction: It has been shown that small-dose, short-interval meropenem dosing regimens generate similar PK/PD properties compared to the standard regimen, as well as reduced costs. However, there is a lack of evidence demonstrating similar effectiveness. We implemented a pharmacy-driven automatic exchange protocol for meropenem in September 2018.

Research Question or Hypothesis: Is meropenem 0.5 g IV every 6 hours non-inferior to meropenem 1 g IV every 8 hours?

Study Design: Pre- and post-intervention, retrospective, non-inferiority cohort study.

Methods: Medical records were reviewed of cohorts that received either meropenem 0.5 g q6h (alternative regimen) or meropenem 1 g q8h (traditional regimen). The primary outcome of clinical improvement within 72 h of initiation of meropenem was a composite of resolution or trend toward improvement in leukocytosis, fever, and signs/symptoms of infection. Secondary outcomes included length of stay and in-hospital mortality. Non-inferiority was concluded if the lower limit of a two-sided 95% CI for difference in clinical improvement rate was >-15%. Statistical analyses were done in SAS v9.4, using the Farrington-Manning Method for non-inferiority. X2, Fisher's exact, and T-tests were used as appropriate. P-values <0.05 were statistically significant.

Results: Groups had similar baseline characteristics, except for number of patients with sepsis (q6h: 80.0%, q8h: 95.6%) and mean creatinine clearance (q6h: 63.4 mL/min, q8h: 82.0 mL/min). Of 45 patients on the alternative regimen, 24 (53.3%) had clinical improvement in 72 h, compared to 18 of 46 (39.1%) on the traditional regimen. Difference between groups was 14.2% (95% CI -0.0606 to 0.3446, P = 0.0024 for non-inferiority). Mean length of stay was 18 (± 12) days for alternative regimen vs 12 (± 9) days (P = 0.0049). In-hospital mortality was greater for the alternative regimen cohort (35.6% vs 17.4%, P = 0.049).

Conclusion: Meropenem in alternative dosing regimen was non-inferior to the traditional regimen, although length of stay and mortality were higher.

171 | Pharmacy students' knowledge and confidence of penicillin allergy assessment and skin testing following focused didactic instruction and simulation

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Introduction: Pharmacists may be well-positioned to perform penicillin allergy assessment and skin testing (PAAST) to potentially de-label penicillin allergies; however, educational preparation and instruction during pharmacy school is unclear. Thus, we sought to evaluate the impact of an interactive didactic class focused on PAAST on pharmacy students' knowledge and confidence.

Research Question or Hypothesis: Do pharmacy students' knowledge and confidence regarding PAAST improve following interactive didactic instruction and simulation?

Study Design: Multicenter, cross-sectional survey.

Methods: An anonymous, voluntary, electronic survey was distributed to 159 pharmacy students before and after a focused instruction and simulation class on PAAST during an interactive skills lab course at two schools of pharmacy. The pre- and post-survey contained the same ten PAAST knowledge-based questions and multi-step, 5-point Likert scale statements related to confidence and familiarity of PAAST. The pre- and post-survey were distributed prior to and after class, respectively. During class, PAAST instruction and simulation was delivered via a brief instructor-led lecture followed by student-led penicillin allergy counseling interviews, simulated penicillin skin testing, and case work to assess penicillin allergy management strategies. Descriptive statistics were performed, and the paired t-test was used to compare pre- and post-survey responses.

Results: 143 surveys were completed resulting in a survey response rate of 89.9%. PAAST knowledge scores (mean ± SD) increased overall following the interactive PAAST instruction and simulation (6.67 ± 1.51 vs. 7.81 ± 1.39; P < 0.001). In particular, knowledge scores increased considerably for questions related to penicillin skin testing, untoward consequences of penicillin allergies, and graded challenges. Pharmacy students' PAAST confidence scores (mean ± SD) also improved following the interactive instruction and simulation (2.30 ± 0.70 vs. 3.22 ± 0.67; P < 0.001) with considerable increases in confidence related to graded challenges and penicillin skin testing.

Conclusion: Pharmacy students' knowledge and confidence of PAAST improved following an interactive didactic instruction and simulation.

172 | Nephrotoxicity with cefepime versus piperacillin-tazobactam in combination with vancomycin dosed by AUC

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Introduction: Previously, we reported that the use of vancomycin (VAN) concomitantly with common anti-pseudomonal agents such as piperacillin/tazobactam (TZP) and cefepime (FEP) at our medical center was associated with a 29% and 11% rate of acute kidney injury (AKI), respectively. However, VAN was dosed to target trough concentrations at that time. Recent data suggests that VAN dosed by AUC results in lower rates of AKI, but it remains unclear whether this is also true when VAN is given concomitantly with TZP or FEP.
Research Question or Hypothesis: We hypothesize that the risk of VAN-AKI is lower with FEP than with TZP.
Study Design: This was a retrospective cohort study of patients treated with VAN+TZP or FEP at Detroit Medical Center hospitals between 2015 to 2020.
Methods: Adult patients started on VAN+FEP or VAN+TZP within 24 hours of each other and continued for ≥48 hours were included. Patients with no documented AUC dosing, acute kidney injury, end-stage renal disease, or renal replacement therapy prior to treatment were excluded. Nephrotoxicity was defined as an increase in serum creatinine ≥50% or 0.5 mg/dL, whichever was greater, over two consecutive measurements.
Results: A total of 64 patients were included (29 VAN+TZP and 35 VAN+FEP); baseline characteristics were well-balanced among groups. The median(IQR) age was 57 years(47-65), 61% were male, and 69% were African American. The median(IQR) baseline serum creatinine was 0.68 mg/dL(0.58-0.85). VAN-AKI occurred in 14% of patients; 21% vs. 9% in VAN+TZP and VAN+FEP respectively (P = 0.15), with a number needed to harm (NNH) of 6. After controlling for age, IV contrast, culture source, and diabetes, VAN+TZP was not associated with increased odds of AKI.
Conclusion: Our preliminary results suggest that the prevalence of AKI is higher in VAN+TZP vs. VAN+FEP. Although rates of AKI appear to be lower than previously reported, larger studies are needed to validate these findings.

173 | Antimicrobial stewardship in major elective orthopedic surgery: Final program results

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Introduction: While antimicrobial therapy is a critical component of orthopedic surgical care, limited high-quality data exists to optimize use and guide stewardship efforts.
Research Question or Hypothesis: A comprehensive antimicrobial stewardship program (ASP) can optimize antibiotic use in total joint arthroplasty (TJA), with downstream improvements in institutional surgical site infection (SSI) and postoperative acute kidney injury (AKI) rates.
Study Design: Prospective interventional study at a large urban hospital.
Methods: An interprofessional Orthopedic Surgery ASP was formed in late 2017 at the study institution. A total of 12 recommendations were issued with 11 ultimately implemented across 3 project phases spanning March 2018 - December 2019. A new protocol for preoperative antibiotic selection was implemented during Phase I and was prospectively supported by perioperative clinical pharmacist interventions in a resource-neutral manner. The primary study outcome was rate of optimal preoperative antibiotic selection as assessed for pre- vs. post-intervention time periods. Descriptive analyses were pursued for ASP and pharmacist interventions, institutional SSI and AKI rates, and population colonization rates across the affected fiscal years. A cost-benefit estimation of the ASP was pursued from the institutional perspective.
Results: Rate of optimal preoperative antibiotic selection increased from 64.1% in the pre-implementation sample (Feb 2018, n = 64) to 97.4% post-implementation (Jun 2018-Dec 2019, n = 1312)(P < 0.001), supported by an average of 24 pharmacist interventions per month. Clindamycin and gentamicin use significantly decreased while cefazolin use significantly increased. Total SSI rate decreased throughout the affected fiscal years (1.38% FY18 vs. 0.69% FY19 vs. 0.42% FY20TD) and AKI rate appeared to improve (1.55% FY18 vs. 1.20% FY19 vs. 1.33% FY20TD). The ASP was estimated to save the institution >$1.2 million annually.
Conclusion: A comprehensive ASP for TJA was associated with improved antibiotic use and cost-savings without detriment to SSI rates. Clinical pharmacists were key drivers in this initiative.

174 | Comparison of hepatitis C virus sustained virologic response rates at an urban academic medical center before and after removal of Medicaid sobriety restrictions

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Introduction: Until 11/1/2018, Illinois Medicaid restricted hepatitis C virus (HCV) medication coverage to patients with sobriety from illicits/alcohol ≥12 months. This denied treatment access for patients with high HCV transmission risk, despite clinical trial data demonstrating high sustained virologic response (SVR) rates among substance users. It is important to understand the impact of this policy change on SVR.

Research Question or Hypothesis: Do HCV SVR rates differ between patients treated before and after the Illinois Medicaid sobriety restriction removal?

Study Design: A retrospective cohort study of HCV patients.

Methods: Medicaid-insured patients who started direct-acting antivirals at an urban academic medical center from 1/1/2014–3/20/2020 were included and stratified by treatment initiation date. Baseline characteristics and HCV treatment details were extracted from electronic records. The primary endpoint was SVR. Characteristics of the groups were compared with chi-square tests or Fisher's exact tests for categorical variables and t-tests for continuous variables. Logistic regression was used to account for group differences.

Results: Among 442 Medicaid-insured patients, 346(78%) were treated pre-policy change and 96(22%) were treated post-change. Excluding patients with loss-to-follow-up/early discontinuation, 311 patients were treated pre-change and 74 post-change. Groups did not differ by age, gender, genotype, or ethnicity ($P > 0.05$). Patients treated post-change had lower rates of cirrhosis (31% vs. 56%; $P < 0.001$), but higher rates of non-intravenous illicit substance use in the last 12 months (30% vs. 14%; $P = 0.004$), recent alcohol use (42% vs. 27%; $P = 0.01$), opioid substitution therapy (24% vs. 5%; $P < 0.001$), and failed appointments (96% vs. 67%; $P < 0.001$) compared to the pre-change group. The per-protocol SVR rates (95.95% in the post-change, 95.5% in the pre-change group) did not differ after adjusting for the differences in cirrhosis between groups (OR = 0.77, 95% CI 0.21-2.85).

Conclusion: Per protocol SVR rates did not differ before or after the Illinois Medicaid sobriety restriction removal. Results support HCV treatment regardless of documented sobriety to work toward HCV elimination.

175 | Clinical characteristics associated with high Pitt Bacteremia Score in *Streptococcus pneumoniae* bloodstream infections

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Introduction: Pitt Bacteremia Score (PBS) is widely used to characterize the severity of acute infection. However, clinical characteristics associated with high PBS in *Streptococcus pneumoniae* Bloodstream Infections (SP-BSI) are not well-described.

Research Question or Hypothesis: What are the risk factors and clinical outcomes of patients with SP-BSI presenting with higher PBS (≥4) vs patients presenting with lower PBS (<4)?

Study Design: Retrospective cohort observational study

Methods: Adult patients from two hospitals were included in the study. Patients were excluded if they did not receive >48 h of antibiotic therapy or did not receive antibiotic therapy <48 h of a positive culture. Patients were divided into two groups with PBS <4 (lowPBS) vs PBS ≥4 (highPBS) at the onset of SP-BSI. The primary outcome was 30-d mortality. Secondary outcome was LOS. All statistical tests were performed using GraphPad Prism v 8.4.0 (San Diego, CA).

Results: 118 patients were included in this study with 27 (23%) in highPBS group. Overall, mean age was 52.69y with 66% male and 53% Hispanic. Comorbidities were similar based on CCI (highPBS 4 (1-5) vs lowPBS 3 (1-5); $P = 0.5198$), except for higher proportion of diabetes (37% vs 22%; $P = 0.1342$) and significantly lower proportion of immunocompromised state (11% vs 32%; $P = 0.0331$) in highPBS group. Most common source of SP-BSI was pneumonia (highPBS 67% vs lowPBS 68%). highPBS group had significantly more patients admitted to ICU vs lowPBS group (93% vs 40%; $P < 0.0001$) Most commonly utilized empiric therapy was ceftriaxone (highPBS 67% vs lowPBS 71%; $P = 0.6343$) . 30-day mortality was significantly higher (44% vs 19%; $P = 0.0063$) and LOS was significantly longer (19.5d (IQR 8.5-31.75) vs 6d (IQR 5-11); $P = 0.0005$) in highPBS group compared with lowPBS group.

Conclusion: In patients with SP-BSI, highPBS group had numerically higher proportion of diabetes but significantly lower proportion of immnocompromised state. highPBS was associated with worse clinical outcomes assessed by 30d mortality rate and LOS.

176 | A descriptive analysis of patients diagnosed with COVID-19 and co-infection in detroit during the early pandemic

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Introduction: Coronavirus disease 2019 (COVID-19) is responsible for a global pandemic. A concern with COVID-19 are co-infections. Studies have reported between 5.8-8.1% of COVID-19 patients having documented co-infection(s); however, no study has reported the prevalence of co-infections during the early pandemic in Detroit, one of the first "hot spots." While the number of patients with COVID-19 and co-infections is low, there is limited to no information on the

impact of acquiring these virulent and/or multidrug-resistant (MDR) pathogens.

Research Question or Hypothesis: Investigate the prevalence of co-infections in the early pandemic in patients diagnosed with COVID-19 in Detroit.

Study Design: Single-center, retrospective, descriptive study.

Methods: All adult patients diagnosed with COVID-19 and admitted to Medical Center were screened from March to April 2020. Any patients with a documented co-infection with any pathogen were included. Descriptive statistics were utilized for analysis.

Results: A total of 309 COVID-19 patients were screened, and 45 (14.6%) were found to have ≥1 co-infection (thus, total percentage > 100%; bacterial: 88.9%, fungal: 11.1%, viral: 8.9%). The majority of patients were male (62.2%) and African American (75.6%), while median age and weight were 67 (57-74) years and 85.0 (72.7-104.5) kg, respectively. Of the 40 (88.9%) patients with a bacterial co-infection, 9 (22.5%) were infected with multiple bacteria, and 3 (7.5%) also had fungal and viral 1 (2.5%) co-infections. The majority of bacterial co-infections included *Pseudomonas aeruginosa*(15.0%), *Staphylococcus aureus*(12.5%), and *Enterococcus faecalis*(10.0%). Three (6.7%) and 2 (4.4%) patients had *Candida albicans* and *Candida glabrata*, respectively, and 3 (6.7%) patients had influenza. The pathogens were cultured from the blood (46.7%), sputum and/or bronchoalveolar lavage (42.2%), or urine (11.1%).

Conclusion: Patients with COVID-19 and documented co-infections were more prevalent in Detroit compared to previous studies. Further studies should be conducted to efficiently identify the presence and impact of co-infections in patients diagnosed with COVID-19 to optimize patient outcomes.

177 | Comparative accuracy of COVID-19 qualitative rapid tests and quantitative molecular assays

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Introduction: Coronavirus Disease 2019 (COVID-19) is transmitted at an exceptionally high rate with a much higher mortality rate than the seasonal influenza. It is difficult for the mildly symptomatic or asymptomatic patients to know when to quarantine as the evidence suggest that patients are most contagious before symptoms. Testing is at the forefront of combating COVID-19 but it is difficult to find a fast and reliable test that does not require sophisticated laboratories.

Research Question or Hypothesis: How accurate are the current COVID-19 qualitative rapid tests in detecting the virus compared to the quantitative molecular assays?

Study Design: Literature Review

Methods: This literature review compares eight different rapid (minutes/hours) real time reverse transcription-polymerase chain reaction (RT-PCR) or antigen tests with laboratory-controlled RT-PCR quantitative assays (days) to determine positive predictive agreement (PPA) and negative predictive agreement (NPA) through studies found on PubMed using keywords. The laboratory-controlled RT-PCR tests were used as a reference because of their quantitative accurate approach. The RT-PCR-based Abbott ID NOW® was the most featured rapid test because it is used at several rapid testing sites.

Results: Over 1300 tests conducted with the Abbott ID NOW® showed 78.7% PPA and almost 100% NPA with an average test time of 13 minutes. The Cepheid Xpert Xpress®, another RT-PCR-based rapid qualitative test, had a much higher PPA of 98% but had only 96% NPA with 45-minute test time. Among the antigen tests, the immunofluorescence-based Bioeasy test had the most accuracy with 93.9% PPA and 100% NPA but the median cycle threshold was 17.1.

Conclusion: With the most commonly used rapid test having <80% PPA, there is room for improvement in COVID-19 point-of-care testing; however, other rapid tests have the drawbacks of longer wait time or inability to detect low viral load. Thus, patients receiving a negative result on a rapid COVID-19 test, may follow-up with a quantitative test to confirm.

178 | Impact of discordant results for *Candida* species between BioFire FilmArray blood culture identification panel and conventional blood cultures

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Introduction: Discordance between rapid diagnostic technology (RDT) and conventional culture results may challenge clinical decision making in bloodstream infections (BSI).

Research Question or Hypothesis: What is the impact of discordance among *Candida* species between BioFire® FilmArray Blood Culture Identification panel (BCID) and conventional blood culture results on patient outcomes?

Study Design: Multi-center, retrospective cohort study

Methods: Hospitalized adults with positive BCID for *Candida* species between October 2014 and July 2019 were included. Patients who died within 48 hours of index blood cultures were excluded. Discordance was considered a positive BCID result for *Candida* spp. followed by a negative blood culture. The primary composite endpoint was 90-day occurrence of mortality, hospital readmission, recurrence of infection, and/or infectious sequelae compared between patients with concordant and discordant results. Data were analyzed using chi-square tests for categorical data and Mann-Whitney U tests for continuous data.

Results: A total of 161 patients with positive BCID for *Candida* species were identified, including 43 (27%) with discordant blood culture results. Overall, median age was 61 years, 73 (45%) were men, and 21 (13%) had an immune compromising condition. Among patients with discordant results, 42 (98%) had a polymicrobial BSI and 19 (44%) had no identifiable candidemia risk factors. The primary composite endpoint occurred in 63 (53%) and 24 (56%) patients in the concordant and discordant groups, respectively (P = 0.78). In the discordant group only, a non-significant increase in 90-day mortality was observed in patients treated for <48 hours compared to those who received >48 hours of antifungal therapy [6/16 (38%) vs 6/27 (22%); P = 0.38].

Conclusion: Discordance was relatively common between BCID and blood culture results for *Candida* spp. The composite clinical outcome was comparable between patients with concordant and discordant results. The role of antifungal therapy in patients with discordant results should be examined in future larger studies.

179 | Bezlotoxumab compared with fecal microbiota transplantation for prevention of recurrent *Clostridioides difficile* infection

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Introduction: Bezlotoxumab is a monoclonal antibody approved for the prevention of recurrent *Clostridioides difficile* infection (CDI). Risk of recurrence increases with each CDI episode, which makes bezlotoxumab a promising option to prevent recurrence when used in conjunction with standard of care treatment.

Research Question or Hypothesis: How does bezlotoxumab compare with fecal microbiota transplantation (FMT) for preventing CDI recurrence?

Study Design: A retrospective chart review of 21 patients who received bezlotoxumab or FMT at an academic medical center

Methods: Patients who received bezlotoxumab were time-matched in a 1:2 ratio to patients who received FMT between 2017 and 2019. Data related to CDI history, recurrence risk factors, and clinical outcomes were collected.

Results: Overall, severe disease was less in the bezlotoxumab group (42.6% versus 57.1%) but more were immunocompromised than the FMT group (42.8% versus 35.7%). Bezlotoxumab was used earlier in disease course than FMT with 26.8% receiving bezlotoxumab versus 7.1% receiving FMT for first recurrence but 71.4% versus 85.7% for second recurrence respectively. Recurrence within 3 months of treatment were lower overall with bezlotoxumab than with FMT (14.3% versus 28.6%). Clinical cure was achieved in 85.7% of bezlotoxumab patients and 50% of FMT patients.

Results	FMT (n = 14)	Bezlotoxumab (n = 7)	*P*-value
CDI characteristic			
Risk factors for recurrence			
0	1 (7.1%)	1 (14.3%)	1
1	2 (14.3%)	1 (14.3%)	1
2	6 (42.9%)	1 (14.3%)	0.34
≥3	5 (35.7%)	4 (57.1%)	0.40
Initial episode	1 (7.1%)	0	1
1st recurrence	1 (7.1%)	2 (28.6%)	0.25
2nd or more recurrence	12 (85.7%)	5 (71.4%)	0.57
Outcomes			
Recurrence within 3 months	4 (28.6%)	1 (14.3%)	0.62
Clinical cure	7 (50%)	6 (85.7%)	0.17

Conclusion: This small retrospective chart review suggests that bezlotoxumab is comparable to FMT for preventing CDI recurrence. Future prospective studies should be undertaken to confirm these findings.

180 | Opportunity for vancomycin laboratory stewardship for patients admitted with uncomplicated acute bacterial skin and soft structure infections

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Introduction: Laboratory stewardship through appropriate therapeutic drug monitoring (TDM) can impact health-system finances by decreasing unnecessary blood draws and pharmacist time interpreting levels. Trough monitoring recommendations for vancomycin therapy durations <5 days are based on expert opinion for patients with uncomplicated acute bacterial skin and soft structure infections (uABSSSI).

Research Question or Hypothesis: Does monitoring vancomycin levels to ascertain if the level is therapeutic impact vancomycin therapy duration in patients with uABSSSI?

Study Design: Retrospective cohort review

Methods: Adult general medicine patients with uABSSSI who received scheduled vancomycin for <5 days with a trough level (before 3rd or 4th dose) from 1/1/2016-12/31/18 were reviewed. Patients were grouped by subtherapeutic (ST;<10 mg/L) and therapeutic troughs (TT; ≥10 mg/L). The primary outcome was vancomycin therapy duration. Secondary outcomes included hospital length of stay and initial and final serum creatinine (SCr).

Results: Fifty-eight patients were included (n = 38 ST, n = 19 TT). The initial mean vancomycin level (mg/L) for ST was 6.96 (range 2.7-9.9) compared to 12.8 (range 10.2-17.9) for TT. The median vancomycin therapy duration (hours) was non-significantly (*P*-value = 0.4215) lower with ST (48.25, IQR 39-65.5) than TT (59.5, IQR 47.5-67.25). The median hospital length of stay (days) was similar for ST (3, IQR 3-4.5) and TT (4, IQR 3-4; *P*-value = 0.8381). Initial and final mean SCr were similar for ST (0.82 and 0.71 mg/dL) and TT (0.82 and 0.70 mg/dL, respectively).

Conclusion: There were similar vancomycin durations of therapy and hospital lengths of stay regardless of actual vancomycin level for patients with uABSSSI. Opportunities for laboratory stewardship exist to curb potentially unnecessary vancomycin levels which may lead to decreased direct and indirect costs.

Medication safety

181 | Development of a specialty medication clinical dashboard to improve tumor necrosis factor-alpha inhibitor safety and adherence monitoring

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Introduction: The high risk, expense, and complexity of specialty medications has made managing these medications increasingly challenging for clinicians. Amongst them, tumor necrosis factor-alpha (TNF-α) inhibitors are the most commonly prescribed class of biologics for chronic inflammatory conditions.

Research Question or Hypothesis: What is the clinical utility of a real-time clinical dashboard to assess TNF-α inhibitor safety and adherence?

Study Design: A quantitative cross-sectional study within a VA health care system

Methods: The dashboard was designed and developed in collaboration between clinical pharmacists and specialty clinic providers in rheumatology, gastroenterology, and dermatology. Patients with an active prescription for an FDA-approved TNF-α (adalimumab, certolizumab, etanercept, golimumab, or infliximab) were included. Patients with prescriptions written by non-VA providers were excluded. Dashboard criteria flagged patients for new infection, heart failure exacerbation, new malignancy, overdue and critical lab results, concurrent biologic use, high treatment doses, non-adherence, emergency department visits, and inpatient admission. The primary outcome was the number of potential pharmacist interventions. Descriptive statistics were utilized for all assessments.

Results: A total of 223 of 431 patients on TNF-α inhibitor therapy were flagged through the dashboard. These flags included new infection (3%), overdue labs (9%), critical labs (5%), on 2 biologic agents (2%), non-adherence (27%), emergency department visit (6%), and inpatient admission (2%). No patients were flagged for heart failure exacerbation or new malignancy. In addition, 5% of patients were prescribed etanercept at frequency greater than once weekly and 12% of patients were prescribed adalimumab at frequency greater than once every other week. This represented a potential annual cost savings of $302,497 if 50% of patients were successfully dose-reduced to label dosing.

Conclusion: Pharmacists have an opportunity to improve monitoring of TNF-α inhibitor for safety and adherence using a clinical specialty medication dashboard. The dashboard should be used in conjunction with collaborative practice protocols to increase impact on clinical practice.

182 | Evaluation of hypoglycemic events and complications in treating diabetic ketoacidosis and hyperosmolar hyperglycemic syndrome for patients with impaired renal function

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Introduction: Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic syndrome (HHS) are severe metabolic complications of diabetes that require correction with insulin infusions. The kidneys play a pivotal role in clearance and degradation of insulin; however, there is scarce evidence in managing insulin for these patients with impaired renal function.

Research Question or Hypothesis: Is there a difference in hypoglycemic events in patients with DKA or HHS treated with insulin infusions when comparing those with preserved and impaired renal function?

Study Design: Retrospective cohort study

Methods: Patients 18 years of age or older who received treatment for DKA or HHS with an insulin infusion for at least one hour between 9/18/2018 – 6/30/2019 were included. The primary outcome was the difference in hypoglycemic events in patients with preserved compared to impaired renal function, defined as eGFR <60 mL/min/1.73m^2. Secondary outcomes included incidence of hypoglycemia in patients with different stages of chronic kidney disease (CKD) as well as any complications with treatment. Chi-square or Fisher's exact test were used for evaluating categorical data and an unpaired t-test was used for continuous data.

Results: One hundred eighty-five patients were included; 120 with preserved renal function and 65 with impaired renal function. No difference was seen in the incidence of hypoglycemia between patients with preserved and impaired renal function (15.8% vs. 24.6%, respectively; *P* = 0.1701). There continued to be no statistical difference when performing sub-analyses based upon stage of CKD. Patients

with impaired renal function had a greater incidence of potassium disturbances (32.3% vs. 17.5%; $P = 0.0017$), median number of days in the hospital (5 vs. 3 days; $P < 0.001$), and mortality rate (7.7% vs. 0%; $P = 0.005$).

Conclusion: There was no difference in the incidence of hypoglycemia between groups; however, patients with impaired renal function had more complications associated with treatment. The treatment of DKA and HHS in patients with renal insufficiency may require stricter monitoring.

183 | Influence of electronic ordering on medication errors in an investigational drug service

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Introduction: Standardized safety practices in an Investigational Drug Service (IDS) is limited. Medication prescribing through a computerized provider order entry system has been shown to decrease medication errors for conventional dispensing, but its effect in the setting of an IDS has not been studied.

Research Question or Hypothesis: Does conversion to electronic ordering for investigational medications reduce the incidence of medication errors during the ordering process?

Study Design: Retrospective review of medication error reports within an IDS at a VA medical center

Methods: The study site's IDS converted to electronic ordering for new and ongoing outpatient studies in the fall of 2018. Study protocols and dispensing records for all outpatient investigational drug studies were reviewed for the time period of January 1, 2018 to June 30, 2018 (pre-intervention) and January 1, 2019 to June 30, 2019 (post-intervention). The primary endpoint was the incidence of medication errors documented during each time period. Categorization of errors and protocol therapeutic area in both time periods were collected as secondary endpoints. Descriptive statistics were utilized for all assessments.

Results: A total of 8 unique protocols and 362 dispensations were recorded during the pre-intervention time period and 6 unique protocols and 171 dispensations were recorded during the post-intervention time period. During each time period, a total of 22 (6.1%) and 7 (4.1%) medication errors were recorded, respectively. This represents a 33% relative risk reduction. The most common medication error categorization was missing allergy assessment (n = 7) in the pre-intervention time period and incorrect quantity (n = 3) in the post-intervention time period. During both time periods, mental health protocols were the most commonly dispensed therapeutic area and had the highest incidence of medication errors.

Conclusion: There was a decrease in the incidence of documented medication errors in the IDS after conversion to electronic ordering. Additional assessment is necessary to further decrease the potential for errors with electronic ordering.

184 | Impact of a pharmacist-led medication history program at a community hospital emergency department

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Introduction: It is crucial to obtain an accurate medication use history (MH) in the emergency department (ED), because erroneous MH can cause inappropriate medication use during hospitalization and adversely affect the patient safety. However, little is known regarding the medication errors identified by pharmacists in ED, when for the same patient MH was conducted in a recent past by another provider.

Research Question or Hypothesis: What are the types and severity of medication errors identified by pharmacists at a hospital ED, when for the same patient MH was conducted 14-days prior by another healthcare provider?

Study Design: Descriptive Study

Methods: Pharmacists conducted MH with patients presenting to the Yavapai Regional Medical Center (YRMC) ED between 03/14/2018 and 06/20/2018. The YRMC and affiliated clinics share a common electronic health records system, including medication information. The MH data obtained by a pharmacist at the YRMC ED were included in this study for patients whose MH was previously obtained by another provider at a YRMC location within 14 days. The types and severity of medication errors were recorded, and descriptive statistics was used to analyze the parametric data.

Results: Pharmacists reviewed 4094 medications for 316 patients and identified total 2554 medication errors, from which 1692, 298 and 564 were mild, moderate and severe errors, respectively. The number of most common error types were: 615 drug-drug interactions, 547 drug omissions, 481 drug commissions, 415 wrong frequencies and 367 incorrect doses. The pharmacists identified 8.2, 9.8 and 7.6 medication errors per patient, whose MH was conducted 14-days prior by physicians, mid-level practitioners or non-mid-level practitioners, respectively.

Conclusion: The pharmacists-led MH program identified a number of medication errors at the hospital admission for patients whose medication history was recently obtained by a non-pharmacist provider. These findings support greater involvement of pharmacists for conducting MH in the hospital ED.

Nephrology

185 | Effect of subacute kidney injury on blood pressure in patients with chronic kidney disease and hypertension

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Introduction: Acute kidney injury is a complication that often requires discontinuation of essential antihypertensive medications. In patients with chronic kidney disease (CKD), these adjustments can impair renal sodium handling and fluid homeostasis, worsening hypertension.

Research Question or Hypothesis: In CKD patients with hypertension, we hypothesized that patients who experienced subacute kidney injury (sAKI) achieve less blood pressure (BP) reduction compared to patients without sAKI.

Study Design: A retrospective analysis was performed on N = 39 CKD patients from a pharmacist-led hypertension clinic.

Methods: Through electronic medical record review, 20 of the 39 patients met criteria for sAKI (increase in serum creatinine >0.3 mg/dL occurring over 7-90 days). Pharmacist-led hypertension intervention at intervals of 4-12 weeks was provided using patient reported home BPs. Differences between the initial and current BP values were calculated. Effort to control BP over time was calculated by dividing BP change by the number of visits in clinic and medication changes.

Results: Mean ± standard error baseline systolic blood pressures were similar in patients who experienced sAKI (151 ± 3) compared to those with no kidney injury (146 ± 2) (P = 0.21). Mean change in systolic BP during treatment was -15 ± 4 mm Hg in sAKI group compared to -17 ± 2 mm Hg in patients without kidney injury (P = 0.45). However, when duration of follow-up and number of medication changes were accounted for, reduction in SBP was less per visit (-2.0 ± 0.4 vs -3.1 ± 0.4) mm Hg Hg/visit (P = 0.04)) and less per BP medication change (-4.0 ± 1.1 vs -6.8 ± 1.6 mm Hg/change (P = 0.03)) for patients with sAKI compared to those without sAKI, respectively.

Conclusion: In a small sample of patients with CKD and hypertension, equally effective BP lowering was achieved in patients with and without sAKI. Likely due to concerns for harm, sAKI necessitated more follow up visits and medication changes to achieve comparable control.

186 | Optimal extended-infusion dosing of ceftazidime in critically ill patients receiving continuous renal replacement therapy with varying effluent rates

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Introduction: Ceftazidime efficacy correlates with the percentage of time during a dosing interval that free serum concentrations exceed the minimum inhibitor concentration (%fT > MIC) with maximal bactericidal effect occurring at free concentrations 4 times the MIC. Extended-infusion can maximize this pharmacodynamic target attainment yet data is limited to determine the optimal ceftazidime extended-infusion dosing regimens for patients receiving continuous renal replacement therapy (CRRT) with different effluent rates.

Research Question or Hypothesis: What are the optimal ceftazidime extended-infusion dosing regimens in critically ill patients receiving CRRT with different effluent rates?

Study Design: Prospective *in-silico* study using Monte Carlo simulation

Methods: A 5,000 virtual patient cohort receiving CRRT with three effluent rates (e.g. 20, 30, and 45 mL/kg/h) was modeled using published pertinent demographic/pharmacokinetic data. Four ceftazidime dosing regimens (e.g. 2 g loading dose (LD) then 1-2 g every 8-12 hours) infused over 4-hours were simulated to predict probability of target attainment (PTA) with target of ≥60% fT > 4xMIC of 8 mg/L. Optimal dosing was defined as the one attaining ≥90% PTA during the initial 48 hours of therapy. Additionally, the regimens were assessed for toxicity risk at 48 hours using the suggested toxicity threshold concentrations of >100 mg/L.

Results: Ceftazidime 2 g LD then 2 g every 8 hours infused over 4-hours attained ≥90% of PTA in patients receiving CRRT with effluent rates of 20 and 30 mL/kg/h while no simulated regimens achieved the desired PTA in CRRT with the effluent rate of 45 mL/kg/h. The percentage of those with >100 mg/L at 48 hours of ceftazidime therapy was 10%, 0.8% and 0% in effluent rate of 20, 30, and 40 mL/kg/h respectively.

Conclusion: MCS predicted that even with extended-infusion, the highest ceftazidime conventional dose is necessary to attain pharmacodynamic target successfully in most patients receiving conventional CRRT. Utilization of higher effluent rates may need higher ceftazidime doses than maximal usual doses.

187 | Impact of fluid administration on acute kidney injury with combination vancomycin and piperacillin/tazobactam

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Introduction: The combination of vancomycin and piperacillin/tazobactam (VPT) is associated with an increased risk of acute kidney injury (AKI) in critically ill patients. The mechanism by which this occurs is unknown, but experimental data indicate cast nephropathy and intratubular obstruction may play a role. Intravenous fluid administration mitigates these processes with other antibiotics (acyclovir) and may be useful to prevent AKI from VPT.

Research Question or Hypothesis: The administration of intravenous fluids prior to and during VPT will decrease the incidence of AKI in critically ill adults.
Study Design: Retrospective, multi-center, cohort study
Methods: Adult critically patients that received VPT for at least 72 hours were eligible. Exclusion criteria were: AKI on admission, history of chronic kidney disease, and creatinine clearance below 30 ml/min. AKI was defined by the KDIGO criteria. Intravenous fluid type (isotonic, hypotonic, balanced, albumin) and amount were characterized 24 hours before and for the duration of VPT administration. Appropriate descriptive and inferential statistics were used (SASv9.4).
Results: The study included 132 patients that were 65.2 ± 14.3 years old, 48.5% female, with a body mass index of 28.8 ± 8.1 kg/m^2 and an APACHE-II score of 19.6 ± 6.7. The incidence of AKI was 25.0%, with 16 stage 1, 9 stage 2, and 8 stage 3 AKI per KDIGO severity criteria. Patients with AKI received 5,927 ± 3,075 mL of fluids before and during VPT compared to 8,353 ± 4,962 mL in patients without AKI (mean difference 2,626 mL; 95%CI: 1,172-4,079 mL; P = 0.0097). There was no difference in the type of fluid administered between patients that developed AKI and those without AKI (P = 0.269). On multivariable logistic regression, every 1,000 mL increment of fluids administered was associated with an adjusted odds ratio of 0.90 (95% CI: 0.82-0.98) for AKI.
Conclusion: Increased fluid administration before and during VPT was associated with a lower risk of AKI in critically ill adults. Validation in a controlled prospective study is needed to address confounding in this observational study.

188 | Monte Carlo simulation to determine optimal extended-infusion cefepime dosing in continuous renal replacement therapy with varying effluent rates

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Introduction: Extended-infusion cefepime can improve outcome in the treatment of serious infections with *Pseudomonas aeruginosa*. However, optimal cefepime extended-infusion dosing regimens in patients receiving continuous renal replacement therapy (CRRT) with varying effluent rates are unknown.
Research Question or Hypothesis: What are the optimal cefepime extended-infusion dosing regimens in critically ill patients receiving CRRT with varying effluent rates?
Study Design: Prospective in-silico study with Monte Carlo simulation
Methods: Published relevant pharmacokinetic/demographic data was used to construct 5,000 virtual critically ill patients receiving cefepime and CRRT. Simulations were performed to predict drug exposure from four conventional cefepime dosing regimens (2-gram loading dose (LD) followed by 1-2 gram every 8-12 hours) given over 4-hours in CRRT at effluent rates of 20, 30, and 45 mL/kg/hr. The pharmacodynamic target was attaining free serum concentration above four times of the minimum inhibitory concentration of 8 mg/L for ≥60% of the initial 48 hours. The dose achieving ≧90% of probability of target attainment (PTA) was considered optimal. Drug toxicity risk was also surveyed using the reported toxicity threshold of >70 mg/L at 48 hours of therapy.
Results: The highest simulated dosing regimen (2-gram LD, then 2-gram every 8 hours over 4 hours) was required to attain ≧90% PTA in CRRT at effluent rate of 20 mL/kg/hr but increased the risk of drug toxicity in 22% of patients. In CRRT with effluent rates of 30 and 45 mL/kg/hr, this cefepime dose achieved only 89% and 67% PTA respectively.
Conclusion: MCS predicts that varying CRRT effluent rates alter optimal extended-infusion cefepime doses. Cefepime 2-gram LD then 2-gram every 8 hour over 4-hours would be optimal in patients receiving CRRT at effluent rates of 20-30 mL/kg/hr, but higher doses would be necessary when higher effluent rates are utilized. These findings should be validated in the clinical settings.

Nutrition

189 | Effects of early versus delayed advancement of parenteral nutrition rate on electrolytes imbalances and refeeding syndrome

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Introduction: Early advancement of parenteral nutrition (PN) to goal rate could provide adequate nutrition to malnourished patients; however, some clinicians are concerned this may precipitate refeeding syndrome (RS). There is a dearth of research that systematically compared early versus delayed advancement of PN rate. This study examined effects of early versus delayed advancement of PN rate on development of RS.
Research Question or Hypothesis: Does early advancement of PN rate causes electrolyte imbalances and RS development in more patients compared with the delayed advancement?
Study Design: Retrospective cohort study
Methods: Chart reviews were conducted for 60 patients who received PN at Yavapai Regional Medical Center from 01/01/2017 to 05/31/2018. Two groups were created: patients that received PN with an early (n = 30) or delayed (n = 30) advancement to the goal rate. Chi-square tests were conducted to evaluate whether proportions of patients with hypokalemia, hypophosphatemia,

hyperglycemia, hypomagnesemia or hypoalbuminemia differed between groups. T-tests were conducted to compare groups for demographics and PN-related variables.

Results: No significant differences were detected between groups for average age, length-of-stay, PN duration, and fluid rates (t[51] > 0.78, $P > 0.09$), and no patient experienced RS. The average time for PN rate advancement was significantly lower in the early-advancement group (13.3 ± 2.5 hours) than in the delayed-advancement group (44.7 ± 4.3 hours; t[51] = 6.36, $P = 0.00000018$). The proportion of patients with hypokalemia, hypophosphatemia, hyperglycemia or hypomagnesemia did not significantly differ between groups (X2 [1, 60] < 2.07, $P > 0.15$); however, fewer patients in the early-advancement group had hypoalbuminemia than in the delayed-advancement group (X2[1, 57] = 6.48, $P = 0.01$).

Conclusion: The findings indicate that early advancement of PN rate did not cause RS in more patients than in the delayed advancement group. The fewer patients with hypoalbuminemia with early-advancement of PN rate indicates that it provided adequate nutrition compared with the delayed-rate-advancement.

Oncology

190 | Preventing chemotherapy-induced peripheral neuropathy using cryotherapy in breast cancer patients receiving paclitaxel: A randomized, controlled trial

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Introduction: Up to 77% of patients receiving paclitaxel experience chemotherapy-induced peripheral neuropathy (CIPN), leading to treatment disruptions and reduced quality of life. Currently there is a lack of prevention for CIPN in clinical practice, and cryotherapy is emerging as a potential non-pharmacological strategy. We postulate that cold-induced vasoconstriction limits the exposure of distal epithelial nerves to paclitaxel, thus preventing CIPN.

Research Question or Hypothesis: Cryotherapy is an effective preventive strategy for CIPN among breast cancer patients receiving weekly paclitaxel.

Study Design: This study was an open-labelled, randomized controlled trial.

Methods: Patients were recruited from the National Cancer Centre Singapore and randomized (1:1) to either the cryotherapy or control arm. Cryotherapy was applied as frozen gloves and slippers, starting 15 minutes before paclitaxel until 15 minutes post-infusion. The primary endpoint was the proportion of subjects reporting Patient Neurotoxicity Questionnaire (PNQ) grade C-E symptoms within two weeks post-treatment. Secondary outcomes include EORTC QLQ-CIPN20 and tolerance to cryotherapy. Fisher's exact test was performed to compare proportions of nominal data. Linear regression was used for analysis of continuous data. All statistical tests were two-sided and $P < 0.05$ was considered statistically significant. Stata/SE version 16.0 was used to execute all statistical analyses.

Results: 46 patients were recruited, with 38 providing evaluable data. No difference was observed two weeks after treatment in all outcome measures. At 3 months post-paclitaxel, fewer cryotherapy subjects reported severe motor symptoms compared to control based on PNQ (0% vs 29.4%, $P = 0.012$), although the difference was not significant with CIPN20 motor score (β = -7.27, 95%CI = -14.56 to 0.04, $P = 0.051$). 80.9% of subjects had cryotherapy temporarily interrupted at least once due to intolerance, with gloves and slippers being removed once per cycle and once every two cycles on average, respectively.

Conclusion: Cryotherapy can reduce CIPN-related motor symptoms, however patients' intolerant to cryotherapy may limit its use in clinical practice. ClinicalTrials.gov: NCT03429972.

191 | PEGylated asparaginase does not impair fatty acid oxidation, increase lipid synthesis, or decrease VLDL secretion in HepG2 cells

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Introduction: Pegylated-asparaginase (PEG-ASNase) is a critical component of acute lymphoblastic leukemia therapy and its use is associated with high- grade adverse drug reactions, including hepatoxic steatosis in 15-20% of adults. Many studies propose PEG-ASNase-induced liver injury is due to defects in liver fatty acid oxidation, fatty acid de-novo synthesis, or very low-density lipoprotein (VLDL) triglyceride secretion.

Research Question or Hypothesis: What is the effect of PEG-ASNase on intracellular triglyceride levels, cell viability, and protein expression of genes involved in fatty acid oxidation and fatty acid synthesis?

Study Design: This in vitro study interrogated the effect of PEG-ASNase on various lipid metabolic proteins in human hepatoma

HepG2 cells by treating cells with various concentrations of PEG-ASNase or vehicle control and collecting cell culture media or preparing cell lysate for protein expression analysis.

Methods: 40,000 HepG2 cells were treated with increasing concentrations of PEG- ASNase for 24 hours to determine dose dependent effects of the drug on cell viability, lipid synthesis, fatty acid oxidation, and/or VLDL secretion. Cell viability was tested using an MTT assay, triglyceride levels were quantified using the Stanbio TG screening assay kit, and protein expression was tested using Western blot analysis.

Results: PEG-ASNase had a dose-dependent cytotoxic effect on HepG2 cells when treated for 24 hours. However, intracellular triglyceride levels were not increased in the PEG-ASNase treated groups. Furthermore, PEG- ASNase treatment downregulated protein expression of de-novo fatty acid synthesis, did not alter the lipid catabolic genes studied, and increased in vitro VLDL secretion.

Conclusion: These data support a hypothesis suggesting abnormal lipid accumulation within the liver of patients treated with PEG-ASNase is not due to increased de-novo synthesis of fatty acid, impairment in mitochondrial fatty acid oxidation, nor decreased VLDL secretion. This sheds light for future research relating to a possible novel mechanism involved in the development of PEG-ASNase induced hepatic steatosis, contradicting current general belief.

192 | Do anti-infectives impact response to checkpoint inhibitor immunotherapy in cancer patients?

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Introduction: Immune-checkpoint inhibitors (ICI) have provided groundbreaking advancements for various cancers. Unfortunately, up to 60% of patients demonstrate primary resistance to ICI. Antibiotics have been recognized as potential negative predictors of ICI anti-tumor activity by reducing intestinal microbiota diversity. Preclinical studies in mice with advanced cancer treated with broad spectrum antibiotics have been associated with resistance to ICI treatment.

Research Question or Hypothesis: Do anti-infective medications impact response to ICI in cancer patients?

Study Design: Retrospective analysis

Methods: Cancer patients receiving ICI were classified as having received anti-infective (AI) therapy within 30 days of ICI initiation or during ICI treatment or no anti-infective (no-AI) treatment. Progression-free survival (PFS), overall survival (OS), and objective response rates (ORR) were measured at 6-months.

Results: 241 cancer patients receiving ICI treatment between 2017 and 2020 were analyzed. 120 patients were included in the AI group and 121 patients in the no-AI group. There was no difference in PFS between patients who received AI versus no-AI (50% vs 59%, $P = 0.40$). There was also no difference in OS (74% vs 79%, $P = 0.42$). In multivariate analysis, performance status, use of beta-lactam antibiotics, and AI use 30 days prior to ICI initiation significantly impacted OS while only performance status impacted PFS. No significant difference was noted between ORR although those who received AI had a lower incidence of complete response (CR) (11% vs 17%, $P = 0.20$) and a higher incidence of progressive disease (PD) (48% vs 40%, $P = 0.35$).

Conclusion: AI therapy does not appear to affect ICI efficacy in cancer patients. Although our results were not statistically significant, we did appreciate a trend towards worse PFS and OS, with more patients demonstrating PD and less patients with CR in the AI group. Caution should be taken to minimize empiric use of anti-infectives to situations of clear or high suspicion of infections.

193 | Retrospective analysis of the effects of proton pump inhibitor use on methotrexate elimination in hospitalized adult oncology patients

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Introduction: High dose methotrexate (HD-MTX) is used for treatment of aggressive lymphomas, osteosarcomas, and leukemias. MTX toxicities including mucositis, myelosuppression and hepatitis may be increased with delayed elimination. Proton pump inhibitors (PPI) are utilized in oncology patients as supportive care, but concurrent use with MTX remains controversial based on prior publications demonstrating variable effects on delayed HD-MTX elimination.

Research Question or Hypothesis: Assess whether or not co-administration of a PPI with HD-MTX (≥1 gm/m2 IV) resulted in delayed elimination of plasma methotrexate at 24 h, 48 h and 72 h.

Study Design: This was a retrospective, cohort, single center study.

Methods: Patient specific data were collected from July 2013-2019; these included age, gender, body surface area, MTX dose, infusion time, PPI administration, serum creatinine, creatinine clearance, plasma MTX levels at 24, 48, 72 hours, time to MTX level < 0.1 μmol/l, urine pH, leucovorin rescue doses and liver function tests. Repeated measures logistic regression was used to assess risk factors for delayed elimination. Factors contributing to the time to non-toxic levels were analyzed using Cox proportional hazards model and adjusted for clustering.

Results: Seventy three patients received a total of 281 cycles. PPIs were co-administered in 21.4% patients (60 cycles). The groups had similar baseline characteristics. The overall incidence of delayed methotrexate elimination was 20% (12 cycles) in patients that received concomitant PPIs and 16.7% (37 cycles) in patients that did not

receive PPIs. Methotrexate levels were not significantly different between groups at 24 (P = 0.689), 48 (P = 0.633), and 72 hours (P = 0.360). Likewise, the incidence of delayed MTX elimination was not significantly different between groups.

Conclusion: Our study suggests there is no association between concomitant PPI use and delayed MTX elimination. The outcomes can be used to validate prior research finding no association in delayed elimination, and help aid clinicians in decision making when a PPI is desired for concomitant use.

194 | A real-world evaluation of radium-223 in combination with abiraterone or enzalutamide for the treatment of metastatic castration-resistant prostate cancer

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Introduction: Radium-223, abiraterone, and enzalutamide have each been shown to significantly improve survival as monotherapy in patients with metastatic castration-resistant prostate cancer (mCRPC). However, effects of concurrent radium-223 plus abiraterone or enzalutamide on survival and safety are still unclear.

Research Question or Hypothesis: Radium-223 in combination with abiraterone or enzalutamide will prolong survival, but will not increase the incidence of serious adverse events (SAEs) compared to radium-223 alone.

Study Design: Single-center retrospective cohort study

Methods: This study used electronic health record data of patients ≥18 years old with mCRPC and bone metastases who were treated with radium-223 from 4/1/2014 to 2/19/2019. Patients who received radium-223 monotherapy were compared to patients who received combination radium-223 plus abiraterone or enzalutamide. The primary endpoint was overall (OS). Secondary endpoints included progression-free survival (PFS), time to symptomatic skeletal-related event (SSE), SSE-free survival, and incidence of drug-related adverse events. Time-to-event analyses were estimated by log rank tests using Kaplan-Meier curves. Hazard ratios and 95% confidence intervals were derived from Cox proportional hazards models. Chi-square tests evaluated differences in SAEs between the two cohorts. $P < 0.05$ was considered significant. All statistical testing was conducted using SAS JMP version 14.0.

Results: A total of 60 patients met inclusion criteria (n = 41 in the monotherapy cohort, n = 19 in the combination cohort). Differences in median OS were not observed (12.7 versus 12.8 months; HR 1.15, 95% CI 0.59-2.23; P = 0.68), but median PFS was significantly longer in the combination cohort (7.6 versus 4.9 months; HR 1.94, 95% CI 1.11-3.40; P = 0.02). Significant differences were not observed in time to first SSE (P = 0.97), SSE-free survival (P = 0.16), or in the overall incidence of SAEs (P = 0.45).

Conclusion: Compared to radium-223 monotherapy, combination radium-223 plus abiraterone or enzalutamide did not improve OS, but prolonged PFS without increasing the incidence of serious adverse events in mCRPC patients with bone metastases.

195 | Evaluation of a pharmacist-driven rapid infusion rituximab conversion protocol at a multisite cancer center

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Introduction: Infusion-related reactions (IRR) are a common adverse event associated with rituximab, an anti-CD20 monoclonal antibody indicated for the treatment of B-cell lymphomas. IRR risk is highest with the first infusion, which is given by a slow titration over an average of 3.5 hours. Subsequent administrations can be given over an accelerated, rapid 90-minute infusion if patients meet specific criteria. To improve rapid infusion rituximab (RIR) utilization, we developed and implemented a pharmacist-driven protocol to allow pharmacists to convert patients to RIR.

Research Question or Hypothesis: What is the impact of a pharmacist-driven RIR conversion protocol on the utilization of RIR at a multisite cancer center?

Study Design: Retrospective chart review.

Methods: Patients ≥18 years with B-cell lymphoma eligible to receive RIR following protocol implementation were included and compared to historical, pre-protocol controls. The primary outcome was the prevalence of the use of RIR for eligible patients. Secondary outcomes included the frequency of pharmacist-initiated conversions to RIR and incidence of IRR with rapid infusions.

Results: A total of 180 patients were included in this study; 89 patients in the pre-protocol group and 91 patients in the post-protocol group. A total of 246 and 271 rituximab doses were administered in the pre-protocol and post-protocol study timeframe, respectively, that were deemed eligible for rapid infusion. Twenty-eight rituximab doses in the pre-protocol group and 180 doses in the post-protocol group were administered via rapid infusion (11% vs. 66%; $P < 0.00001$). Fifteen patients and 66 patients in the pre-protocol and post-protocol groups, respectively, received RIR (17% vs. 73%, $P < 0.00001$). The pharmacist-driven protocol was used to convert 49 patients (54%) to rapid infusion. No IRR occurred in patients receiving RIR.

Conclusion: The implementation of a pharmacist-driven protocol led to a significant improvement in the utilization of RIR at our institution.

196 | Identification of clinical risk factors for post-transplant cyclophosphamide-related cardiotoxicity

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Introduction: Post-transplant cyclophosphamide (PTCy) is utilized in allogeneic hematopoietic stem cell transplantation (HSCT) to prevent graft-versus-host disease (GVHD). High doses of cyclophosphamide (> 50 mg/kg) have been associated with an increased risk of cardiotoxicity, yet there is minimal data regarding PTCy related cardiotoxicity.

Research Question or Hypothesis: What are the incidence and risk factors associated with PTCy-induced cardiotoxicity?

Study Design: A retrospective observational case control study was performed in 134 patients who underwent allogeneic HSCT between March 2014 and August 2018.

Methods: Cardiotoxicity was defined as an increase in brain natriuretic peptide, cardiac arrhythmias, pericardial effusions, or heart failure documented by LVEF decline of at least 10% to <55%. Patients were also evaluated for baseline relevant cardiac comorbidities. Kaplan-Meier method was utilized to estimate the probabilities of one-year survival, and the differences between patients with and without cardiotoxicity were assessed via a log-rank test. Univariable and multivariable logistic regression models were performed to evaluate risk factors for the development of cardiotoxicity.

Results: The overall incidence of cardiotoxicity was 15.7% at 30 days, 18.7% at 60 days, and 20.9% at 90 days. Older age was significantly associated with risk of cardiotoxicity at 90 days after PTCy (OR 1.03, 95% CI 1.00 – 1.07, P = 0.038). Age and previous exposure to cardiotoxic chemotherapy were significantly associated with PTCy-related cardiotoxicity within 90 days of PTCy (P = 0.010, 0.046 respectively). Among 28 patients developing cardiotoxicity, cardiotoxicity resolved in 7 patients with median time to resolution of 44 days (range 4 - 425).

Conclusion: The overall incidence of PTCy-induced cardiomyopathy was 20.9%, which is consistent with previous reports. Age and previous exposure to cardiotoxic chemotherapy were the only risk factors that were found to be statistically significant. This study provides data to support utilizing PTCy in patients despite comorbidities or existing cardiomyopathy.

197 | Publication rates of hematology/oncology abstracts presented at major pharmacy association meetings

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Introduction: Professional conferences are where research findings are initially presented. Studies suggest many research ideas presented at conferences are never published. Previous studies have demonstrated that the full publication rate of abstracts presented at pharmacy meetings is approximately 20%.

Research Question or Hypothesis: What are the publication rates among hematology/oncology abstracts presented at major pharmacy organization annual meetings?

Study Design: Systematic review of abstracts presented at professional pharmacy meetings over the course of 5 years.

Methods: A systematic search of PubMed and Google Scholar was performed. Publication status was evaluated for hematology/oncology abstracts presented at annual meetings for the following organizations: Hematology/Oncology Pharmacy Association Annual Meeting, International Society of Oncology Pharmacy Practitioners Annual Meeting, American College of Clinical Pharmacy Annual Meeting, and American Society of Health-System Pharmacists Midyear Clinical Meeting. Data collected included the meeting of abstract presentation, number of authors, abstract study type, country of origin, journal of publication, and type of publication. Abstracts presented as trainee research were excluded.

Results: Of 451 oncology abstracts evaluated, the most common topic categories included pharmacotherapy (n = 244; 54.1%), clinical pharmacy practice (n = 84; 18.6%), and operational/compounding (n = 69; 15.3%). The overall publication rate was 17.5% (n = 79). Abstracts were published as full manuscripts over a spread of 48 different journals. The most common journals of publication included Journal of Oncology Pharmacy Practice (n = 16) and Supportive Care in Cancer (n = 4). Factors associated with full publication included abstracts with more than 5 authors (OR 2.87, 95% CI 1.76-4.69; P < 0.001) and abstracts presented at oncology-focused pharmacy meetings (OR 2.32, 95% CI 1.19-4.53; P = 0.014).

Conclusion: This study showed an overall publication rate of 17.5% for abstracts presented at pharmacy meetings, consistent with prior studies. Factors associated with higher publication rates of abstracts presented at pharmacy meetings included having more than 5 authors and presentation at an oncology-focused pharmacy meeting.

198 | Factors associated with initiation of oral antineoplastic therapies in an urban academic medical center

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Introduction: Limited information exists surrounding the potential barriers that may contribute to delays in receipt of oral antineoplastic therapy that may impact our patients.

Research Question or Hypothesis: To identify barriers within our patient population affecting time to initiation of oral antineoplastic therapy in hopes to address these gaps moving forward.

Study Design: Single-center, retrospective chart review

Methods: Adult patients, above 18 years of age, with a diagnosis of cancer, treated by physicians at an urban academic medical center were included if they were prescribed an oral antineoplastic agent from June 2018 to January of 2020. Prescriptions that were initially sent to our institution's preferred Specialty Pharmacy were specifically evaluated. The primary endpoint was to determine the proportion of patients with the following barriers leading potentially to delays in initiation: costs/financial burden, pharmacy processing delays, issues with insurance, insurance denial, delays in contacting patient/ caregiver, delays in delivery, in-network pharmacy required, and/or prescription inadvertently sent to non-specialty pharmacy. Secondary endpoints included assessing the time involved in the initial processing of the oral antineoplastic prescription (date prescription generated to the date prescription filled). Descriptive statistics were used to analyze the endpoints.

Results: A total of 105 patients were reviewed. A majority of these patients were African American around the age of 66, with the following primary malignancies: prostate, breast, colon/rectal, hepatobiliary, renal, or lung. The most common barriers identified in more than 15% of patients were: issues with prescription insurance (36.9%), delays in contacting patient/caregiver (30.6%), in-network pharmacy required (21.9%), followed by delays in delivery (19.6%). Average time to fill was 13.7 days (range: 1-64 days; standard deviation: 11.3).

Conclusion: In conclusion, issues with prescription insurance, delays in contacting the patient/caregiver, and restrictions on pharmacy allowed to fill the prescription were amongst the common barriers identified that represent areas that we can target for improvement moving forward.

199 | Impact of type 2 diabetes mellitus on renal cell carcinoma prognosis

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Introduction: Metastatic renal cell carcinoma (mRCC) is incurable, with an estimated five-year survival of only 12.3%. Type 2 diabetes mellitus (T2DM) has not yet been validated as a risk factor for poorer prognosis in mRCC, but its pro-angiogenic and pro-vascular pathophysiology has been associated with upregulation of growth factors that are central to RCC pathogenesis and metastatic spread.

Research Question or Hypothesis: Is the presence of T2DM associated with a difference in the time to progression to metastatic disease, progression-free survival (PFS) and overall survival (OS) in mRCC patients?

Study Design: Single-health system retrospective cohort study

Methods: Patients ≥18 years–old were included if they had been treated at UNC Healthcare System for mRCC between March 1, 2014 and March 1, 2019. Time from diagnosis of localized disease to progression to mRCC, PFS on first-line treatment for mRCC, and OS from time of initial diagnosis of RCC were compared between patients with T2DM and without T2DM.

Results: A total of 147 mRCC patients were included in the study cohort (n = 27 with and 120 without T2DM). Among patients who initially presented with localized disease (n = 79), patients with T2DM were at a greater than 2-fold increased risk of progressing to mRCC (median 11.4 vs. 33.2 months until mRCC; HR = 2.41, 95% CI 1.16-4.99; $P = 0.0006$). However, significant differences in PFS (23.4 vs. 14.6 months, HR = 0.78, 95% CI 0.5-1.25; $P = 0.32$), OS (58.6 vs. 48.3 months HR = 0.86, 95% CI 0.48-1.54; $P = 0.63$), and the prevalence of a *de novo* mRCC diagnosis ($P = 0.29$) were not observed between T2DM and non-T2DM patients.

Conclusion: These data suggest that T2DM could shorten the time to progression from localized RCC to mRCC, but may not be a negative prognostic marker for PFS or OS. These data are hypothesis generating and require validation in larger cohorts.

200 | Antiviral prophylaxis for herpes zoster infection prevention during arsenic trioxide treatment in APL

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Introduction: Acute promyelocytic leukemia (APL) is a biologically and cytogenetically distinct acute leukemia, characterized by t(15;17). Treatment with tretinoin (ATRA) and arsenic trioxide (ATO) has resulted in improved overall survival for patients with APL. Clinical reports have observed reactivation of varicella zoster virus (VZV) infections in APL patients treated with ATO. Based on the available literature and anecdotal experience here at Roswell Park Comprehensive Cancer Center (PRCCC), antiviral prophylaxis was implemented for all APL patients receiving ATO starting in 2012. The purpose of this study is to determine the incidence of VZV infections in APL patients on ATO who received prophylaxis versus those who did not receive prophylaxis.

Research Question or Hypothesis: What is the clinical benefit of antiviral prophylaxis in APL patient treated with ATO?
Study Design: Retrospective review
Methods: Data consisted of APL patients who received ATO treatment at RPCCC from May 2000 to December 2018. Electronic Health Records were searched for the presence of, or absence of VZV infection as the primary endpoint. Patient demographics, APL risk stratification, chemotherapy regimen, use of steroid therapy (for prophylaxis and/or treatment of differentiation syndrome), and history of prior VZV infection were also identified to assess the risk association with VZV infection.
Results: Fifty-two patients were included; 32 patients with no antiviral prophylaxis and 20 patients received antivirus prophylaxis. 4 (12.5%) patients had documented diagnosis of herpes zoster in the group without antivirus prophylaxis versus 0 in patients with antiviral prophylaxis (P = 0.1507). The median age in patients with VZV infection was 74. The risk of VZV infections was the same for patients treated with ATO alone versus patients receiving ATO + ATRA.
Conclusion: Older age and no antiviral prophylaxis were associated with development of VZV infections. Based on this, routine use of antiviral prophylaxis should be considered throughout ATO therapy and for 6 months after the last dose.

Other

201 | Integration and incentives for board certification in hospital pharmacy departments in California

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Introduction: Board certification by the Board of Pharmacy Specialties (BPS) has been endorsed as a manner to distinguish pharmacists qualified to contribute in advanced practice areas. However, less than 10% of pharmacists in California are board-certified. Value to career opportunities is poorly described.
Research Question or Hypothesis: Characterize how board certification is implemented in hospital pharmacy departments across California.
Study Design: Prospective, cross-sectional, descriptive survey study of hospital pharmacy departments.
Methods: All hospital pharmacy directors in California were invited to participate in an anonymous survey between November 2019 and March 2020. Licensed institutions and their corresponding pharmacy directors were identified from the California State Board of Pharmacy. The survey queried for institution and pharmacy director characteristics, and if/how board certification was integrated at the institution. Multivariable logistic model selections were performed to identify predictors of institutions with ≥25% full-time board-certified pharmacists and those that reward board certification.
Results: Surveys were completed by 29% of institutions (134/465). Most institutions were urban (81%), non-teaching (57%), and have <50 full-time pharmacists on staff (86%). In the majority (62%), <25% of their pharmacists are board-certified. Currently, 47% of institutions consider BPS board certification in hiring preferences and 38% reward employees for board certification. The Advanced Practice Pharmacist certification was included in hiring preferences to a lesser extent (17%). Predictors of institutions with ≥25% board-certified pharmacists are indicated in the Table. Hospitals with ≥100 pharmacist positions was predictive of institutions that reward board certification (OR 16.69, 95% CI 1.78-156.86).

	OR	95% CI
Teaching institution	2.93	1.17-7.37
≥325 beds	8.78	3.21-23.99
Pharmacy directors 40-60 years old	4.04	1.29-12.65
Pharmacy directors previously/currently board-certified	4.01	1.35-11.89

Conclusion: BPS board certification is integrated in the minority of institutions in California. Institutions more likely to value or reward board-certified pharmacists are larger, urban or teaching, and have pharmacy directors who were board-certified.

202 | Experience of and attitudes toward research among pharmaceutical sciences and Pharm.D. students in Saudi Arabia

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Introduction: Developing scientific research skills is an essential part of pharmacy programs, and a good understanding of the importance of research may help to increase the amount and quality of research being conducted.
Research Question or Hypothesis: To investigate attitudes toward, experience of, and perceived barriers to conducting research among Pharmaceutical Sciences and Doctor of Pharmacy (Pharm.D.) students in pharmacy colleges in Saudi Arabia.
Study Design: A cross-sectional study
Methods: A validated questionnaire distributed electronically between July and August 2016 to a convenient sample of Pharmaceutical Sciences and Pharm.D.students in Riyadh, Saudi Arabia.
Results: Of the 245 respondents, 73.5% agreed that research is important. Sixty percent agreed that conducting research should be mandatory for Pharm.D.students. However, the majority disagreed that research experience should be a criterion for acceptance on a

residency program. Of the Pharm.D.students, 73.8% believed that research projects would improve their ability to work and think independently, whereas only 58% of Pharmaceutical Sciences students agreed (P = 0.03). More Pharm.D.students than Pharmaceutical Sciences students believed that they would learn from research experience (65.2% vs. 40.7% [P = 0.00]) and publishing or presenting research work (61.6% vs. 39.5% [P = 0.26]). The students' major motivations to perform research were that it is a mandatory requirement of the curriculum (43.7%), is a positive addition to one's résumé (22.4%), and facilitates acceptance to a residency program (18.8%). Lack of time and training courses were the most commonly cited barriers to conducting research. Regarding knowledge about performing research, Pharm.D.students had a slightly better average score than Pharmaceutical Sciences students (38.6 vs. 37.28 [P = 0.49]) in an objective assessment of knowledge.

Conclusion: Overall, Pharm.D. and Pharmaceutical Sciences students share a positive perception of the importance of research. However, their general knowledge about conducting research is low; thus, more training on time management and research processes is recommended.

203 | Do you mind? A mindfulness practice curriculum for the pharmacy workforce

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Introduction: Stress and burnout can develop when student pharmacists are still in school. It is imperative to give pharmacists tools to manage their stress early in their career. Mindfulness practice has been shown to reduce stress and improve quality of life (QoL); however, little is known about its utility in pharmacy students.

Research Question or Hypothesis: By teaching mindfulness practice through a mindfulness course, pharmacy student stress will be decreased and quality of life will increase at the end of the course curriculum.

Study Design: Prospective, case-control, mixed-methods study

Methods: A mindfulness curriculum was developed using the Six-Step Approach for Medical Education and offered as an 8-week elective for pre-clinical (PC) pharmacy students from the University of Illinois at Chicago College of Pharmacy. Perceived Stress Scale (PSS), SF 12 v2 Health Related QoL Scale (SF12 v2), and the 5-Facet Mindfulness Questionnaire (5FMQ) was administered to participants at baseline, week 8 (post-course), and week 12. The primary outcome was change in 5FMQ results from baseline to week 12. Secondary outcomes included comparisons in PSS and SF12 v2 scores between participants and a control group of PC pharmacy students at week 12.

Results: Eighteen of 25 students from the mindfulness course consented to participate. Scores increased from baseline to week 12 for four of the five mindfulness facets of observing (3.3-3.5, P = 0.02), awareness (2.6-3.0, P = 0.01), nonjudging (3.0-3.4, P = 0.03), and nonreactivity (2.9-3.5, P < 0.0001) among participants. Compared to controls (n = 20), participants in the mindfulness elective had statistically lower PSS scores at week 12 (18.0 participants versus 19.9 controls, P = 0.037). Mental health-related QoL was also higher in the participant group versus control group (45.7 versus 36.8 respectively, P = 0.003).

Conclusion: An 8-week mindfulness curriculum significantly increased students' self-report of mindfulness facets and significantly decreased stress and improved mental health-related quality of life compared to controls. This difference was seen during the time of COVID-19 changes.

204 | Assessment of burnout among pharmacist preceptors

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Introduction: High levels of burnout have been reported in many healthcare professionals, in particular with physicians and nurses, and is a target area of the National Academy of Medicine. While there is increased awareness of burnout and education for all healthcare professionals, burnout in pharmacists especially preceptors, is not well understood. Characterizing the extent of burnout among pharmacists, particularly those interested in precepting learners, is important to develop interventions and to maintain the well-being of those interested in teaching.

Research Question or Hypothesis: To characterize burnout and associated factors among pharmacists attending preceptor development programs.

Study Design: Cross-sectional survey.

Methods: Between February 2019 to January 2020, pharmacists attending preceptor development programs in California and Arizona were administered anonymous surveys containing the Maslach Burnout Inventory with additional demographic questions. Surveys were entered into Qualtrics® (Qualtrics, version 052020) and analyzed via SPSS® (IBM, version 26) using descriptive and correlation analyses.

Results: The response rate was 61% (89/145 pharmacists). Of the respondents, 42.7% (38/89) experienced high levels of emotional exhaustion, 20.2% (18/89) had high levels of depersonalization and 13.5% (12/89) reported low levels of personal achievement. Those without a hobby (33.7%) had high levels of emotional exhaustion (60.7% vs 36.4%; P = 0.040). Primary setting of employment, total years worked post graduation or at current institution, workweek hours, ethnicity, marital status, having children, having a mentor, exercise, gender, or age were not significant predictors of emotional exhaustion, depersonalization, or personal achievement.

Conclusion: Pharmacists interested in precepting are experiencing emotional exhaustion similar to pharmacy practice faculty and clinical pharmacists, however, burnout predictors for pharmacists that serve as preceptors may vary. Additional studies are needed to identify potential solutions addressing burnout among pharmacist preceptors.

205 | Pharmacist-led transition of care protocol in a primary stroke center: A pilot intervention study

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Introduction: Stroke is the fifth cause of death in the United States and the leading cause of long-term disability. Pharmacist-led transition of care (P-TOC) programs have been shown to reduce morbidity and mortality in chronic conditions, but the effect on secondary stroke prevention is limited.

Research Question or Hypothesis: Does a P-TOC protocol improve secondary stroke prevention regimen use 30 days post-discharge compared to usual care?

Study Design: This study was a randomized, open-label, interventional pilot study comparing the P-TOC group versus usual care.

Methods: Adult patients admitted with a diagnosis of an ischemic stroke from January to April 2020 were included. Informed consent and baseline data were obtained in the initial encounter. At discharge, patients in the P-TOC group received written education material for anticoagulants, antiplatelets, and high dose statin medications, a medication reconciliation, and a follow-up phone call at 7-14 days post-discharge. All patients were contacted via phone at 30 days post-discharge. The primary endpoint was to evaluate the successful use of the secondary stroke prevention regimen at 30 days post-discharge. A two-sided alpha of 5% was used as the level of significance.

Results: Twenty patients were included in the study, 10 per group. Baseline characteristics were similar across groups. Use of secondary stroke prevention regimen was numerically different but not statistically significant between the P-TOC group and the usual care (antiplatelets: 50% vs. 100%, statins: 100% vs. 90%, anticoagulants: 37.5% vs. 10%, $P > 0.05$). There was no difference in medication adherence, readmission, emergency visits, and mortality.

Conclusion: This P-TOC protocol did not improve the use of indicated medications for secondary stroke prevention compared to the usual care. Secondary stroke prevention medication use in this pilot study was found to be high overall in patients post-stroke. Larger, and long-term prospective studies are needed to evaluate the true effect of the P-TOC protocol in the stroke population.

206 | Assessing the value of a longitudinal pharmacy intern program at an academic medical center

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Introduction: The Wake Forest Baptist Health (WFBH) Pharmacy Intern Program was established in 2017 to empower student pharmacists with knowledge and skills in hospital pharmacy operations, acute care clinical pharmacy services, research, and leadership. This longitudinal program is designed to complement the three academic years of pharmacy school, with the third year culminating in clinical profile review and patient education. Previous research supports the use of interns to offset growing responsibilities of clinical pharmacists; however, it is also important to assess the value of internships on the primary consumer, pharmacy interns.

Research Question or Hypothesis: What value does a longitudinal pharmacy intern program provide to an academic medical center and pharmacy interns?

Study Design: Single-center retrospective observational study

Methods: Pharmacy interns from June 2018 to May 2020 were included. Interventions documented in the electronic medical record were reviewed and categorized to assess the value of intern clinical profile review and patient education to the institution. Additionally, interns were asked to complete a quality assurance (QA) survey to capture perceptions of the program and its offerings. This study was approved by the Wake Forest University Institutional Review Board.

Results: A total of 7,191 interventions (18 types) were documented by 15 interns during the study period. Clinical profile review was the most prevalent type with 2,893 (40%) interventions documented. Medication education accounted for 28 (0.4%) interventions, without which many patients would not have received pharmacy education. The total interventions resulted in $1,295,825 of cost value for the health system. Of the 14 interns who completed the QA survey, 12 (86%) strongly agreed with program satisfaction overall. All 14 interns either agreed or strongly agreed to feeling more prepared professionally than their classmates due to participation in the internship.

Conclusion: This longitudinal WFBH pharmacy intern program is mutually beneficial to the health system and pharmacy interns.

207 | Ketamine degradation in emergency medical service deployment and in extreme temperature simulation

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Introduction: Ketamine can be used for analgesia and sedation in the prehospital setting. It is used by the United States military abroad in locations with extreme temperatures. Ketamine stability when exposed to temperatures outside manufacturer recommendations is unknown.
Research Question or Hypothesis: Ketamine will undergo enhanced degradation when exposed to real world and simulated environments with extreme temperatures.
Study Design: This study evaluated ketamine stability on an active emergency medical service (EMS) unit during summer months and in simulated environment chambers with preprogrammed temperature fluctuations.
Methods: The study consisted of two phases: moderate heat (MHP) and high heat (HHP). Twenty-four ketamine 50 mg/mL vials were placed in an EMS vehicle for 6 months during the summer (May–October 2019) during MHP. Ninety-six ketamine vials were evenly divided and placed in four controlled temperature chambers during HHP. Each chamber was set to different temperatures: Chamber 1 (C1): constant 120 °F; C2: fluctuated over 24 hours from 86 °F-120 °F; C3: fluctuated over 24 hours from 40 °F-120 °F; and C4: constant 70 °F for a total of 6 months. Four ketamine vials were removed every 30 days from each environment and analyzed for stability testing against a standard. Temperature was recorded every minute for all environments and mean kinetic temperature (MKT) was calculated at time of ketamine removal.
Results: The MKT ranged from 73.6 °F-80.7 °F during MHP. No clinically significant ketamine degradation was observed. All samples except one sample taken from month four in the EMS vehicle retained >90% of the standard ketamine concentration. The MKT stayed constant during HHP for each chamber (C1 MKT: 120 °F, C2 MKT: 107.3 °F, C3 MKT: 96.5 °F, C4 MKT: 70 °F). No statistically significant ketamine degradation occurred in any of the chamber environments as all vials maintained concentration ≥ 48.4 mg/L.
Conclusion: Ketamine samples exhibited limited degradation when exposed to real world and simulated extreme temperature environments exceeding manufacturer recommendations.

Pain management/analgesia

208 | Strategies for rotation between gabapentinoids in the inpatient setting

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Introduction: Gabapentinoid use has grown significantly in recent years, however evidence to support best practice in rotating between gabapentin and pregabalin is lacking. Only one switching strategy, direct switch (DS), has been described in clinical studies and the dose conversion ratios used are not supported by robust evidence.
Research Question or Hypothesis: What switching strategies are used for gabapentinoid rotation in routine clinical practice and is use of one associated with better efficacy or safety outcomes?
Study Design: Retrospective cohort study
Methods: Patients who were receiving gabapentinoids for pain and who were rotated while admitted from June 1st, 2014 to April 25th, 2020 at a large, academic medical center were included. The primary outcome was the proportion of rotations using DS compared to a cross-taper (CT). Secondary outcomes were successful rotation (i.e. stable or improved pain scores pre- to post-rotation), dose ratios, and adverse effects.
Results: Sixty-seven patients were included. Median age was 50 years (35 – 59) and 58% (38) were male. Eighty-seven percent of patients were rotated using DS. Successful rotations were achieved in 95% of DS rotations and 78% of CT rotations. There was no significant difference in type of switching strategy used between those who were successful and those who were not. *Post hoc* analysis of patients (n = 50) with normal renal function (eGFR ≥50 mL/min/1.73 m^2) found that those who were successful were more likely to have used DS (P = 0.048). There were no differences in adverse effects.
Conclusion: The majority of patients were rotated using DS and these findings suggest that either strategy is reasonable for gabapentinoid rotation in the inpatient setting.

209 | Opioid use evaluation with continuous ropivacaine wound infiltration after cesarean section

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Introduction: Postoperative pain from cesarean deliveries is a common symptom in many patients. Treating pain with multimodal therapy is a strategy to reduce opioid consumption for postoperative pain. Wound infiltration of a local anesthetic is one of those strategies. Ropivacaine 0.2% delivered through an elastomeric pump has shown variable benefit in postoperative cesarean patients.
Research Question or Hypothesis: The purpose of this study is to evaluate the difference in opioid utilization in patients who received ropivacaine as a continuous wound infiltration versus standard therapy for treating postoperative pain.
Study Design: This is a retrospective observational study analysis.
Methods: 470 patients who underwent elective cesarean sections via Pfannensteil incisions were examined. All patients received intrathecal

morphine via spinal epidural. 44 patients also received ropivacaine 0.2% as a continuous wound infiltration via an elastomeric pump. The primary outcome was total postoperative morphine milligram equivalents (MME) with and without ropivacaine administration. Secondary outcomes included time of first demand for opioid analgesia and readmissions for wound site infections. Statistical data was analyzed using Welch's t-test in Minitab.

Results: There were no significant differences in baseline characteristics between both groups. Continuous wound infiltration with ropivacaine failed to show a significant decrease in opioid utilization (46.5 ± 43.9 versus 57.2 ± 56.3, P = 0.140). The time to first dose of opioids did not show a difference between the groups (0.66 ± 0.58 versus 0.56 ± 0.59, P = 0.295). Readmissions for infections were greater in patients who received ropivacaine, though not statistically significant (0.25 ± 1.37 versus 0.007 ± 0.08, P = 0.245).

Conclusion: Ropivacaine administered as a continuous wound infiltration does not significantly decrease total MME. The cost associated with continuous wound infiltration should be evaluated against its effectiveness in future studies.

210 | Acute opioid prescribing in medicine patients on hospital discharge

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Introduction: The opioid epidemic and the new Joint Commission standards around opioid stewardship has made the appropriate use of opioids a priority. While an abundance of literature has established the importance of surgery and emergency medicine prescribing protocols, a knowledge gap exists pertaining to the acute prescription of opioids at hospital discharge for non-surgical patients.

Research Question or Hypothesis: The primary objective of this study is to characterize opioid prescriptions for acute pain indications in non-surgical patients at hospital discharge. Secondary objectives are to assess quantity and duration of opioid utilization, description of leftover opioid disposal, as well as other post discharge pain management characteristics.

Study Design: Prospective quality improvement cohort study assessed inpatient nonsurgical patients prescribed opioids at hospital discharge from a multi-state health system.

Methods: Adult patients were prospectively identified who were newly prescribed opioids upon discharge from non-surgical services for acute pain indications. Patients were surveyed 3-4 weeks after discharge regarding their opioid use by a non-biased survey research center.

Results: In total 200 patients were surveyed between January 6th, 2020 and May 1st, 2020 with a median total quantity of 112.5 morphine milligram equivalents (MME) (IQR 75-200) prescribed on discharge. The top general indications for opioid prescribing were abdominal pain, trauma-related pain, and joint pain. At the time of survey 45% of prescribed opioids remained unused. The median duration of opioid use was four days and 20.9% reported continued opioid use at the time of survey. Only 5% of patients no longer using opioids with remaining medication reported disposal.

Conclusion: Results suggest that there is excess opioid prescribing among non-surgical medicine patients, with over half of prescribed quantities remaining unused after hospital discharge. A utilization assessment could aid in the development of institutional guidelines to optimize appropriate opioid prescribing for non-surgical patient populations.

Pediatrics

211 | Evaluation of State Behavioral Scale and Cornell Assessment of Pediatric Delirium scoring on sedation and delirium in the pediatric intensive care unit

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Introduction: Critically ill children often require respiratory support and adequate sedation, which may prolong mechanical ventilation and precipitate delirium. Validated scoring systems assess sedation efficacy and delirium presence in critically ill pediatric patients. This study aimed to observe the impact of implementing SBS (State Behavioral Scale) and CAPD (Cornell Assessment of Pediatric Delirium) sedation and delirium scoring systems on clinical control of sedation and delirium in the pediatric intensive care unit (PICU).

Research Question or Hypothesis: Implementation of SBS & CAPD scoring will improve clinical control of sedation and delirium in the PICU.

Study Design: Prospective observational study with comparative historical cohort.

Methods: Patients <18 years old at a single children's hospital on mechanical ventilation and receiving continuous sedation from 7/1/2016 through 4/30/2020 were included. Patients were excluded if they received neuromuscular blocking agents. The primary outcome was days free from sedation in patients assessed in the historical cohort with the COMFORT score compared to patients assessed with SBS and CAPD scoring systems. Secondary outcomes included the difference between the two groups in days free from mechanical ventilation, percentage of patients receiving delirium treatment with antipsychotic medications, and length of stay. Analysis was performed via t-test for continuous data and Fisher's exact test for categorical data.

Results: The historical cohort included 15 patients and the prospective cohort included 7 patients. The difference in days free from

sedation between the COMFORT and SBS/CAPD groups was not statistically significant [2.53 vs 2.29; P = 0.503; (95% CI -3.05-1.53)]. There were no statistically significant differences observed in a subgroup analysis by pediatric risk of mortality (PRISM score) or secondary outcomes.

Conclusion: Compared to using COMFORT, utilizing SBS and CAPD scoring systems did not result in significant improvement in days free from sedation in critically ill children. However, due to the limited number of patients assessed, this topic requires further research with larger trials.

212 | National amoxicillin/clavulanic acid formulation use pattern survey

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Introduction: Amoxicillin/clavulanic acid is an oral combination beta-lactam/beta lactamase inhibitor antibiotic introduced into the US market in the mid-1980's. Subsequently, the number of commercially-available ratio formulations have increased, resulting in 5 available currently. There is significant variability in ratio selection approach per anecdotal conversations with pediatric clinicians. Choosing an incorrect ratio has efficacy and toxicity implications.

Research Question or Hypothesis: Determine amoxicillin/clavulanic acid formulation use patterns across the United States.

Study Design: Multicenter practitioner survey.

Methods: An IRB-approved survey was sent to multiple listservs (ACCP pediatrics, infectious diseases, ambulatory care, pharmacy administration; ASHP; PPA(G) members), and selected pediatric Vizient members in June, 2019. 193 independent responses were received. Responses were screened for multiples within institutions. Duplicate responses were identified (n = 37) and excluded if matching another response from the organization exactly (n = 0).

Results: Nearly 62% of respondents represented a children's hospital within an acute care hospital; remainder being from stand-alone children's hospitals. Around 55% of respondents indicated prescribers were responsible for choosing the patient-specific formulation for inpatients. Nearly 70% of respondents indicated multiple formulations were available due to clinical need (efficacy, toxicity, measurable volume), while over 40% responded that the number of liquid formulations were limited to decrease the potential for error. Variability was demonstrated among institutions using ≥2 different formulations for acute otitis media (AOM), sinusitis, lower respiratory tract infections (LRTI), skin and soft tissue infections, and urinary tract infections (33.6%, 37.3%, 41.5%, 35.8%, and 35.8%, respectively). The 14:1 formulation was the most common, but not exclusive, for AOM, sinusitis, and LRTI with 2.1%, 2.1%, and 2.6% of respondents indicating use of the 2:1 formulation and 10.9%, 15%, and 16.6% of respondents indicating use of the 4:1 formulation.

Conclusion: There was significant amoxicillin/clavulanic acid formulation selection variability. The clinical impact of this variability cannot be determined from this survey; this topic should be a focus of future research.

213 | Community-onset extended-spectrum b-lactamase: Producing Enterobacteriaceae urinary tract infection in pediatric—Retrospective case control trial

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Introduction:Urinary tract infections are a common and important problem in childhood and may lead to renal scarring, and end-stage renal dysfunction. UTI caused by resistant strains of bacteria is increasingly prevalent in children.

Research Question or Hypothesis: Find the incidence of ESBL-enterobacteriaceae UTI among pediatric population.

Find the impact of antibiotics exposure, antibiotic prophylaxis, recurrent UTIs, hospitalization, Urinary tract abnormalities on the development of ESBL- enterobacteriaceae UTI in same population.

Study Design: Cross Sectional and Retrospective Case Control study

Methods: Pediatric patients from 0 months up to 14 years, who were admitted with UTI to Al-Wakra Hospital from January 2018 to January 2019 were included.

Case group was defined as patients who developed ESBL-PE UTI, though control group was defined as patients who developed sensitive enterobacteriaceae UTI.

Results: 406 patients were included, 33% of them had ESBL Enterobacteriace UTI. Regarding antibiotics exposure during the preceded 6 months, 28% of the case group was prescribed more than one course of antibiotics vs 10 % in control group *(odd ratio 3.7,* **95% CI** *2 to 6, P < 0.005)*, no significant difference was found among patients who received a single course of antibiotic. 21% of case group received antibiotic prophylaxis vs 6% in control group *(odds ratio 4.1,* **95% CI** *2 to 8, P < 0.005)*. 21 % of case group was diagnosed with urinary tract anomalies, Vs 4.5% in control group *(odds ratio 5.6, 2.5 to 11.7, P < 0.005)*, however, no significant difference regarding UTI recurrence was found. 17 % of case group was hospitalized previously vs 7 % in control group (*odds ratio 2.6,* **95% CI** *1.3 to 5.1, P < 0.002)*

Conclusion: The incidence of ESBL enterobacteriaceae UTIs among pediatric patients was significantly high. Repeated antibiotic exposures, antibiotic prophylaxis, previous hospitalization, and UT anomalies may have an impact on the resistance rate.

214 | Evaluation of vancomycin dosing in a neonatal intensive care unit

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Introduction: While much literature exists regarding vancomycin pharmacokinetics and therapeutic targets in adults, this area is less defined in neonates. The current institutional goal in our neonatal intensive care unit (NICU) is a trough serum concentration of 10 to 20 mcg/mL, with an ideal goal of 10 to 15 mcg/mL.

Research Question or Hypothesis: To compare the incidence of therapeutic first vancomycin trough serum concentrations in the NICU before and after an institutional vancomycin guideline update.

Study Design: This was a retrospective study at a single center.

Methods: Neonates in the NICU who received vancomycin and had a trough serum concentration at steady state from December 2009 to June 2013 (old protocol) and January 2017 to February 2020 (new protocol) were included. The primary outcome was achievement of a therapeutic first vancomycin trough at goal of 10 to 20 mcg/mL. Secondary outcomes included a tighter goal trough of 10 to 15 mcg/mL and nephrotoxicity.

Results: A total of 252 neonates were included (143 old protocol versus 109 new protocol). First vancomycin trough at goal of 10 to 20 mcg/mL increased from 45.5% (n = 65) to 53.2% (n = 58). The tighter first trough at goal of 10 to 15 mcg/mL increased from 30% (n = 43) to 34% (n = 37), respectively. Median first trough increased from 10.3 (IQR 6, 15) mcg/mL to 12.3 (IQR 8.6, 16.5) mcg/mL, respectively. Sub-therapeutic concentrations decreased from 45.5% with the old protocol to 36.7% with the new protocol, while supratherapeutic concentrations >20 mcg/mL were relatively unchanged at 11.2% to 10.1%, respectively. The incidence of nephrotoxicity was similar between groups at 7% (n = 10) versus 5.8% (n = 6), respectively.

Conclusion: Updates to our institutional NICU dosing protocol increased the achievement of therapeutic vancomycin levels without an increase in nephrotoxicity. Further research into the ideal empirical vancomycin dosing strategy in neonates is still warranted.

215 | Implementation of a pediatric vancomycin dosing protocol

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Introduction: Vancomycin is a widely used agent to treat children[1]. Despite a scarcity of data about optimal dosing and pharmacokinetic diversity, it is difficult to develop an efficacious and safe standardized regimen in pediatrics. The 2020 guidelines recommend 60-80 mg/kg/day divided every 6-8 hours for those >3 months[2]. In 2014, Batson Children's Hospital developed a dosing protocol based on institutional historical data. The protocol aligns with the recommendations, except those >12 years receive only 45 mg/kg/day.

Research Question or Hypothesis: Compare vancomycin dosing in pediatric patients before and after protocol.

Study Design: A retrospective chart review was completed.

Methods: Patients from 1 mo – 17 yrs that received vancomycin from December 2013 – May 2014 were included in the "pre" group and July 2018 – July 2019 were included in the "post" group. Troughs were considered subtherapeutic at <5 – 10 mg/dL; therapeutic at 10 – 20 mg/dL; and supratherapeutic at >20 mg/dL.

Results: There were 184 patients included, 72 pre and 112 post. The protocol was followed in 78.6% of patients. For the entire cohort, the mean initial trough was 9.28 ± 5.27 pre-protocol vs 11.36 ± 6.13 post-protocol (P = 0.019). There were no statistically significant differences in subtherapeutic or supratherapeutic levels in any age group. In the 2 – 5 yr group, there was a significant increase in therapeutic troughs (11% pre; 57.89% post, P = 0.017). In the 12 – 17 year age group, patients received significantly less vancomycin; but initial troughs trended to subtherapeutic, with no statistical difference.

Conclusion: The implementation of an institution dosing protocol led to improvements in our 2 – 5 year old age group; but opportunity for improvement in the >12 year old age group. The relative low incidence of supratherapeutic troughs suggest that our protocol is safe while achieving adequate trough concentrations.

216 | Evaluation of the use of synergistic antibacterial therapy for gram positive and gram negative organisms for sepsis in critically ill pediatric patients

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Introduction: The 2020 Surviving Sepsis Campaign Guidelines provides guidance against the routine use of empiric antimicrobial therapy directed against the same pathogen for synergy ("double coverage"), in pediatric patients greater than or equal to 37 weeks gestation to 18 years old.

Research Question or Hypothesis: The purpose of this study is to determine how often and what types of multiple synergistic antibiotics are being used for critically ill pediatric patients admitted for suspected sepsis.

Study Design: Retrospective cohort study of pediatric patients admitted for sepsis between 2015-2019 to evaluate the occurrence of synergistic antibiotics directed against gram positive and gram negative organisms. Patients were included if greater than or equal to 37 weeks gestation to 18 years old during January 1, 2015 and December 31, 2019, had an ICD 10 code for sepsis, septic shock as a primary diagnosis, and received antibiotics greater than 24 hours during hospitalization.

Methods: Patients were identified by ICD-10 codes for sepsis and septic shock as a primary diagnosis for their hospitalization. The primary outcome was percent of patients receiving synergistic empiric antimicrobial therapy compared to monotherapy. Data collection included demographics, time to initiation of antibiotics, suspected source of infection, timeline of synergistic therapy, infectious disease

consult presence, antimicrobials used, presence of a positive culture and isolated organisms, and length of double coverage.

Results: Nineteen of 254 patients (7.5%) received synergistic antimicrobials during an admission for suspected sepsis. Four of those were gram positive; 2 anaerobic and 13 gram negative. Eleven patients (57.9%) received dual β-lactam therapy. 77% percent of patients had antibiotics started within one hour of presentation. Cultures were sent upon admission in 74% of patients. Forty-seven percent of patients received previous antibiotics within the past 30 days.

Conclusion: Pediatric patients admitted for sepsis in our institution are currently being treated per the guideline recommendations without the use of dual antimicrobial synergistic therapy.

Peri-operative Care

217 | Retrospective evaluation of intrapleural tissue plasminogen activator with or without dornase alfa for the treatment of traumatic retained hemothorax

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Introduction: Intrapleural fibrinolytic instillation is endorsed by the Eastern Association for the Surgery of Trauma as second line treatment for retained hemothorax (rHTX). Dornase alfa has demonstrated efficacy in parapneumonic effusion, but pathophysiology precludes extrapolation to traumatic rHTX treatment.

Research Question or Hypothesis: The incidence of operative intervention will be higher for rHTX treated with tPA alone (tPA) versus tPA plus dornase alfa (dornase)

Study Design: Single center, retrospective, cohort study of patients treated by the trauma service at an urban, academic, American College of Surgeons-verified level 1 trauma center.

Methods: Patients ≥16 years old with rHTX admitted between January 1, 2013 to July 31, 2019 who received ≥1 tPA instillation were included. Exclusion criteria included concomitant empyema or parapneumonic effusion, tPA for other indications, pregnant women, and prisoners. The primary endpoint was operative intervention. Secondary endpoints included chest tube output, rHTX reduction, bleeding, and operative intervention risk factors. Statistical analysis was performed using SigmaPlot 14®, Systat Software, Inc.

Results: Fifty patients were included (28, tPA; 22, dornase). Baseline median [interquartile range] rHTX size (315 [141-867] mL vs 306 [75-980] mL, $P = 0.71$) was similar between groups. Median tPA dose per treatment (6 [6-6.4] mg vs 10 [8.4-10] mg, $P < 0.001$) and cumulative tPA dose (18 [6.5-24] mg vs 30 [29.5-40] mg. $P < 0.001$) were significantly lower in tPA. Surgical intervention occurred in 4 (14.3%) vs 3 (13.6%) of tPA and dornase, respectively ($P > 0.99$). Chest tube output, rHTX reduction, hemoglobin and hematocrit change, and transfusions were similar between groups. There was no difference in bleeding incidence (7.1% vs. 9.1%, $P > 0.99$). Multivariate logistic regression demonstrated no significant risk factors for treatment failure.

Conclusion: Dornase added to tPA did not reduce the incidence of operative intervention. Larger, adequately designed studies are necessary to determine the role of dornase in rHTX.

218 | Continuing maintenance buprenorphine for opioid use disorder reduces perioperative opioid use

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Introduction: Buprenorphine has become the most frequently utilized medication for opioid use disorder (MOUD), and misunderstanding of buprenorphine's unique pharmacology has historically complicated perioperative analgesia. The purpose of this study was to evaluate impact of perioperative buprenorphine continuation on perioperative analgesia and opioid use.

Research Question or Hypothesis: We hypothesize that continuation of MOUD with buprenorphine decreases postoperative full mu-opioid agonist use.

Study Design: This was a single center retrospective cohort study conducted at UK HealthCare.

Methods: Patients were eligible for inclusion if (1) they were hospitalized for any operation between January 2010 and September 2019 and (2) buprenorphine for MOUD was listed as a home medication in their medical record. Patients with a length of stay greater than 14 days, greater than 2 operating room bookings during admission, or who did not survive to discharge were excluded. Patients were assigned to the continuation or control cohorts based upon receipt of buprenorphine within the first two days of admission. The primary endpoint of the study was use of full mu-opioid analgesics during days 1-7 of admission. Categorical variables were assessed using Chi-square analysis, and continuous variables were assessed using Mann-Whitney U-test.

Results: Of the 174 patients included in this study, 140 continued buprenorphine and 34 had buprenorphine withheld for at least the first two days of admission. Patients in the continuation cohort were less likely to receive full mu-opioid agonists during days 1-7 (44.2%

vs. 5.9%, $P < 0.001$). No difference in median length of stay was noted (4.7 [IQR 3.3-7.1] days vs. 6.1 [IQR 3.4-7.7] days, $P = 0.36$). There was no statistical difference in pain scores between cohorts (day 1 (5.3 vs. 6.7, $P = 0.45$) and day 7 (0 vs. 0, $P = 0.34$)).

Conclusion: Perioperative continuation of buprenorphine reduced the use of alternative full mu-opioid agents while admitted.

219 | An evaluation of opioid prescriptions upon discharge from colorectal surgical procedures

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Introduction: The opioid epidemic is a serious problem nationally, but particularly in the Commonwealth of Kentucky. At the University of Kentucky HealthCare system, opioid prescribing following a colorectal surgical procedure was provider specific from the years 2013 to 2019. During this timeframe there were no colorectal opioid prescribing guidelines for discharging patients, and therefore a wide variety of opioid quantities were written for at discharge. This study evaluated which opioids patients were being prescribed after their colorectal procedure upon discharge.

Research Question or Hypothesis: What prescribing patterns are being seen upon discharge for patients undergoing a colorectal surgical procedure at UK HealthCare from 2013 to 2019?

Study Design: Descriptive, retrospective, observational study

Methods: 879 patient charts from 2013 to 2019 at UK HealthCare were reviewed. Data collected included: chronic opiate and gabapentin prescriptions prior to admission as well as NSAID, muscle relaxer, gabapentin and opiate medications prescribed at discharge. The data were analyzed to determine percentages of patients receiving each of these medications and amount of opioids given on discharge.

Results: 25.3% of patients who had a colorectal surgical procedure had a history of chronic opioid usage on admission. 92.8% of patients were prescribed opioids upon discharge. The most common opioids were hydrocodone and oxycodone. Acetaminophen was prescribed at discharge to 81.3% of patients.

Conclusion: While approximately one quarter of patients were admitted with chronic opioids, nearly all patients were discharged with an opiate. The data demonstrates that prescribing patterns over the period were heavily trended toward opiate prescriptions, with less emphasis on multimodal pain control. Other medications studied were prescribed in 20% or less than patients, indicating that opiates were the most widely used method of pain control in patients upon discharge. This study has led to development of an opioid prescribing guideline to better standardize the patients' care.

220 | Role of alvimopan in return of bowel function in patients undergoing colorectal surgery receiving opiate-sparing measures

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Introduction: Post-operative ileus (POI) and delayed return of gastrointestinal (GI) function are complications seen frequently in patients undergoing colorectal surgery. Enhanced recovery after surgery (ERAS) protocols have been widely developed; many ERAS protocols include alvimopan, which reverses the effects of opiates in the gastrointestinal tract without compromising analgesia. Additionally, lidocaine has been utilized in ERAS protocols to decrease the use opioid analgesics. Limited data exists regarding alvimopan's efficacy in opiate-sparing regimens.

Research Question or Hypothesis: In patients undergoing colorectal surgery receiving opiate-sparing measures, does alvimopan accelerate time to gastrointestinal recovery?

Study Design: A single center, retrospective cohort analysis in 192 adult patients undergoing colorectal surgery divided into four groups dependent upon whether or not they received alvimopan or lidocaine: groups AL (n = 93), Al (n = 34), aL (n = 44), and al (n = 21).

Methods: Patients meeting inclusion criteria were randomly selected between February 2018 and October 2019. The primary endpoint in this study was median time to first bowel movement or discharge, whichever came first. Secondary endpoints include incidence of POI and length of stay (LOS). For the primary outcome, a Kruskal-Wallis test was used to determine if there was any difference between the four groups. Post-hoc Mann-Whitney U tests were utilized to determine pairwise differences.

Results:

The three pairwise comparisons resulting in significant difference in the primary outcome were groups LA and Al ($P = 0.003$), groups LA and la ($P = 0.001$), and groups Al and al ($P = 0.01$). Post-hoc analysis of

	Group LA (n = 93)	Group Al (n = 34)	Group aL (n = 44)	Group al (n = 21)
Time to BM or BM–median hrs (IQR)	39.4 (22.7-56.6)	44.9 (24.7-56.6)	56.0 (36.8-76.9)	55.4 (43.2-88.6)

laparoscopic-only procedures revealed no difference between any of the four groups (P = 0.22).

Conclusion: Treatment with alvimopan resulted in a significant improvement in time to GI recovery. This finding was complicated by disproportionate amounts of laparoscopic procedures and opiate exposure among the groups.

Pharmacoeconomics/Outcomes

221 | Effectiveness of palliative care clinical pharmacists in an inpatient care setting

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Introduction: Palliative care clinical pharmacists (PCCP) on multidisciplinary palliative care teams have expanding roles in the treatment of pain, nausea, and other symptoms for patients with serious illnesses. Information on the effectiveness of PCCP participation is limited.

Research Question or Hypothesis: What are the clinical and financial outcomes associated with a PCCP on an inpatient palliative care team?

Study Design: Retrospective cohort study conducted in an integrated healthcare delivery system.

Methods: Adult patients with an inpatient stay and a palliative care consult between 10/01/2016 and 02/28/2019 were included. Patients were assigned to the observation group if they received care from a clinical pharmacist and control group if they received usual care. The primary outcome was the 180-day change in daily total cost-of-care expenditures. Secondary outcomes included length of index hospitalization and 180-day change in daily morphine milligram equivalents (MME), healthcare utilization, and opioid adverse effects (AE). Multivariable regression analyses were performed.

Results: 1543 patients were included with 228 and 1315 in the observation and control groups, respectively. Control patients were older and had lower baseline mean MME while observation patients were more likely to have had a cancer diagnosis and higher burden of chronic illness. After adjustment for baseline characteristics, the observation group had a greater median decrease in daily expenditures (-$22 vs. $6, P = 0.003), higher median increase in daily MME (16.5 mg vs. 9.7 mg, P = 0.007), and fewer patients with a hospitalization (34.2% vs. 39.2%, P = 0.010) or urgent care visit (10.5% vs. 14.6%, P = 0.024) during follow-up but longer mean index hospitalization (9.3 days vs. 7.7 days, P = 0.003) and no differences in a follow-up opioid AE (all P > 0.05).

Conclusion: In the inpatient palliative care setting, PCCP participation was associated with reduced total cost-of-care and increased opioid prescribing without subsequent opioid AE. Future research should be conducted to confirm these findings in a prospective manner.

222 | Predictors of pharmacists' job satisfaction: Analysis of the 2018 Virginia pharmacist workforce survey

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Introduction: Pharmacist job satisfaction is critical for employees' wellbeing and performance, as well as an important consideration for employers seeking to reduce turnover.

Research Question or Hypothesis: What factors predict job satisfaction among pharmacists in Virginia (VA)?

Study Design: Cross-sectional study using data from the 2018 VA Pharmacist Workforce Survey, which is presented to pharmacists during annual license renewing.

Methods: Of the 15,424 registered pharmacists, 13,962 completed the survey (90.5% response rate). Only pharmacists who responded as being employed and working in VA in the past year were included (n = 6,042). Data were summarized using descriptive statistics. Bivariate analyses examined associations between individual factors and job satisfaction. Multiple logistic regression identified predictors of job satisfaction with the independent variable collapsed into very/somewhat satisfied versus very/somewhat dissatisfied.

Results: Respondents were women (66.3%), Pharm.D. degree holders (65.5%), with a 15-year average work experience. Most pharmacists (86%) reported being very/somewhat satisfied with their job. In the bivariate analysis, a significantly greater proportion of pharmacists who reported job satisfaction were residency trained, board certified, worked 40-49 hours/week, had more practice years, and earned an annual income ≥$150,000. Pharmacists working in chain and mass merchant community pharmacies reported greater dissatisfaction compared to other settings. Predictors of job satisfaction included: female (aOR = 1.32, 95%CI 1.01, 1.73); ≥60 years-old (aOR = 2.59, 95%CI 1.05, 6.43) versus ≤30 years-old; working 30-39 (aOR = 1.79, 95%CI 1.07, 3.01) or 40-49 hours/week (aOR = 1.63, 95%CI 1.02, 2.61) versus ≥50; annual income ≥$150,000 (aOR = 2.01, 95%CI 1.20, 3.38) versus $100,000-$149,999; having health insurance benefits (aOR = 1.40, 95%CI 1.003, 1.95); working in a clinic-based pharmacy (aOR = 4.26, 95%CI 1.49, 12.19), independent community pharmacy (aOR = 3.30, 95%CI 1.88, 5.78), health system (aOR = 4.25, 95%CI 2.69, 6.71), long-term care (aOR = 2.31, 95% CI 1.17, 4.55), and other pharmacy settings (aOR = 4.22, 95%CI 1.41, 12.61) compared to chain community pharmacy.

Conclusion: Job satisfaction is multifaceted. Findings may inform career paths associated with higher satisfaction.

Pharmacoepidemiology

223 | Impact of hydrocodone rescheduling on opioid-prescribing by general and specialist dentists in the United States: An interrupted time-series analysis

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Introduction: Dentists frequently prescribe hydrocodone-combination products (HCP) for acute dental pain. In 10/2014, the US Drug Enforcement Administration (DEA) rescheduled HCP from schedule III to II, introducing more restricted prescribing and dispensing regulations, as a means to reduce opioid prescribing.

Research Question or Hypothesis: To evaluate the impact of HCP rescheduling on opioid-prescribing by general and specialist dentists in the US.

Study Design: Interrupted time-series analysis.

Methods: Monthly prescriptions by dentists of HCP, codeine, oxycodone, and tramadol were assessed using IQVIA LRx from 2012-2017. Segmented linear regression models with robust standard errors examined changes in prescription volume, prescribing-rates, quantity/duration, and morphine milligram equivalents/day (MME/day), in the 33 months prior to index (10/2014) compared to 33 months post-index, and stratified by general and specialist (e.g. endodontics) dentists.

Results: From 1/2012-7/2017, dentists prescribed over 68 million opioid prescriptions. Most commonly prescribed opioids by general and specialist dentists were HCP (69% and 67%, respectively), followed by codeine (18% and 16%), oxycodone (9% and 12%), and tramadol (4% and 4%). Segmented regression models demonstrated that after rescheduling, HCP prescribed by general and specialist dentists' immediately decreased by 118,362 and 937 prescriptions, respectively, with increases for codeine (70,260 and 716), oxycodone (15,780 and 246), and tramadol (17,039 and 253); $P < 0.001$. Following the rescheduling, general dentists significantly decreased monthly prescribing of HCP (-3,240 prescriptions/month), oxycodone (-459), and tramadol (-119), except for codeine (108; $P = 0.4408$); significant at $P < 0.001$. In contrast, specialists increased monthly prescribing of codeine (11 prescriptions/month; $P < 0.001$), with modest increases in HCP (3; $P = 0.682$) and oxycodone (2; $P = 0.509$). Overall, general and specialist dentists' prescribed similar HCP quantities/durations, and MME/day.

Conclusion: General and specialist dentists' prescribing of HCP decreased at rescheduling, but consequently increased prescribing of high-potency opioids. Specialist dentists gradually increased HCP prescribing in the months following rescheduling. Understanding how regulations impact different dentist groups can aid in development of tailored opioid interventions.

224 | Anticholinergic medication burden and longitudinal cognitive function in older persons

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Introduction: Evidence suggests that anticholinergic medications may increase dementia risk, but it is unknown whether these medications predict cognitive decline in adults who have reached older ages without dementia.

Research Question or Hypothesis: What is the impact of exposure to anticholinergic burden on cognitive function in healthy older adults?

Study Design: Post-hoc analysis of longitudinal observational data from the ASPirin in Reducing Events in the Elderly study.

Methods: 19,114 participants 70 years of age and older (65+ for US minorities) from Australia and the US were recruited and followed up for a mean of 4.7 years. At enrollment, participants were free of cardiovascular disease, major physical disability, and dementia. Participants underwent baseline and biennial cognitive assessments, including the Modified Mini-Mental State examination (3MS), Hopkins Verbal Learning Test–Revised (HVLT-R), Controlled Oral Word Association Test (COWAT), and Symbol Digit Modalities Test (SDMT). Anticholinergic burden was calculated at baseline using the Anticholinergic Cognitive Burden (ACB) scale and grouped as scores of 0, 1-2, or 3+. Linear mixed models were used to assess the relationship between ACB score and cognitive outcomes over time.

Results: Compared to participants with ACB score of 0, participants with ACB score of 1-2 or 3+ had lower 3MS, HVLT-R, COWAT, and SDMT at study enrollment. After adjusting for sex, age, education, minority status, smoking history, hypertension, diabetes, depression, and CKD, participants with ACB score of 3+ had worse performance over time for 3MS (Adjusted [Adj] B = -0.097, $P = 0.021$), HVLT-R (Adj B = -0.097, $P < 0.001$), COWAT (Adj B = -0.150, $P < 0.001$), and SDMT (Adj B = -0.127, $P = 0.023$), than participants with ACB score of 0. Participants with ACB score of 1-2 had worse performance over time only for HVLT-R (Adj B = -0.038, $P = 0.004$) and COWAT (Adj B = -0.065, $P = 0.002$).

Conclusion: Anticholinergic burden predicts decline in cognitive function in initially healthy older adults, particularly for episodic memory and executive function.

225 | **Correlation between pharmacist immunization services and adolescent vaccinations**

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Introduction: Pharmacy immunization services correlate positively with adult influenza vaccination coverage. More states have expanded pharmacist immunization privileges, thereby increasing immunization access to the adolescent population at pharmacies.
Research Question or Hypothesis: Do pharmacist immunization privileges or the proportion of adolescents vaccinated against influenza at pharmacies correlate with national adolescent influenza vaccination coverage?
Study Design: Using the American Pharmacists Association/National Alliance of State Pharmacy Associations (APhA/NASPA) survey, data on pharmacist immunization privileges were gathered. Using the National Immunization Surveys-Teen (NIS-Teen) survey, data on place of vaccination and influenza vaccination coverage were collected.
Methods: Linear regression was used to analyze the correlation between pharmacist immunization privileges, adolescents vaccinated against influenza at pharmacies, and national adolescent influenza vaccination coverage.
Results: From 2013 to 2019, the number of states with pharmacist influenza immunization privileges for adolescents ages 13 to 18 increased from 40 to 47. Moreover, the proportion of adolescents vaccinated against influenza at pharmacies increased from 4.08% to 6.47% and national adolescent influenza vaccination coverage increased from 46.6% to 52.2%. The correlation (R^2 = 0.47) between pharmacist immunization privileges and national adolescent influenza vaccination coverage was weak and not statistically significant (P = 0.130). On the other hand, the correlation (R^2 = 0.79) between the proportion of adolescents vaccinated against influenza at pharmacies and national adolescent influenza vaccination coverage was strong and statistically significant (P = 0.018).
Conclusion: The proportion of adolescents vaccinated against influenza at pharmacies is positively correlated with national adolescent influenza vaccination coverage. Up-to-date immunization records are essential to vaccination compliance and infectious disease prevention. Better coordination between pharmacies and providers along with insurance-aligned incentives could improve adolescent access to vaccinations and improve co-operative public health initiatives.

226 | **Opioid prescribing and health outcomes in opioid naive patients in Indiana before and after pivotal events related to opioid prescribing**

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Introduction: The effects of recent initiatives including the CDC opioid prescribing guidelines and hydrocodone/tramadol rescheduling (i.e., "pivotal events") on opioid safety are unknown.
Research Question or Hypothesis: Opioid prescribing practices and adverse outcomes related to opioid prescribing are altered following pivotal events related to opioid prescribing.
Study Design: Retrospective cohort with interrupted time series analysis (ITS)
Methods: Opioid prescribing data (2012-2017) was extracted from the Indiana Network for Patient Care, a statewide health information exchange. Opioid naive at least 18 years old with an opioid prescription(s) within the study period were included. Patients with cancer, terminal illness, and hospice care were excluded. Prescribing practices included average opioid dose in morphine milligram equivalent (MME/day) and days supply. Health outcomes included a composite outcome (of opioid abuse, dependence, and overdose), and mortality. Each outcome was measured monthly from 2012-2017. Pivotal events related to opioid prescribing included tramadol/hydrocodone rescheduling (October 2014) and CDC opioid prescribing guidelines (January 2016). ITS with segmented regression was conducted using R (1.2.1335) to determine changes in prescribing and health outcomes before and after the pivotal events by assessing changes in level (immediate effect) and trend (prolonged effect).
Results: A total of 1,328,287 opioid prescriptions were identified for 341,722 patients. Mean age was 52 (±18.1), 58% were females, and 83% were Caucasians. The most commonly prescribed opioids were hydrocodone, tramadol and oxycodone. Opioid dose declined after the CDC guideline release (level = -0.007, P = 0.9758; trend = -0.045, P = 0.0635), but not after tramadol/hydrocodone rescheduling (level = -0.114, P = 0.6294; trend = 0.074, P = 0.0030). Opioid days supply declined after tramadol/ hydrocodone rescheduling (level = -0.333, P = 0.4839; trend = -0.263, P = 0.0161)., but not after CDC guideline release (level = 0.585, P = 0.2078; trend = 0.038, P = 0.7514). The composite outcome and mortality did not significantly change following the pivotal events.
Conclusion: Policies related to opioid prescribing may affect opioid prescribing practices, however, those effects did not immediately impact related health outcomes.

Pharmacogenomics/pharmacogenetics

227 | **Predictors of genotype-guided antiplatelet therapy prescribing following percutaneous coronary intervention in CYP2C19 intermediate metabolizers**

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Introduction: Due to a moderate strength guideline recommendation, not all CYP2C19 intermediate metabolizers (IM) undergoing percutaneous coronary intervention (PCI) may be prescribed pharmacogenetically (PGx)-recommended $P2Y_{12}$ antiplatelet therapy (APT), which may affect post-PCI major adverse cardiovascular event (MACE) and bleeding risk. Evidence of predictors of post-PCI APT selection in CYP2C19 IMs is limited.

Research Question or Hypothesis: To investigate the effect of clinical and socioeconomic factors on post-PCI $P2Y_{12}$ prescribing and MACE/bleeding risk in CYP2C19 IM patients prescribed PGx-recommended (PGxAPT) APT (prasugrel, ticagrelor) or non-PGx-recommended (Non-PGxAPT) APT (clopidogrel).

Study Design: Retrospective cohort observational study

Methods: Adults identified as CYP2C19 IMs undergoing PCI prescribed a $P2Y_{12}$ inhibitor between January 2017 and March 2020 were included. Participants were stratified by PGxAPT or Non-PGxAPT based on APT prescribed. Clinical, socioeconomic, and prescribing data up to 6 months following index PCI were collected. Data were analyzed using Fischer's exact test, Kruskal Wallis test, and multivariable logistic regression.

Results: A total of 131 patients, 50.4% with acute coronary syndrome, were included (59 in the PGxAPT group, 72 in the Non-PGxAPT group). PGxAPT patients were younger (62 vs. 66 years, P = 0.024) and less likely on anticoagulation (1.4% vs 10%, P = 0.045). There were no differences in socioeconomic indicators (median income, Area Deprivation Index score) between the two groups. Significantly more patients prescribed PGxAPT possessed commercial insurance (29% vs 10%, P = 0.007). Following multivariable logistic regression model adjustment, commercial insurance was a predictor for PGxAPT selection (OR 1.164, 95% CI: 2.197-0.130, P = 0.024). There was no statistical difference in composite MACE (5.6% vs 13.6%, P = 0.136) or bleeding (11.1% vs 8.5%, P = 0.661) between PGxAPT and Non-PGxAPT patients.

Conclusion: Commercial insurance, younger age, and no anticoagulant use are associated with ticagrelor and prasugrel prescribing post-PCI in CYP2C19 intermediate metabolizers. Further study is needed to address barriers to optimal $P2Y_{12}$ antiplatelet prescribing regardless of insurance status.

228 | A machine learning approach to predict clopidogrel bleeding outcomes among genotyped post-PCI patients

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Introduction: CYP2C19 genotype-guided antiplatelet therapy after percutaneous coronary intervention (PCI) reduces the risk of secondary ischemic events. Studies have suggested that CYP2C19 genotype is also associated with bleeding on clopidogrel. Scores that predict bleeding post-PCI, such as PRECISE-DAPT (Predicting Bleeding Complication in Patients Undergoing Stent Implantation and Subsequent Dual Antiplatelet Therapy), have been validated but none have included CYP2C19 genotype as a predictor. Employment of machine learning (ML) algorithms along with a comprehensive array of clinical variables, such as CYP2C19 phenotype, may produce superior bleeding prediction results among patients receiving clopidogrel compared with current prediction standards.

Research Question or Hypothesis: Does the inclusion of CYP2C19 data and the application of ML models produce superior clopidogrel bleeding prediction results compared with PRECISE-DAPT?

Study Design: Retrospective cohort.

Methods: A manually curated, retrospective database of genotyped post-PCI patients was searched for patients who received clopidogrel for 1-year post-PCI and had bleeding that required medical intervention while taking clopidogrel. 465 patients met inclusion criteria and were split into model training (n = 419) and validation (n = 46) datasets. A neural network ML model was built based on the training set using CYP2C19 genotype/phenotype and clinical variables. The trained model was further evaluated by the validation set, measured by the sensitivity, specificity, and ROC-AUC (receiver operating characteristic – area under the curve). As a control of our algorithm's performance, patients in the validation dataset were scored by PRECISE-DAPT.

Results: The ML algorithm was determined to have a sensitivity, specificity and ROC-AUC of 1, 0.812, and 0.912, respectively. When the CYP2C19 data was removed during model training, the ROC-AUC decreased (0.895). The sensitivity, specificity, and ROC-AUC of PRECISE-DAPT was determined to be 0.928, 0.656, and 0.868.

Conclusion: A ML algorithm incorporating clinical factors and CYP2C19 pharmacogenomic data better predicted post-PCI bleeding in patients receiving clopidogrel versus PRECISE-DAPT. Future work will test this ML algorithm in a larger, independent cohort.

229 | Olanzapine increases skeletal muscle DNA 5-hydroxymethylation in healthy volunteers

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Introduction: Atypical antipsychotics cause acute and direct insulin resistance independent of significant weight gain and psychiatric disease. The skeletal muscle is responsible for a majority of insulin-stimulated glucose uptake in the body. Molecular dysregulation of this

glucose uptake, including epigenetic modifications like 5-hydroxymethylcytosine (5-hmC), may help to explain the development of insulin resistance. Despite the skeletal muscle's importance, it is not known what role it plays in atypical antipsychotic-induced insulin resistance.

Research Question or Hypothesis: What is the effect of olanzapine on global DNA 5-hmC in the skeletal muscle?

Study Design: Healthy volunteers (screened for medical or psychiatric history) were given blinded placebo or olanzapine (10 mg) for 7 days. Anthropometrics, energy expenditure via indirect calorimetry, an insulin sensitivity test (the frequently sampled intravenous glucose tolerance test) and muscle biopsies were obtained before and after drug administration.

Methods: 5-hmC levels were measured using enzyme-linked immunosorbent assays according to manufacturer instructions. Methylation levels were normalized and change in 5-hmC was compared before and after treatment between groups using student t-tests. A value of $P < 0.05$ was considered statistically significant.

Results: Six olanzapine and six placebo subjects completed the trial. The average age was 25.4 ± 4.2 and 42% were female. The olanzapine group had a greater increase in insulin resistance ($P = 0.0412$) and a borderline increase in energy expenditure ($P = 0.0542$). Skeletal muscle 5-hmC significantly increased following olanzapine treatment (1.5-fold increase; $P = 0.0052$). 5-hmC had trending associations with increased insulin sensitivity and energy expenditure (both $P < 0.14$).

Conclusion: We identified increased skeletal muscle 5-hmC DNA methylation following acute olanzapine treatment. This may suggest that atypical antipsychotics alter gene regulation in the skeletal muscle. Future work will need to expand on these findings through gene-specific analyses in increased sample sizes to understand the role of 5-hmC changes in atypical antipsychotic-induced insulin resistance.

230 | Simulation to estimate the utility of pharmacogenomic testing in adults hospitalized with COVID-19

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Introduction: Pharmacogenomic testing can help guide treatment selection and dosing. The value of pre-emptive pharmacogenomic testing depends on the frequency of actionable variants and medication use patterns in the population of interest. Patients with high comorbidity burden are more likely to be hospitalized for COVID-19. These patients may benefit from pharmacogenomic testing for medications used to treat both their acute symptoms and chronic comorbidities. Further, institutional biorepositories for COVID-19 patients may provide an avenue for the return of pharmacogenomic results at minimal cost.

Research Question or Hypothesis: What medications with pharmacogenomic guidance are used most often in patients hospitalized with COVID-19, and how often would pharmacogenomic results present opportunities to optimize care?

Study Design: Cross-sectional analysis and simulation.

Methods: We used a registry consisting of electronic health records from consecutive individuals hospitalized with confirmed COVID-19 at a large, urban academic health system. We characterized medication orders, focusing on medications with actionable pharmacogenomic guidance related to 14 commonly-assayed genes. A simulation analysis used medication order data and population phenotype frequencies to estimate how many treatment modifications would be enabled if multi-gene pharmacogenomic results were available.

Results: Our cohort (n = 1852, mean age 60.1 years) was roughly an even mix of Black, White, and Hispanic individuals. During the index hospitalization, 19.7% required mechanical ventilation and 14.4% died. Sixty-four unique medications with pharmacogenomic guidance were ordered at least once in the cohort. Nearly nine in ten individuals (89.7%) had at least one order for a medication with pharmacogenomic guidance. The simulation estimated that 17 treatment modifications per 100 patients would be enabled if pharmacogenomic results were available. The genes *CYP2D6* and *CYP2C19* were responsible for the majority of treatment optimization opportunities, and the medications most often affected were ondansetron, oxycodone, and clopidogrel.

Conclusion: Pharmacogenomic results would be relevant for nearly all individuals hospitalized with COVID-19 and would provide the opportunity to improve clinical care.

231 | Impact of clinical *CYP2C19* genotyping on P2Y12 inhibitor prescribing in post-PCI patients

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Introduction: P2Y12 inhibitors (e.g., clopidogrel, ticagrelor, and prasugrel) prevent cardiovascular events in post-percutaneous intervention (post-PCI) patients. Clopidogrel is bioactivated by *CYP2C19* and

is less effective in patients with a *CYP2C19* no function allele. The objective of this study was to evaluate whether clinical *CYP2C19* genotyping led to clinically effective prescribing of P2Y12 inhibitors in a contemporary cohort of post-PCI patients.

Research Question or Hypothesis: Providers will be less likely to prescribe clopidogrel versus alternative therapy (ticagrelor or prasugrel) for patients with a *CYP2C19* no function allele.

Study Design: Retrospective, cohort study conducted at UF Health Gainesville from 2016 to 2019.

Methods: Data were abstracted from electronic health records for a random subset of 147 post-PCI patients with *CYP2C19* genotype results. Clinically effective prescribing was determined based on the Clinical Pharmacogenetics Implementation Consortium (CPIC) Guidelines recommending ticagrelor or prasugrel over clopidogrel in patients with one (intermediate metabolizer [IM]) or two (poor metabolizer [PM]) *CYP2C19* no function alleles. The antiplatelet prescribed for each patient was evaluated based on each patient's phenotype after the *CYP2C19* test resulted. A chi-square test was used to determine statistical significance.

Results: The patients had a mean age of 62 years and 69% were male. Of the 147 patients, 41 (28%) were PMs or IMs. Clopidogrel was prescribed to 41% (17/41) of PM/IMs versus 84% (89/106) of NM/RM/UMs ($P < 0.001$). Amongst patients with acute coronary syndrome (ACS), 36% (13/36) of PM/IMs versus 85% (78/92) of NM/RM/UMs were prescribed clopidogrel ($P < 0.001$).

Conclusion: A lower rate of prescribing clopidogrel was seen in patients with a *CYP2C19* no function allele. This demonstrates that providers are utilizing *CYP2C19* genetic testing. However, more than 40% of PM/IMs continue to receive clopidogrel, and recent data suggest these patients are still at unnecessary risk of adverse cardiovascular events. Thus, more provider education is needed to further change prescribing practices in post-PCI settings based on pharmacogenetic testing.

232 | Clinical utility of pharmacogenetic testing in medication management within a hispanic population: Pharmacists' perception

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Introduction: Despite the availability of pharmacogenetic assays and the potential benefits of pharmacogenetic testing (PGx) in primary clinical settings, adoption has been slow, particularly for minority populations. We recently published findings from the first pilot program that incorporated PGx-driven recommendations into a Comprehensive Medication Management (CMM) service for a Hispanic population. Since perception of utility is a barrier to implementation, the current study aims to assess pharmacists' perception of the clinical utility of PGx.

Research Question or Hypothesis: Do pharmacists perceive as useful the addition of PGx-driven recommendations to a CMM service?

Study Design: Cross-sectional.

Methods: Twelve pharmacists with CMM experience completed a questionnaire, consisting of 26 items in Likert scale (1-strongly disagree, 5-strongly agree). The instrument underwent technical revision and expert validation. Perception of utility was measured with the variables "perceived value" and "decision-making". "Decision-making" was defined by the usefulness of PGx in identifying drug-related problems (DRPs) of indication, effectiveness, safety, and compliance. Because PGx is not readily available in our routine practice setting, we provided the medication-related action plans from the pilot program, before and after PGx-guided recommendations, to the polled pharmacists for reference. Descriptive statistics were utilized.

Results: 50% of respondents had Medication Therapy Management certification. Most respondents agreed on the utility of PGx for identifying DRPs of efficacy (median Likert-score, 4; IQR, 3-5) and safety (median, 4; IQR, 4-5). Neutral scores were obtained for the "indication" domain (median, 3; IQR, 2-4). However, most respondents disagreed or strongly disagreed with the utility of PGx for assessing compliance. Median score in the overall "decision-making" domain was 4 (IQR, 3-4), similar to overall "perceived value" (median, 4; IQR, 4-5).

Conclusion: Pharmacists agreed that PGx helps them identify DRPs of efficacy and safety, helps guide drug selection, and allows them to make clinical decisions that could not be made otherwise.

233 | Cardiovascular outcomes according to clinical presentation with *CYP2C19*-genotype guided antiplatelet therapy in patients undergoing PCI: A multi-site investigation in real-world settings

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Introduction: Clopidogrel is the most commonly prescribed P2Y12 inhibitor in patients undergoing percutaneous coronary intervention (PCI). *CYP2C19* no function alleles impair clopidogrel effectiveness and have prompted investigations assessing the role of genetic testing to guide post-PCI P2Y12 inhibitor therapy. Differential risk profiles according to clinical presentation may impact the benefit of *CYP2C19*-guided antiplatelet therapy (APT).

Research Question or Hypothesis: To assess the impact of *CYP2C19*-guided APT among PCI patients with an acute coronary syndrome (ACS) vs. a non-ACS indication.

Study Design: A multicenter, pragmatic investigation of clinical *CYP2C19*-guided APT in a real-world setting was conducted. Nine institutions examined outcomes after implementation of genotype-guided APT. *CYP2C19* testing and APT prescribing decisions were per-provider discretion.

Methods: All sites recommended alternative APT (prasugrel or ticagrelor) in no function allele carriers (intermediate and poor metabolizers [IM/PMs]). Major atherothrombotic events (defined as the composite of death, myocardial infarction, stroke, stent thrombosis, or hospitalization for unstable angina) within 12 months post-PCI were ascertained by electronic health record abstraction for 3342 patients. Time to event was compared between IM/PMs receiving clopidogrel (IM/PM-clopidogrel) and either alternative APT (IM/PM-alternative) or patients without a no function allele (normal, rapid, or ultra-rapid metabolizers [NM/RM/UMs]) separately in patients with ACS and non-ACS PCI indications using weighted Cox regression by inverse probability of treatment weights.

Results: Mean age was 63 ± 12, 32% were females, 20% were Black, 31% were IM/PMs, and 69% underwent PCI for ACS. In the ACS subset (n = 2290), event risk was higher in the IM/PM-clopidogrel group versus IM/PM-alternative group (adjusted HR, 1.89;95% CI,1.23-2.91; *P* = 0.004) and NM/RM/UMs (adjusted HR, 1.65;95% CI,1.21-2.25; *P* = 0.002). Among non-ACS patients (n = 1052), risk was similar between IM/PM-clopidogrel and IM/PM-alternative (HR, 1.08;95% CI,0.47-2.45;*P* = 0.859) and NM/RM/UM (HR, 1.20;95% CI,0.63-2.29;*P* = 0.585) groups.

Conclusion: Major atherothrombotic event risk was higher in CYP2C19 IM/PMs prescribed clopidogrel vs. alternative APT in ACS, but not non-ACS patients. This suggests *CYP2C19*-guided APT may be most effective in high-risk patients.

234 | Pharmacogenomics as a guide to improve antidepressant drug selection and dosing in Minnesota Hmong

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Introduction: Current medication treatment for depression is trial-and-error with as few as 37% of patients achieving remission by 8 weeks of receiving their first treatment. In Eurocentric populations, genomic-guided treatment for depression has demonstrated improved remission rates vs. usual-care. Comprehensive genotyping of variants within very important pharmacogenes (VIPs) such as *CYP2D6* and *CYP2C19* for antidepressants minimizes erroneous phenotype calls especially in select populations, such as the Hmong, where allele frequencies differ from that of Eurocentric populations.

Research Question or Hypothesis: Pharmacogenomic panels which include different genetic variants within VIPs will impact treatment recommendations for antidepressants in the Hmong.

Study Design: Descriptive observational study

Methods: Genotype inferred phenotypes were determined in 12, self-identified Hmong adults using a more comprehensive panel (RightMed™, OneOme, MN) and a more focused in-house (University of Minnesota) panel. Predicted medication recommendations based on guidance from the FDA and PharmGKB, and guidelines from Clinical Pharmacogenetics Implementation Consortium and Dutch Pharmacogenetics Working Group were made.

Results: Phenotypes for CYP2C19 from both panels yielded 4 normal metabolizers [NM], 7 intermediate metabolizers [IM], and 1 poor metabolizer [PM]). Phenotypes for CYP2D6 from the in-house panel yielded 12 NM's versus 1NM, 9 IM's, and 2 PM's from the OneOme panel. Moderate or major "gene-drug interactions" between *CYP2C19* and/or *CYP2D6* with at least one antidepressant were predicted in twelve participants from the OneOme and 8 from the in-house panel. All antidepressants carry a "gene-drug interaction" recommendation for at least one participant. From the OneOme panel, the "choose alternate medication" recommendation occurred for 11/16 antidepressants versus 7/16 antidepressants from the in-house panel due to CYP2D6 phenotype calls.

Conclusion: A greater number of variants tested related to drug metabolism in a more comprehensive panel increased the number of

antidepressant gene-drug interactions in the Hmong. Our results imply pharmacogenomics could improve antidepressant success metrics for Hmong patients.

235 | Assessing pharmacogenomics perceptions and education needs in diverse pharmacy professionals in a large, community-based healthcare system

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Introduction: Pharmacogenomics testing provides an opportunity to optimize therapeutics and avoid costly adverse side effects using a person's unique genetic information; however, clinical uptake of pharmacogenomics remains limited. Of importance to our institution is the need to understand the educational readiness of the Pharmacy Department to lead pharmacogenomics implementation into clinical care.

Research Question or Hypothesis: The purpose of this study was to explore confidence and attitudes of pharmacy professionals toward pharmacogenomics implementation through a needs assessment survey to guide development of a comprehensive education program in a large, multi-state community-based hospital and clinic healthcare system.

Study Design: This was a cross-sectional descriptive survey.

Methods: A web-based needs assessment survey was developed and sent to practicing pharmacists, pharmacy residents, pharmacy interns, and pharmacy technicians in a large community-based hospital and clinic healthcare system in February 2020. The survey was comprised of 24 questions for pharmacists, pharmacy residents, and pharmacy interns and 20 questions for pharmacy technicians. The survey queried respondents on demographics, perceptions towards pharmacogenomics implementation and barriers, and baseline knowledge. One email reminder was sent prior to survey closure after 19 days of data collection. Data analysis includes descriptive statistics.

Results: The survey was completed by 373 of 1317 pharmacy professionals (28% response rate). Less than half (47%) believed that pharmacogenomics is important to their current practice, but 65% foresee an important future role. Most (58%) felt their education is inadequate. Only 19% of pharmacists and pharmacy interns felt able to apply pharmacogenomics test results. Most (81%) felt ready to increase their knowledge/skills in the next year. Top perceived barriers to applying pharmacogenomics include lack of education, cost of testing, and other healthcare professionals' lack of knowledge/support.

Conclusion: Targeted education is needed for pharmacy professionals to increase their confidence and knowledge to lead pharmacogenomics implementation in a large community-based healthcare system.

236 | Pharmacogenomics testing: Understanding opportunities to expand use in primary care

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Introduction: Pharmacogenomics (PGx) is a tool that can be utilized to improve medication safety and tailor patient centered medication regimens. Despite PGx information included in the US Food and Drug Administration labeling, it is not commonly implemented in primary care practices. The intent of this work is to further explore not only barriers but tactics to incorporate PGx into primary care practice.

Research Question or Hypothesis: What is the level of self-reported knowledge, expertise, and attitudes of primary care providers (PCPs) in applying clinical PGx test results?

Study Design: A questionnaire was designed based on the Implementing GeNomics In practice (IGNITE) network provider survey, authors' expertise, and feedback from the MedStar Health Pharmacogenomics Steering Committee.

Methods: The questionnaire was disseminated to the PCPs practicing in the outpatient clinics within MedStar Health. Three separate emails were sent over five weeks, which included a link to the questionnaire on the Research Electronic Data Capture tool.

Results: Ninety-one of 312 (29%) of PCPs answered the questionnaire. One participant was excluded from analysis as they only answered the first question. Seventy-six (84%) had heard of PGx testing yet 12 (13%) previously ordered a PGx test. The majority (68, 76%) believed PGx testing can help improve care for patients, however, (23, 26%) reported being confident in their ability to use PGx results in prescribing decisions. Sixty-four (70%) stated it would be helpful to consult with a pharmacist for test interpretation and recommendations for drug and dosing selection. Additionally, respondents noted their preferred educational modalities such as online modules (49, 57%) and conferences and symposiums (45, 52%).

Conclusion: These findings illustrate that PCPs feel that PGx testing can help improve patient care, but support is needed on following up on test results (e.g. pharmacist involvement). Additionally, educational offerings on clinical implementation either online and/or in-person would be helpful.

237 | Clinical utility of pharmacogenomic data collected by a health-system biobank

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Introduction: Utilization of pharmacogenomics (PGx) to individualize medication therapy may prevent harm in those with genetic variants that increase risk for adverse drug reactions (ADRs).

Research Question or Hypothesis: The primary objective of this study was to identify patients enrolled in a health-system biobank with actionable PGx results who received relevant medications and to determine the incidence of ADRs that may have been prevented had the PGx results been used to inform prescribing.

Study Design: Retrospective chart review of patients over 18 years old who received testing for genes subject to Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines at a Partners-affiliated institution participating in the Partners Biobank Program between 01/01/2016-08/19/2019.

Methods: Patients with actionable PGx results in the following four genes with CPIC guidelines were identified: *HLA-A*31:01*, *HLA-B*15:02*, *TPMT*, and *VKORC1*. The patients who received interacting medications (carbamazepine, oxcarbazepine, thiopurines, or warfarin) were identified, and electronic health records (HER) were reviewed to determine the incidence of potentially preventable ADRs.

Results: Of 36,424 patients with PGx results, 2,327 (6.4%) were *HLA-A*31:01* positive; 3,543 (9.7%) were *HLA-B*15:02* positive; 2,893 (7.9%) were TPMT intermediate metabolizers; and 4,249 (11.7%) were homozygous for the *VKORC1* c.1639 G > A variant. Among patients positive for one of the *HLA* variants who received carbamazepine or oxcarbazepine (n = 92), four (4.3%) experienced a rash that warranted drug discontinuation. Among the TPMT intermediate metabolizers who received a thiopurine (n = 56), 11 (19.6%) experienced severe myelosuppression that warranted drug discontinuation. Among patients homozygous for the *VKORC1* c.1639 G > A variant who received warfarin (n = 379), 85 (22.4%) experienced active bleeding and/or INR greater than 5 that warranted drug discontinuation or dose reduction.

Conclusion: Patients with actionable PGx results from a health-system biobank who received relevant medications experienced predictable ADRs. These ADRs may have been prevented if the patients' PGx results were available in the EHR prior to prescribing.

Pharmacokinetics/pharmacodynamics/drug metabolism/drug delivery

238 | Metabolism-mediated drug interactions between ritonavir and oral BTK inhibitor rilzabrutinib in rats

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Introduction: Rilzabrutinib (RLZ), a potent and reversible, covalent oral Bruton tyrosine kinase (BTK) inhibitor, is being developed for the treatment of autoimmune diseases (eg, pemphigus and immune thrombocytopenia). RLZ has limited solubility and is highly metabolized, mainly through CYP3A4.

Research Question or Hypothesis: Evaluate the impact of ritonavir, a potent CYP3A4 inhibitor, on plasma exposure of RLZ and assess its impact on BTK occupancy.

Study Design: Ritonavir 10 mg/kg PO alone and with RLZ 5, 10, and 20 mg/kg PO were given to female Sprague-Dawley rats for PK/PD evaluations.

Methods: PK parameters included peak plasma concentrations, area under the curve, clearance, and half-life followed by comparison in a clinical drug-drug interaction study and assessment of BTK occupancy.

Results: This study revealed that ritonavir affected the disposition of RLZ in rats, likely due to inhibition of CYP3A1/A23 (corresponding to CY3A4 in humans) that increased both RLZ concentrations and 24 h BTK occupancy. Change in RLZ plasma exposure was dose limited (ie, the ratio of change in exposure decreased with increasing dose). The plasma AUC_{inf} was increased ~10-fold at 5 mg/kg, 9-fold at 10 mg/kg and 8-fold at 20 mg/kg RLZ (**Table**), whereas clearance decreased ~90%. The elimination half-life increased slightly from 1.9 to 3.9 h. Mean BTK occupancy at 24 h post-dose in co-treated rats was also increased ~2-fold compared with rats treated with RLZ alone. Similar findings have been confirmed by clinical drug-drug interaction studies.

Conclusion:

Overall results from in vivo rat studies suggested it was possible to evaluate the level of potential drug-drug interaction between ritonavir

	AUC_{inf} (ng*h/mL)		Mean % BTK Occupancy	
RLZ, mg/kg	Alone	+Ritonavir	Alone	+Ritonavir
5	120	1220	25	59
10	331	3060	45	59
20	1350	10800	51	70

and RLZ. in vivo data correlated well with clinical results, supporting RLZ as a substrate for CYP3A4.

239 | Optimization of a promising scaffold that selectively targets right open reading frame kinase 2 (RIOK2)

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Introduction: Right open reading frame kinase 2 (RIOK2) is a human enzyme that has been recently found to be overexpressed in multiple cancers. While a cell-active chemical probe for RIOK2 does not exist, if found, it could expedite research into the biological function(s) of RIOK2 and validate its potential as a therapeutic target.
Research Question or Hypothesis: Can the cellular potency of an existing RIOK2-selective naphthyl-pyridine compound be improved through rational and structure-based design drug design?
Study Design: Pre-clinical research
Methods: Compounds were synthesized through two reaction schemes: coupling amino-pyridines with naphthyl- or substituted-phenyl acetic-acid analogues through HATU or an acyl-chloride intermediate. HEK293 cells were transfected to express a NLuc-RIOK2 fusion protein and incubated with a fluorescent NanoBRET tracer before being treated with varying concentrations of synthesized compounds. Loss of the Bioluminescence Resonance Energy Transfer (BRET) ratio signal curves were utilized to generate IC50 values.
Results: The addition of a 4-methoxy, trifluoromethyl, or chlorine to the pyridine ring increased activity by 2-3x fold while ethyl and bromo substitutions did not change activity. The addition of an alpha-methyl and 6-methoxy on the naphthyl ring also improves potency by 2-3x fold. There was no potency difference between the (R) and (S) alpha methyl enantiomers. There was no additive effect of adding a 4-methoxy to the alpha-methyl 6-methoxy analogue. Changes to the linker length or replacing the naphthalene ring with a dimethyl-phenyl, benzodioxole, or benzodioxane ring caused a loss in activity while ring substitution with a bi-phenyl analogue maintained activity.
Conclusion: The cellular potency of the selective pyridine-amide scaffold can be improved through various substitutions of the parent compound. Our lead compound (IC_{50} = 5.2 μM) serves as a starting point for further development of cell-active chemical tools to explore the biological functions of RIOK2.

240 | Evaluation of vancomycin pharmacokinetics in critically ill patients receiving continuous renal replacement therapy: A retrospective, single-center cohort study

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Introduction: Optimal antibiotic dosing utilizes pharmacokinetic (PK) properties to achieve pharmacodynamic targets against causative pathogens. There is a paucity of data comparing vancomycin PK in conventional vs high continuous renal replacement therapy (CRRT) flow rates.
Research Question or Hypothesis: Vancomycin PK properties will be significantly altered with high compared to conventional CRRT flow rates.
Study Design: Single-center, retrospective cohort study
Methods: Critically ill adult patients receiving CRRT and intravenous vancomycin loading dose with two consecutive post-dose serum concentrations were eligible for inclusion. Patients were divided into two groups: conventional (<30 mL/kg/hr) or high (≥30 mL/kg/hr) CRRT flow rates. Vancomycin PK assessed using first order kinetic calculations were elimination rate constant (Ke), half-life, volume of distribution (VD), and loading dose area under the curve (AUC) for the study population and between group comparisons. A subgroup analysis comparing a subsequent measured trough to PK-predicted concentrations was performed. Results are reported as mean ± SD or median (IQR) as appropriate.
Results: Twenty patients (13 conventional, 7 high) were included. Study population PK were half-life 10.1 (6.9-16.9) hrs, AUC 452 (406-538) mg*hr/L, Ke 0.072 ± 0.037/hr, and VD 0.75 ± 0.22 L/kg. There were no differences between conventional and high flow groups for Ke (0.077 ± 0.077 vs 0.061 ± 0.040/hr, P = 0.376), half-life (9.5 [6.7-15.9] vs 11.9 [8.7-37.1] hrs, P = 0.383), VD (0.73 ± 0.24 vs 0.77 ± 0.21 L/kg, P = 0.688), or AUC (452 [395-528] vs 452 [424-1213] mg*hr/L, P = 0.751), respectively. AUC >400 mg*hr/L was attained in 6 (76.9%) conventional and 10 (85.7%) high flow groups. No difference was seen between actual (16.3 ± 3.4 mg/L) and predicted (15.1 ± 3.2 mg/L) trough concentrations in four available patients.
Conclusion: There were no statistical differences observed in vancomycin PK between conventional and high CRRT flow rates. Variability across PK parameters suggests individualized PK-guided dosing may be warranted. Further studies are needed to confirm the utility of two-point PK calculations for optimizing vancomycin dosing in CRRT.

241 | Comparing mechanism-based protein binding models for unbound phenytoin using population pharmacokinetic modeling in adult patients

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Introduction: Phenytoin (PHT) is a widely used anticonvulsant with a narrow therapeutic range. The pharmacologically active, free PHT (fPHT) is ideal for therapeutic drug monitoring due to PHT's capacity-limiting metabolism and extensive protein binding, but total PHT (tPHT) is still commonly measured in clinical practice for cost savings. Various protein binding models have been proposed to describe the relationship between fPHT and tPHT, but systematic comparisons of these models within a single dataset and experimental setting have not been conducted.

Research Question or Hypothesis: To determine the optimal model for PHT protein binding and the influence of clinical covariates using non-linear mixed-effects modeling in adult patients in a tertiary hospital.

Study Design: Retrospective data analysis from Vancouver General Hospital (Canada).

Methods: Population pharmacokinetic modeling with stochastic approximation expectation-maximization (MonolixSuite2019R2) using 37 paired fPHT and tPHT concentrations were conducted. A stepwise approach was utilized to identify the optimal structural, protein binding, and residual error models. The Winter-Tozer(tPHT = fPHT*[albumin coefficient*albumin+0.1]*10), linear binding(tPHT = fPHT+binding proportionality constant*fPHT), and non-linear single- or multiple-binding site models(tPHT = fPHT+Σ[maximal binding capacities*fPHT]/[dissociation constants+fPHT]) were compared. Models were evaluated based on biological plausibility, relative standard errors (RSEs), objective function values (OFVs), goodness-of-fits plots, visual predictive checks, and bootstrapping.

Results: The majority of the sample population was considered non-critical-care(56.8%) with median[range] age of 62[20-93]years, weight 70[30-102]kg, albumin 2.7[1.7-3.6]g/dL, bilirubin 0.4 [0.1-14.6]mg/dL, and serum creatinine 0.9[0.3-6.5]mg/dL. PHT free fraction was 0.118[0.071-0.194]. The linear binding model had reduced OFV(-4.68) than the Winter-Tozer model, illustrated smaller RSEs in fixed-effects parameters than the non-linear single-binding site model, and exhibited physiologically-relevant estimates. In contrast, the non-linear multiple-binding site model preformed the worst, possibly due to model over-complexity. Albumin concentration positively affected the binding proportionality constant in the linear binding model.

Conclusion: The linear binding model is best suited for describing the population pharmacokinetics of PHT and may be utilized to improve the prediction of fPHT from tPHT in adult patients.

242 | Pharmacokinetics (PK) and dialytic clearance of apixaban during *in vitro* continuous renal replacement therapy (CRRT)

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Introduction: While apixaban may represent a safer, more efficacious alternative to parenteral anticoagulation in ICU patients, the lack of PK data to inform appropriate dosing during CRRT currently precludes its use in a significant proportion of this population.

Research Question or Hypothesis: To evaluate apixaban transmembrane clearance (CL_{TM}) via AUC, sieving coefficient (SC) and saturation coefficient (SA) during *in vitro* CRRT, assess protein binding and circuit adsorption, and provide initial dosing recommendations.

Study Design: *In vitro* PK study.

Methods: Following addition of apixaban to the CRRT circuit, serial pre- and post-filter bovine blood samples were collected along with analogous effluent samples. Experiments were performed in duplicate using CVVH and CVVHD modes, multiple filter types (M150; HF1400), flow rates (2 L/h; 4 L/h), and points of CVVH replacement fluid dilution (pre; post; pre/post filter). Apixaban concentrations were quantified via LC/MS-MS, and PK parameters were estimated via noncompartmental analysis. Optimal doses were estimated for CRRT flow rates from 0.5-5 L/h vs. CL_{TM} via linear regression by matching AUCs observed *in vitro* via three-way ANOVA to target AUC thresholds demonstrated in Phase 2/3 studies.

Results: Mean HF1400 and M150 filter adsorption differed significantly (38% versus 13%, $P < 0.05$), while mean (±SD) protein binding was 70.81 ± 0.01%. CL_{TM} calculated by AUC was more precise than by SC/SA * flow rate. Linear regression revealed significant effects of filter type and flow rate on CL_{TM} by AUC, suggesting doses of 5-10 mg BID may be needed for flow rates ranging from 0.5-5 L/h, respectively.

Conclusion: Apixaban CL_{TM} during modeled *in vitro* CRRT resulted in estimated dosing recommendations of 5 mg BID for flow rates ≤3 L/h and 7.5-10 mg BID for rates >3 L/h, depending on filter type. Safety and efficacy of these proposed dosing regimens warrants further investigation in clinical studies.

243 | Prohibitin-1, a circulating protein with therapeutic potential for glycemic control

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Introduction: The development of new therapeutics for Type 2 Diabetes Mellitus are evolving to fit the growing clinical need. In humans, serum prohibitin-1 (PHB1) concentrations are elevated during septic shock and preliminary data from our lab suggests PHB1 may activate glycolytic flux and glucose uptake in the heart. However, no studies

to date have explored the direct effect circulating PHB1 has on insulin signaling and glucose homeostasis.

Research Question or Hypothesis: Does an injection of recombinant PHB1 (rPHB1) affect blood glucose levels (BGLs) and insulin signaling? Is the effect differentially impacted by age?

Study Design: Mouse Model.

Methods: Young (8 weeks, n = 40) and old (30 weeks, n = 30) cohorts of wild type C57BL6J mice received intraperitoneal doses of rPHB1 (300 ng/100 μl) or normal saline (100 μl) two separate times with or without addition of insulin (0.75 U/kg body weight) during an insulin tolerance test. Tail nicks and a glucometer were used to measure BGL at baseline and at 15, 30, 60, 75, 120, and 180 minutes. BGLs were normalized based on change from baseline level. Biochemical analysis, immunoblots, of skeletal muscle tissue was completed to interrogate a potential mechanism for increased peripheral glucose uptake.

Results: Administration of rPHB1 alone resulted in a decrease in BGLs for old (-12% BGL, $P < 0.05$) but not young (3%, $P = 0.33$) mice over the full monitoring period. Combination of rPHB1 with insulin did not significantly have additive effect on BGL in old (-7%, $P = 0.20$) and young (-9% $P = 0.38$) mice. Immunoblots suggest rPHB1's effect on blood glucose is independent of the insulin pathway.

Conclusion: Overall, these results suggest circulating PHB1 stimulates serum glucose uptake into peripheral tissues independent of insulin in an age-dependent manner. Further analysis at the cellular and biochemical level suggested rPHB-1 affects BGL independent of the insulin pathway in skeletal muscle tissue. Future studies will investigate if this effect is homogenous at other tissue sites.

244 | Determining the risk of elevated digoxin concentrations in patients with acute and chronic kidney disease: A retrospective cohort study

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Introduction: Tertiary drug references recommend reducing digoxin loading doses by 50% for patients with renal dysfunction. This recommendation is based on literature utilizing immunoassays that are falsely elevated by the presence of digoxin-like immunoreactive substances (DLIS) which are present in patients with renal impairment. Newer assays are less affected by the presence of DLIS. The question remains of whether a dose reduction is necessary for patients with renal dysfunction.

Research Question or Hypothesis: Is a reduced loading dose of digoxin necessary for patients with renal dysfunction?

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

Methods: Included patients received an intravenous loading dose of digoxin and had a digoxin concentration 6-24 hours after the digoxin load. Patients were stratified into three groups: acute kidney injury (AKI), chronic kidney disease (CKD) and non-AKI/CKD (NKI) based on glomerular filtration rate and serum creatinine. The primary outcome was frequency of supratherapeutic digoxin concentrations (> 2 ng/ml) within each group and secondary outcomes included rates of adverse events.

Results: A total of 146 digoxin concentrations were included (AKI = 59, CKD = 16, NKI = 71). Median total digoxin loading dose was 12.9, 10, and 13.3 mcg/kg (ideal body weight [IBW]) respectively ($P = 0.22$). Frequency of supratherapeutic levels was similar between groups (AKI: 10.2%, CKD: 18.8%, NKI: 11.3%; $P = 0.61$). When accounting for dose, a pre-planned logistic regression demonstrated no significant relationship between AKI or CKD and the development of a supratherapeutic level (AKI OR 1.3 95% CI: 0.4-4.5; CKD OR 4.3 95% CI: 0.7-23). There was no difference in adverse events between groups.

Conclusion: A reduced digoxin loading dose is not necessary in patients with AKI. However, the CKD group was underpowered to detect a difference and future studies are warranted. No supratherapeutic concentrations developed in any patient who received ≤12 mcg/kg IBW.

245 | Population PK of ibrexafungerp in healthy subjects and patients treated for vulvovaginal candidiasis

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Introduction: Ibrexafungerp is a novel antifungal in Phase 3 clinical trials for treatment of Vulvovaginal Candidiasis (VVC).

Research Question or Hypothesis: Develop population pharmacokinetic (PPK) model for ibrexafungerp and perform simulations to assess dosing regimens for VVC patients.

Study Design: PK data was analyzed using NONMEM (V7.3). Data was pooled from two studies in healthy subjects and one study in VVC patients at doses ranging 150-750 mg QD or BID.

Methods: PK data was assessed for 2- and 3-compartment linear models with first-order absorption. Absorption delay and influence of covariates on PK were evaluated. The final PPK model was qualified using goodness-of-fit plots, bootstrap and visual predictive checks (VPCs). The final PPK model was used to simulate PK profiles for dosing scenarios of interest: One-day dosing 150 mg BID, 300 mg BID, and 600 mg BID.

Results: PPK model included total of 1,263 PK observations from 101 subjects (55 healthy, 46 patients). The PK data was best described by a 2-compartment model with first-order absorption with lag-time (8 minutes), plus one transit compartment. Food increases exposures (C_{max} and AUC_{0-24}) by approximately 44%. Median (5^{th} and 95^{th} percentile) AUC for fed status is 9923 (7224, 12188) ng.h/mL and C_{max} is 636 (453, 771) ng/mL in VVC patients treated at 300 mg BID dose. Estimates of PK parameters were different ($P < 0.01$) in healthy subjects compared to VVC patients that results in C_{max} and AUC_{0-24} values predicted to be about 20% lower in healthy subjects, but unlikely to be clinically relevant. The effect of age, gender and body weight on exposure was ≤5% or non-detectable.

Conclusion: A population model was developed which reliably predicts PK of ibrexafungerp. There was an effect of food (44% increase) on exposure. Healthy volunteers have exposures comparable to VVC patients. Other covariates such as age, sex and bodyweight have no clinically relevant effect on exposure.

246 | Effect of oral doses of ibrexafungerp on pharmacokinetics of pravastatin in healthy subjects

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Introduction: Ibrexafungerp is a novel antifungal in Phase 3 clinical trials for treatment of Fungal Infections.

Research Question or Hypothesis: Determine effect of ibrexafungerp repeated oral dosing on pravastatin (PRA) PK, and safety of combination of PRA with ibrexafungerp.

Study Design: Open-label, randomized, two-period, crossover study in healthy adults (n = 28) who received in one period a dose of PRA 20-mg, and in another period ibrexafungerp 750 mg BID plus PRA 20-mg.

Methods: Treatments were all in fasted condition. Serial PK samples taken after PRA administration, limited PK samples taken daily following ibrexafungerp dose to confirm steady-state concentrations. Safety was monitored throughout study by clinical and laboratory evaluations up to 14 days after last dose in each subject.

Results: PRA exposure increased when in presence of ibrexafungerp, AUC_{0-24hr} geometric mean ratio (90% CI) of 2.8 (2.3, 3.5); and C_{max} geometric mean ratio (90% CI) of 3.5 (2.6, 4.5). There was no significant difference in T_{max} (1.0 hour in both treatments), or $t_{1/2}$ (2.4 vs. 2.3 hours for PRA alone).

Ibrexafungerp on Day 3 at pre-dose had Mean (SD) concentration of 1450 ng/mL (401) consistent with the previously observed steady-state concentrations.

The treatments were generally well tolerated, no serious adverse events or deaths reported. There were no clinically significant laboratory or vital signs abnormalities reported during. All adverse events were mild or moderate in intensity, most common treatment-emergent and treatment related AEs in 28 subjects were diarrhea in 19, (68% [18 mild]), Nausea in 5 (18% [all mild]) and headache in 4 (14% [3 mild]).

Conclusion: Ibrexafungerp increased exposure to pravastatin that is a known substrate for OATP1B3 transporter – consistent with the inhibitory effect of ibrexafungerp on OATP1B3 observed in-vitro. There were no significant safety observations. Dose reduction may be required for pravastatin when co-administered with ibrexafungerp multiple-day dosing in invasive fungal infections but not for one-day dosing in VVC treatment.

Psychiatry

247 | Monitoring of prolactin as a measure of bone health for patients prescribed antipsychotics at a federally qualified health center

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Introduction: Antipsychotics are used to treat a multitude of psychiatric conditions. Their use has been associated with hyperprolactinemia. Prolonged elevation of serum prolactin levels can impair bone mineralization, leading to osteopenia, osteoporosis, or bone fractures. There is a lack of consistent recommendations related to decreased bone mineral density and therefore an absence of standard monitoring across patients taking antipsychotics.

Research Question or Hypothesis: In an FQHC, what, if any monitoring of prolactin is being completed for patients prescribed antipsychotics as a measure of bone health?

Study Design: Retrospective Medication Use

Methods: This MUE was approved by the Pacific University IRB. Data report identified patients with an antipsychotic prescription ordered in the EMR between May 31, 2018, and June 1, 2019 and resulted prolactin levels. Patients were excluded if the prescription was from an outside specialist, lack of prolactin level in EMR, or prolactin levels were prior to antipsychotic initiation. Descriptive statistics were used to summarize and describe collected data. Results evaluate the appropriate management of hyperprolactinemia and decreased bone mineral density induced by antipsychotic use.

Results: 715 patients were prescribed antipsychotics during the study period. Of those, 51 had prolactin levels monitored, 39 with levels drawn after antipsychotic initiation. A total of 67 prolactin levels were drawn, with a range of 0.4-132.1 ng/mL, 15 patients had levels >25 ng/mL. Associated diagnosis for prolactin orders included hyperprolactinemia adverse effects (30), antipsychotic use (21). 4 DEXA scans were ordered, 2 were completed with results in the EMR. 4 patients had a fracture history reported in the EMR.

Conclusion: Currently, there is limited monitoring of prolactin for patients prescribed antipsychotics within the FQHC. DEXA scans were ordered in response to fractures, however, it is unknown if due to antipsychotic use. Specific guidance is needed if routine monitoring of prolactin is warranted as a way to monitor bone health in patients prescribed antipsychotics.

248 | Assessing the perception of stimulant medication use in a College of Pharmacy

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Introduction: In 2014, 4 in 10 college-aged students responded to the Partnership for Drug-Free Kids' stimulants survey that they abuse prescription stimulants in order to improve academically. University of Louisiana at Monroe College of Pharmacy student researchers formulated a survey to assess their student population's perception, use, and misuse of stimulant medications and found that over half of respondents believe that prescription stimulants are being used for academic advantage. This study was designed to replicate the survey at Xavier University of Louisiana, and to discover our pharmacy students' perceptions and use or misuse of stimulants.
Research Question or Hypothesis: What are pharmacy students' perceptions of stimulant prescription medication use and misuse by students? Is there stimulant misuse among the pharmacy student population?
Study Design: 595 Xavier College of Pharmacy students were invited to participate in a voluntary electronic survey that was available between November 13 and December 4, 2019, of which 120 students responded.
Methods: Forty-one multiple choice or likert type questions were asked to assess the attitudes of stimulant use within the college. Skip logic was used to target certain questions to students depending on if they had taken a stimulant medication and whether or not they had a prescription. All information obtained remained anonymous and protected through the encryption of Google Forms to ensure privacy and encourage honesty. IRB approval obtained November 2019.
Results: Most students agreed to the statement "Prescription stimulants are being used for academic achievement" and believe that students who take stimulant medications have an academic advantage. Almost all respondents stated that it is easy to obtain stimulants without a prescription, and over 1/4 stated that they would be more inclined to use if it were not against the college policy.
Conclusion: The majority opinion among Xavier Pharmacy students is that stimulant medications offer an academic advantage.

249 | Coping, resilience, and emotional wellbeing in pharmacy students during the COVID-19 pandemic

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Introduction: In March 2020, the World Health Organization declared the COVID-19 outbreak a pandemic impacting the mental wellbeing of the general public. Pharmacy students may experience greater stress during this pandemic due to interruptions in classes or rotations, concerns regarding personal/family health, and social isolation from peers. These changes may result in behavior shifts, difficulty concentrating, and increased use of negative coping strategies. The extent to which these factors affect overall student wellbeing during a pandemic is largely unknown.
Research Question or Hypothesis: The purpose of this study was to assess coping, resilience, personal characteristics, and emotional wellbeing among pharmacy students during the COVID-19 pandemic.
Study Design: This was a cross-sectional study of three pharmacy programs in California, Florida, and North Carolina, after the onset of the COVID-19 pandemic via an online, anonymous 71-item questionnaire using REDCap software during May-July 2020.
Methods: The Emotional Wellbeing in Healthcare Professions Students Questionnaire (EWB-Q) assessed coping, personal resilience, personal characteristics in pharmacy students and determined emotional wellbeing vis-à-vis these factors. Linear regression and descriptive statistics analyses were conducted using SPSS v.26.
Results: Multiple linear regression indicated levels of coping strategies, personal resilience, and ethnicity (Hispanic vs. non-Hispanic) explained a significant amount of the variance (approximately 30%) in emotional wellbeing scores of pharmacy students (N = 104). A significant regression equation was found, $F(2,76) = 11.785$, $P < .000$, $R^2 = .317$, $R^{2\ \text{adjusted}} = .291$). No differences were noted between students in didactic coursework vs. rotations. Greater use of coping strategies, higher levels of resilience, and identifying as Hispanic were significant predictors of increased emotional wellbeing.
Conclusion: Student mental health continues to be of importance, especially during crises and pandemics. Therefore, pharmacy programs should cultivate emotional wellbeing of their students. Campus-based initiatives may be needed to encourage healthy coping behaviors and bolster students' personal resilience to better prepare them for providing front-line patient care in the future.

250 | Polygenic risk for coronary artery disease, cardiovascular medication burden and cognitive performance in psychotic disorders

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Introduction: Cognitive impairment is common in idiopathic psychotic disorders, adversely affecting clinical and functional outcomes. Epidemiology studies have identified associations between cognitive decline in psychotic disorders and/or coronary artery disease (CAD), but not an underlying etiology.

Research Question or Hypothesis: To evaluate relationships between genetic risk for CAD, cardiovascular medications, and cognitive performance in psychosis.

Study Design: Cross-sectional study.

Methods: Neuropsychological performance using the Brief Assessment of Cognition in Schizophrenia (BACS) was assessed in 617 Caucasian participants (psychosis N = 405 and healthy controls N = 212) 18-65 years of age from the Bipolar-Schizophrenia Network on Intermediate Phenotypes (B-SNIP) study. Genotyping was performed using the Illumina PsychChip followed by imputation resulting in 4,322,238 SNPs. Polygenic risk scores for CAD (PRS_{CAD}) were calculated using the clumping+thresholding approach from summary statistics of a large CAD genome-wide association study across 13 *P*-value thresholds (P_T 0.5–5xE^{-8}). The best fit P_T was used for subsequent analyses. Cardiovascular medications were categorized based on drug class/mechanisms. Discriminant analyses contrasted higher (≥2 medications) and lower (<2 medications) cardiovascular drug burden groups for association studies with the BACS. Multiple regression analyses examined PRS_{CAD} and medication burden in relation to the BACS scores controlling for sex, age, and population substructure.

Results: Higher PRS_{CAD} was associated with poorer cognitive performance (lower composite BACS score, r = –0.15, $P = 2.37x10^{-3}$) in the psychosis group. This was primarily driven by the Verbal Memory (r = –0.17, $P = 6.61x10^{-4}$) subtest of the BACS. Cardiovascular medication burden was negatively correlated to the BACS in both psychosis and healthy controls (r = –0.11, *P* = 0.013). No cardiovascular medication*PRS_{CAD} interactions were identified and there were no effects of cardiovascular diagnoses, psychosis severity, or other medications on these findings.

Conclusion: Genetic risk for CAD and cardiovascular medication burden were independently associated with cognitive impairment in psychosis. These findings indicate that genetic risk for CAD, and medications to treat CAD may increase risk for cognitive impairment in psychosis.

Pulmonary

251 | Assessment of the use of procalcitonin in hospitalized, non-critically ill patients with chronic obstructive pulmonary disease exacerbations

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Introduction: Use of antibiotics in chronic obstructive pulmonary disease (COPD) exacerbation is controversial. Guidelines indicate appropriate antibiotic prescribing may improve clinical outcomes. Previous studies found procalcitonin (PCT)-guided algorithms are potentially superior to standard protocols for COPD exacerbations.

Research Question or Hypothesis: Is hospital length of stay (LOS) altered when PCT is appropriately used to guide antibiotic prescribing in COPD exacerbation?

Study Design: Retrospective, multicenter, cohort

Methods: Hospitalized, non-critically ill patients with a primary diagnosis of COPD exacerbation and a documented initial PCT of ≤0.5 μg/L admitted from January 1, 2017 through September 30, 2019 were eligible for inclusion. PCT use was considered appropriate if antibiotics were never initiated or if antibiotics were discontinued within a defined time period based on antibiotic frequency (24 hours if frequency ≥ 24 hours and 12 hours if frequency < 24 hours). The primary outcome was difference in hospital LOS for patients with appropriate PCT use versus inappropriate PCT use. Secondary outcomes included antibiotic days of therapy (DOT), 30-day all-cause and COPD-related readmission rates. Outcomes were analyzed using Chi-square (nominal) and Mann-Whitney U (non-parametric continuous) in SPSS Version 26.0.

Results: One hundred fifty-nine patients [appropriate PCT use (n = 50) and inappropriate PCT use (n = 109)] were included in this study. The median LOS (2.7 days vs. 3.0 days; *P* = 0.02) and median DOT (1 day vs. 9 days; *P* < 0.01) were significantly shorter in the appropriate PCT use group. While not statistically significant, 30-day all-cause (12% vs. 15.6%; *P* = 0.55) and COPD-related (4% vs. 10.1%;

P = 0.23) readmission rates were lower in the appropriate PCT use group.

Conclusion: Appropriate antibiotic discontinuation or not initiating antibiotics in patients with COPD exacerbation and an initial serum PCT level ≤ 0.5 μg/L resulted in a shorter hospital LOS. While there is evidence that supports using a PCT-driven protocol in COPD exacerbation, further research is needed.

Substance Abuse/Toxicology

252 | Exploring the relationships between solo and co-substance use (marijuana, tobacco, alcohol, illicit drugs) and anxiety disorders among diverse college student populations

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Introduction: The prevalence of marijuana use among young adults with anxiety disorders is markedly high. Studies have shown that people with marijuana use disorder are over five times more likely to have anxiety disorders. Data is lacking on the link between marijuana use, along with other substances, and concurrent anxiety disorders.

Research Question or Hypothesis: Exploring the relationships between solo and co-substance use (marijuana, tobacco, alcohol, illicit drugs) and anxiety disorders among diverse college student populations.

Study Design: A cross-sectional study using data from the The Healthy Mind Study survey at the University of Southern California.

Methods: SPSS was used to conduct bivariate analyses (cross tabulation and chi-square analysis) to examine whether students with moderate to severe anxiety disorders varied by demographic and substance use variables. Multivariate logistic regression analyses were conducted to examine the associations of anxiety disorders with the demographic and substance use predictors.

Results: Compared to students that did not use any substance in the past 30 days, students who used marijuana and cigarettes were 2.4 times more likely to have anxiety disorders (AOR = 2.40, P = .000), followed by students who used marijuana, illicit drugs, and cigarettes (1.74 times more likely, AOR = 1.74, P = .003), then students who only used illicit drugs (1.47 times more likely, AOR = 1.47, P = .036), and students who had only used cigarettes (1.38 times more likely, AOR = 1.38, P = .003).

Conclusion: Marijuana use alone does not appear to be significantly predictive of anxiety disorders, however, cigarette and marijuana co-use does appear to be predictive, as well as the tri-use of marijuana, illicit drugs, and cigarettes. Treatment programs can address the co-use of marijana and cigarettes and tri-use with illicit drugs to decrease the likelihood of anxiety disorders. Screening college students with such use patterns may be useful in identifying generalized anxiety disorders.

253 | Clinical effects of acute and acute on chronic warfarin overdose

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Introduction: Guidelines exist on the management of supra-/sub-therapeutic international normalized ratio (INR) values for patients on warfarin. However, there is a paucity of literature relating to an acute overdose of warfarin.

Research Question or Hypothesis: What is the trajectory of INR in patients with acute and acute-on-chronic (AOC) warfarin overdoses?

Study Design: Retrospective observational study

Methods: The Maryland Poison Center database was queried for all acute and AOC warfarin overdoses in patients ≥12 years between January 1st, 2000 until October 31st, 2019 managed in a health care facility. The primary outcome was to determine the time to peak INR. Secondary outcomes included risk factors associated with INR > 10 and describing patient characteristics. Differences between acute and AOC groups were analyzed utilizing chi-square or Fisher's exact and t-test or Wilcoxon rank-sum tests. The association between INR > 10 and various factors was analyzed using multivariate logistic regression.

Results: A total of 163 overdoses were included, 68 acute and 95 AOC. INR peaked at median value of 3.7 (IQR 2.2–5.3) between 36–48-hours. In patients who did not receive phytonadione, INR peaked at a median value of 3.80 (IQR 2.6–5.5) between 24–36-hours. Median time to phytonadione was 22.0 hours (IQR 12.4–38.9). The AOC group had a greater mean age (56 vs 43 years, P < 0.0001), median INR values (2.4 vs 1.4, P < 0.01), and males (62.1 vs 41.2%, P < 0.01). The median dose ingested was 75 mg (IQR 30–170). Factors associated with an INR > 10 included initial INR and reported quantity ingested (P < 0.05). Peak INR was greater in the AOC group (6.1 vs 3.4, P < 0.0001), although bleeding rate was similar (14.7 vs 7.4%, P = 0.13). The majority of patients received phytonadione (62.0%), with fewer receiving blood products (16.6%).

Conclusion: Peak INR values after warfarin overdose occur between 36–48-hours after presentation. Initial INRs and reported quantity ingested may be useful to predict those needing treatment.

254 | A retrospective chart review of key factors of medication assisted treatment (MAT) outpatient program success: A focus on the pharmacy-related characteristics

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Introduction: Opioid use disorders affect 2 million adults and are often underestimated. Medication-Assisted Treatment (MAT) combines behavioral therapy with medications, which provides a controlled approach in overcoming opioid addiction with national retention rates of 46%. MAT programs reduce relapse risk, prevent infection, and avoid overdose. Although not widely studied, MAT retention predictors include program satisfaction, treatment duration, and higher MAT medication dosages. Research is needed to identify others.

Research Question or Hypothesis: Does medication adherence improve MAT program retention rates?

Study Design: IRB-approved retrospective cohort.

Methods: Ambulatory MAT clients ≥18 years old, who completed ≥1 urine drug screen (UDS) within the first 6 months after intake, were included. Baseline characteristics, client demographics, and MAT program adherence, defined as ≥80%, were collected. Adherence to MAT medications, naloxone, and other medications was obtained from pharmacy records. The primary outcome was to determine whether medication adherence improves MAT program retention. Nominal data was analyzed using Chi-squared test and continuous data using unpaired t-test.

Results: Of 108 adults included, an 80% average adherence rate was demonstrated. Fewer clients in the MAT adherent group had comorbid medical conditions (P = 0.047) compared with the MAT nonadherent group. No difference was seen between groups for comorbid psychiatric disorders (P = 0.16), concurrent psychotropic use (P = 0.47), or negative opioid screens (66.2% vs. 59.5%, P = 0.49). MAT adherent clients were more adherent to psychotropic medications (61.2% vs. 34.8%, P = 0.036) and maintenance medications (43.9% vs. 20%, P = 0.048) versus MAT nonadherent clients. Naloxone was prescribed for 92.6% of clients and obtained 66.7% of the time.

Conclusion: This study demonstrated an 80% MAT adherence rate. Clients adherent to their MAT agent were significantly more adherent to both psychotropic and maintenance medications. No difference was seen, however, between groups for negative opioid screens. Further studies may provide additional insight into potential MAT retention factors.

255 | Characteristics and prevalence of self-reported kratom use in a representative US general population sample

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Introduction: Kratom (*Mitragyna speciosa*) is an herbal product that may produce stimulatory effects at low doses and analgesic/sedative effects at higher doses. Recent reports have described an increase in use, though US characteristics of use are widely unknown.

Research Question or Hypothesis: To estimate lifetime use of, and descriptive characteristics associated with, kratom use among a US general sample.

Study Design: Cross-sectional survey

Methods: A questionnaire was administered online by Qualtrics® research panel aggregator via quota-based sampling. Data were collected from a sample of respondents that mirrored the general US population aged 18-59 years, with regards to age, geography, ethnicity, income, and education level, based on census data. The survey assessed demographic/medical history as well as patterns of kratom and other drug use.

Results: Among 1,843 respondents, 112 (6.1%) reported lifetime use of kratom with 16 (14.3%) endorsing daily use, 24 (21.4%) weekly or monthly use each, 12 (10.7%) infrequent or yearly use, and 36 (32.1%) endorsing use once/twice per lifetime. Respondents reporting kratom use were generally between the ages of 25-44 years (n = 81; 72.3%), male (n = 68; 60.7%), non-Hispanic white (n = 73; 65.2%), and living in South (n = 48; 42.9%) and Northeast (n = 24; 24.1%) regions of the US. Those with kratom use reported diagnoses of anxiety (n = 57; 50.9%), depression (n = 55; 49.1%), chronic pain (n = 28; 25.0%) and bipolar disorder (n = 24; 21.4%) along with opioid use disorder (n = 45; 40.2%), alcohol use disorder (n = 52; 47.3%), or other substance use disorders (n = 27; 24.1%). Regular/lifetime use of other substances were high and ranged from 80 (71.4%) endorsing heroin use to 108 (96.4%) endorsing cannabis use amongst those using kratom.

Conclusion: Within this national sample, 6.1% of those surveyed reported lifetime kratom use, and this was often associated with concurrent psychiatric diagnoses, substance use disorders, or use of other substances. Further research is required to determine motivators for kratom use.

256 | Quetiapine and olanzapine misuse and abuse in a US general population sample

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Introduction: Antipsychotic medications may be used outside of medical advice by individuals self-medicating undertreated or undiagnosed mental illness, or for purposes of euphoria. Recent reports have described misuse/abuse of quetiapine and, to a lesser extent, olanzapine.

Research Question or Hypothesis: To estimate lifetime use of, and descriptive characteristics associated with, quetiapine/olanzapine misuse/abuse among a US general population sample.

Study Design: Cross-sectional survey

Methods: A questionnaire was administered online by Qualtrics® research panel aggregator via quota-based sampling. Data were collected from a sample of respondents that mirrored the general US population aged 18-59 years with regards to age, geographic region, ethnicity, income, and education level. The survey assessed demographic/medical history, identification of quetiapine/olanzapine use, patterns and reasons for quetiapine/olanzapine use, and attitudes regarding prescription drug misuse. Misuse/abuse was defined as use of either drug for reasons other than a diagnosed medical condition or obtaining either drug without prescription. A logistic regression model was created to identify individual characteristics associated with quetiapine/olanzapine misuse/abuse.

Results: Among 1,843 respondents, 229 (12.4%) reported use of either quetiapine/olanzapine, with 116 (6.3%) reporting misuse/abuse. Specifically, 5.9% (N = 109; 72 [3.9%] quetiapine; 50 [2.7%] olanzapine) reported use outside of medical recommendations, and 4.0% (N = 74; 53 [2.9%] quetiapine; 26 [1.4%] olanzapine) reported obtaining without a prescription. Recreational quetiapine/olanzapine use was documented in 40 (2.2%) and 29 (1.6%) respondents, respectively, while 53 (2.9%) and 36 (2%) used to enhance effects of another drug. Among those reporting misuse/abuse, concomitant use of opioids, benzodiazepines, or alcohol to enhance effect was reported by approximately 40%-60% of respondents. In the regression model, previous treatment for addiction (OR = 2.48, 95% CI = 1.08-5.71), Black/African American race (OR = 4.28, 95% CI = 1.19-15.46), and total attitudinal risk score (OR = 1.23, 95% CI = 1.15-1.33) were associated with increased risk of misuse/abuse.

Conclusion: Within this national sample, 6.3% of those surveyed reported previous quetiapine or olanzapine misuse/abuse. Further research is required to understand motivators for misuse/abuse.

257 | Evaluation of inpatient formulary substitution of buprenorphine-naloxone products

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Introduction: Outpatient prescribing of buprenorphine-naloxone has increased since amendments to the Drug Addiction Treatment Act of 2000. Patients with substance use disorders have also been found to have a higher rate of hospitalizations; therefore, suggesting a potential for increased utilization of buprenorphine products in the inpatient setting as a continuation of treatment. When considering the pharmacokinetic principles of the buprenorphine-naloxone products, there is not one direct interchange between each of the products. There is a current lack of literature that reports the rates of appropriate formulary conversions in hospitalized patients.

Research Question or Hypothesis: To evaluate the rates of appropriate conversion from patient's home buprenorphine-naloxone product to the formulary product.

Study Design: Retrospective chart review

Methods: Hospitalized patients receiving buprenorphine-naloxone as a continuation of home medication were considered for inclusion. The primary outcome was rates of appropriate conversion from home buprenorphine-naloxone product to formulary buprenorphine-naloxone films. Appropriate conversion was determined by a predetermined conversion chart. Secondary outcomes included describing trends of inappropriate conversions and rates of IV naloxone use. Descriptive statistics and chi square tests were used for data analysis using IBM SPSS Version 26.

Results: One hundred patients were randomized for inclusion, one patient was deemed not eligible after randomization. For the primary end point, 52/99 (52.5%) patients had buprenorphine-naloxone converted appropriately. Of the patients with inappropriate conversions, 31 received a decreased amount of buprenorphine. Seven patients were prescribed ≥3 films/dose, with three patients receiving unfeasible amounts of 5, 6, and 8 films/dose respectively. Six patients received IV naloxone, with one patient receiving six films per dose and one patient receiving a higher dose of buprenorphine than their home dose.

Conclusion: Nearly half of patients had buprenorphine-naloxone inappropriately converted to the formulary buprenorphine-naloxone films. This demonstrates the need for education on pharmacokinetic differences between buprenorphine-naloxone products and implementation of a formulary interchange.

258 | Evaluation of level of care for toxic alcohol ingestions receiving fomepizole: a case series

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Introduction: Toxic alcohol ingestions (ethylene glycol or methanol) are treated by blocking alcohol dehydrogenase, thereby preventing the formation of toxic metabolites, and hemodialysis to remove the alcohol or metabolites and correct acidosis. Fomepizole was introduced into the market with a high cost, justifying intensive care unit (ICU) admission would not be necessary as these patients were not receiving ethanol therapy which requires intensive management.

Research Question or Hypothesis: Determine the reason for critical care admission in patients with toxic alcohol ingestion.

Study Design: Case Series

Methods: This is a subgroup of a 10-year retrospective study that originally evaluated toxic alcohol exposures to derive prognostic factors to determine if toxic alcohols were the cause of metabolic acidosis. This is limited case series examining the population of patients who received fomepizole therapy with a reported toxic alcohol level to determine the reason for ICU admission.

Results: A total of 130 patients were identified over the 10-year period with 106 ethylene glycol and 24 methanol exposures. Median age was 44 (IQR: 29 - 56.5) and 70.8% were male. Highest level of care was ICU for 83 (63.8%), floor for 25 (19.2%), intermediate medical care for 13 (10%), and emergency department for 9 (6.9%). Reason for ICU admission was unclear for 23 cases (27.7%). For those with a clear reason for ICU admission, these were primarily acidemia (43), intubation (37), and altered mental status (28).

Conclusion: Although pharmacoeconomic analyses justify the cost of fomepizole with the decreased need for ICU admission, it was found that approximately 64% of patients receiving fomepizole for toxic alcohol poisoning in this study were managed in the ICU. Most had end-organ toxicity (CNS depression, acidemia) or other reasons for ICU admission. Further prospective studies should clarify reasons for admission to specific units and pharmacoeconomic evaluations should consider a high baseline rate of ICU admission when comparing costs of care.

259 | Impact of state legislation on opioid prescribing practices of orthopedic surgeons

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Introduction: Post-operative patients are twenty times more likely to become chronic users of opioid medications than the general population. Even when surgical patients do not develop dependence, overprescribing by surgeons can lead to unused opioids and possible diversion. Several states have instituted legislation that limits opioid prescriptions, an example being Tennessee's "TN Together" initiative. While data show that opioid prescriptions have decreased nationally, there have been limited studies specifically evaluating the influence of state legislation.

Research Question or Hypothesis: What is the impact of legislation in the state of Tennessee on opioid prescribing practices amongst orthopedic surgeons?

Study Design: Single-center retrospective cohort study.

Methods: Eligible patients were at least eighteen years old and had previously undergone elective orthopedic total joint replacement, for which an opioid prescription was written. Cohorts were established based on two time periods: August 1, 2017 to May 31, 2018 (pre-legislation) and August 1, 2018 to May 31, 2019 (post-legislation). Demographic data and opioid prescription information were collected for all patients from electronic health records. The primary endpoint was morphine milligram equivalents (MME) prescribed. Secondary endpoints were days' supply prescribed, number of tablets prescribed, and MME per day. Statistical analyses were conducted using SPSS®, version 23; categorical data were analyzed using Chi-square or Fisher's exact test and continuous data were analyzed using Mann-Whitney *U* tests.

Results: A total of 203 patients were included in the final analysis, including 101 in the pre-legislation cohort and 102 in the post-legislation cohort. Baseline characteristics were similar between the two groups. Median MME prescribed was significantly lower in the post-legislation group (375 versus 562.5; $P < 0.001$). Days' supply, number of tablets, and MME per day were also significantly lower in the post-legislation cohort ($P = 0.01$, <0.001, <0.001, respectively).

Conclusion: Implementation of state opioid legislation was associated with decreased MME prescribed post-orthopedic surgery.

Transplant/Immunology

260 | Alemtuzumab and associated infectious and transplant outcomes in renal retransplant patients

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Introduction: Renal retransplant patients have decreased graft survival compared to primary renal transplant patients. Alemtuzumab induction is commonly used at the time of transplant; however, literature surrounding alemtuzumab induction in renal retransplant patients and its associated outcomes is limited.

Research Question or Hypothesis: To determine the incidence of infections and assess transplant outcomes in renal retransplant patients within 12 months of receiving alemtuzumab induction

Study Design: Single-center, retrospective, observational cohort study

Methods: This study included adult renal retransplant patients at the UNC Medical Center from 04/01/2014 to 11/01/2018 who received alemtuzumab induction. Dual organ transplant and ABO-incompatible kidney transplant were excluded. The primary outcome was infections within 12 months of renal retransplantation. Secondary outcomes were acute rejection, patient and graft survival, and development of *de novo* donor specific antibodies (DSAs) within 12 months of renal retransplantation. Descriptive statistics were used to quantify the data.

Results: Thirty-four patients were included in the final analysis. Twenty-two (64.7%) patients acquired infections. The most common

infections encountered were urinary tract infections (UTIs) (n = 10, 29.4%), cytomegalovirus DNAemia (n = 7, 20.6%), and BK virus (n = 6, 17.6%; BK viremia [n = 3], BK nephropathy [n = 2], BK viruria [n = 1]) There was no difference in the number of patients who developed infections while on maintenance steroids vs steroid-free maintenance (n = 11). The majority of infections were UTIs in the steroid-free group and viral in the steroid maintenance group. The incidence of acute cellular rejection was 2.9% (n = 1). No patients experienced antibody mediated rejection or mixed rejection. Eleven patients (32.4%) developed *de novo* DSA with only one patient having DSA at any point prior to retransplantation. There was no graft loss, and patient survival was 97% (n = 33).

Conclusion: Alemtuzumab induction in renal retransplant patients resulted in similar bacterial and viral infection rates as previously reported in the literature. Alemtuzumab induction did not negatively impact graft and patient survival.

261 | Changes in body mass index and use of antihypertensive medications after kidney transplant

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Introduction: Patients undergoing kidney transplant experience many factors affecting body mass index (BMI) and blood pressure management, such as metabolic side effects of immunosuppression and changes in renal function. While studies have documented an increase in BMI after transplant, this is not well-quantified. Additionally, the changes in antihypertensive medications after transplant and correlation to changes in BMI are not well described.

Research Question or Hypothesis: How does BMI and use of antihypertensive treatments change after kidney transplant?

Study Design: Single center, retrospective cohort study.

Methods: This study included adult patients undergoing kidney transplantation from June 2012 — June 2016. Data points included baseline demographics, weight, BMI, and number and class of antihypertensive medications. Data was collected at the time of transplant and post-transplant at three months, one year, two years, and three years. Data was censored if graft loss or death occurred prior to three years.

Results: A total of 202 subjects were included. Mean BMI at the time of transplant was 29.2 kg/m^2 ± 5.2 kg/m^2. The mean increase in BMI at each time point was: 0.17 (P = 0.34), 1.96 (P < 0.0001), 2.16 (P < 0.0001), and 2.13 (P < 0.0001), respectively. The average number of antihypertensives at the time of transplant was 3.0 ± 1.5. The average change in number of antihypertensives at each time point was: -0.9 (P < 0.0001), -0.74 (P < 0.0001), -0.61 (P < 0.0001), and -0.5 (P = 0.0003), respectively. The use of renin-angiotensin-aldosterone system inhibitors was significantly lower at all post-transplant time points compared to time of transplant. BMI was not significantly associated with number of antihypertensives at any time point.

Conclusion: BMI significantly increased starting at one year post-transplant, which shifted the mean for the population from overweight to obese. The number of antihypertensive agents prescribed significantly decreased at each time point after transplant, including changes in antihypertensive classes. BMI was not significantly associated with the number of hypertensive medications prescribed.

262 | Comparison of ceftizoxime plus ampicillin-sulbactam versus gentamicin plus ampicillin-sulbactam in the prevention of post-transplant early bacterial infections in liver transplant recipients: A randomized controlled trial

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Introduction: Infections are the most cause of morbidity and mortality after liver transplant (liver Tx).Prophylactic antibiotic regimens have vital role to decrease rate of infections after liver Tx.

Research Question or Hypothesis: We believed Gentamicin as promising agent with safe profile as one of part of prophylactic antibiotic regimen among liver Tx patients.

Study Design: We conducted RCT(IRCT20120731010453N2; http://www.irct.ir/). To compare ceftizoxime with ampicillin-sulbactam versus combined gentamicin with ampicillin-sulbactam as prophylactic antibiotic regimen in preventing early bacterial infections in liver Tx .

Methods: All patients older than 18 years who had undergone liver TX at Abu-Ali Sina transplantation center in Shiraz, Iran from July 2018 to April 2019 were included. In a single-blinded manner, the participants randomly received either combined intravenous ceftizoxime plus ampicillin-sulbactam (ceftizoxime group) or gentamicin plus ampicillin-sulbactam (gentamicin group) as prophylactic antibiotic regimen, which was continued for 48 hrs after liver Tx. The rate and type of bacterial infections, length of hospital and ICU stay, mortality rate, and kidney function were assessed during 1 month following liver Tx between groups.

Results: Two hundred and thirty patients were divided into two groups. One patient in the gentamicin group and five in the ceftizoxime group were excluded due to emergency exploratory laparotomy within the first 3 days after transplantation. The rate of bacterial infections during the first month after transplantation was 25.4%. This rate was significantly lower in the gentamicin group (13.16%) in comparison to the ceftizoxime group (38.18%) (P value<0.01), based

on the univariate logistic regression analysis, Length of ICU and hospital stay and also mortality rate were significantly lower in the gentamicin group (*P* value<0.01). There was no significant difference regarding kidney function between the two groups (*P* value = 0.16).

Conclusion: Our results suggested that gentamicin can be considered as a promising agent in prophylactic antibiotic regimen after liver TX .

263 | Perioperative anidulafungin for the prevention of invasive fungal infections in lung transplant recipients

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Introduction: Invasive fungal infections (IFIs) are a substantial cause of morbidity and mortality among lung transplant recipients (LTRs). Common antifungal strategies, such as triazole prophylaxis, may be insufficient in the post-operative period due to delay in initiation and time to target levels. Few studies have described the role of echinocandins for antifungal prophylaxis in LTRs.

Research Question or Hypothesis: How does an antifungal protocol incorporating perioperative anidulafungin in addition to itraconazole compare to itraconazole prophylaxis alone in reducing the incidence of IFIs within 90 days after transplant?

Study Design: Single-center, retrospective

Methods: Adult LTRs from 1/2016-1/2020 were included. In 6/2018, the protocol cohort received perioperative anidulafungin until chest tube removal. This was later revised to continue until target itraconazole levels were reached or hospital discharge. In both cohorts, itraconazole was started during hospitalization and was typically continued for at least one year. The primary endpoint was incidence of proven or probable IFI within 90 days.

Results: Among 144 LTRs, the incidence of proven or probable IFI was 7.5% (5 of 67) in the protocol cohort and 19.5% (15 of 77) in the pre-protocol cohort (*P* = 0.038). In the protocol group, there were numerically fewer cases of invasive candidiasis (6.0% vs 14.3%, *P* = 0.170). There was no difference in confirmed bacterial infections (*P* = 0.071) or mortality (*P* = 0.579). Median highest itraconazole level within 90 days was 0.09 mcg/mL with only one patient achieving target concentration.

Conclusion: Use of itraconazole in LTRs is limited by inadequate serum concentrations. However, perioperative anidulafungin may be a valuable addition to reduce the risk of 90-day IFI without increasing risk of bacterial infections. Further multivariate analyses are warranted to control for potential confounding variables as well as prospective, multicenter studies to substantiate the utility of echinocandins for antifungal prophylaxis in LTRs.

264 | Postoperative opioid use and outcomes following liver transplantation for fatty liver disease (FLD)

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Introduction: Alcoholic liver disease (ALD) and nonalcoholic steatohepatitis (NASH) are the leading indications for liver transplantation (LT) in the United States. Perioperative opioid use has been associated with an increased risk of post-LT mortality and graft loss, and pre-LT history of alcohol dependence is a reported risk factor for post-LT opioid dependence.

Research Question or Hypothesis: Are there differences in post-LT opioid use between LT recipients with ALD and those with NASH, and does this affect clinical outcomes?

Study Design: Retrospective, single-center chart review.

Methods: Patients who underwent LT for ALD or NASH between 6/2015 and 6/2019 were included. Opioid use was represented by oral morphine equivalent daily dose (MEDD) and categorized according to level of use (Level One = MEDD 0-10 mg or Level Two = MEDD >10 mg). Clinical data included pre-LT opioid use, incidence of small bowel obstruction (SBO) or ileus requiring non-pharmacological intervention, post-LT length of stay, 90-day readmission rate, 1-year rejection rate, and 1-year survival rate. The primary endpoint was the average MEDD during the final 72 hours before discharge. The student t-test and chi-square test (with 2-sided alpha of 0.05) were used for statistical analyses.

Results: A total of 114 patients (86 ALD and 28 NASH; 55 Level One and 59 Level Two) were analyzed. Baseline clinical characteristics were similar between the groups. The average discharge MEDD was higher in ALD than in NASH (29.3 mg vs. 15.0 mg, *P* = 0.02), with 57.0% of ALD and 35.7% of NASH at Level Two opioid use. Severe ileus/SBO occurred only in Level Two (10.2% vs. 0% in Level One, *P* = 0.02), and all cases were in ALD. No other significant differences in outcomes were found.

Conclusion: The average post-LT MEDD upon discharge was nearly two-fold higher in ALD patients as compared with NASH patients. LT recipients with higher level (>10 mg MEDD) of opioid use experienced more frequent SBO/ileus requiring non-pharmacological intervention.

265 | Evaluating the conversion of patients to extended-release tacrolimus (Envarsus XR) from immediate release (IR)-Tacrolimus in liver transplant recipients

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Introduction: Envarsus® (LCP-tac) is an extended-release tacrolimus approved in the USA for kidney transplant recipients, but is not currently approved for use in liver transplant (LT) recipients. Given it's once daily dosing and favorable pharmacokinetic parameters, LT recipients may benefit from this formulation. Phase II trials have shown safety in the use of LCP-tac in LT recipients, however, there is limited data concerning real-world conversion to LCP-tac in LT recipients.

Research Question or Hypothesis: To investigate safety and efficacy of conversion from immediate release tacrolimus (IR-tac) to LCP-tac in LT recipients.

Study Design: Retrospective single center analysis from 5/1/2019-3/30/2020.

Methods: LT recipients were screened for conversion from IR-tac to LCP-tac. Reason for switch, conversion ratio, kidney function, and outcome data were collected (rejection and infection). Median was reported for nonparametric data and mean reported for parametric data. Paired sample t-test was used to analyze continuous data. $P < 0.05$ was considered significant. All analysis was conducted using STATA v. 13.0.

Results: A total of 25 patients were included in the study (8% living donor LT recipients), 44% were switched to LCP-tac due to fluctuation in tacrolimus levels and 32% due to tremors. 88% of recipients switched due to tremor noted improvement after conversion. The average conversion ratio used to achieve therapeutic drug level without further dose adjustment was 0.73 (SD 0.11). There was no difference in SCr ($P = 0.55$) or eGFR ($P = 0.64$) from baseline to 3 months post conversion. There were no acute cellular rejections (ACR) or CMV viremia within 3 months post conversion.

Conclusion: Conversion of IR-tac to LCP-tac in LT recipients may be safe and effective with improved tolerability. No recipients in the study experienced ACR or CMV viremia. Further analysis of time-in-therapeutic range and tolerability is warranted.

266 | Outcomes in kidney transplant recipients of increased risk donor transplants at an urban academic medical center

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Introduction: In 2013, the United States Public Health Service updated criteria based on donor risk factors for HIV, hepatitis B, and HCV infections and termed this group 'increased risk' donors (IRDs). Most IRD kidneys are considered good allografts and comprise ~20% of the deceased donor transplant today.

Research Question or Hypothesis: This study investigated the association between IRD allografts, transplant outcomes, and infectious disease transmission in kidney transplant recipients at an urban academic medical center.

Study Design: Single-center, retrospective, observational chart review of patients who received IRD kidney transplants between 1/1/2016 and 12/31/2018.

Methods: Only kidney transplant recipients who received an IRD allograft were included. Descriptive analyses of demographics, donor derived infectious disease transmission and kidney transplant outcomes were conducted. Primary outcome measures were incidence of delayed graft function (DGF) and acute rejection, graft and patient survival at 12 months post-transplant. Secondary outcomes included time to development of donor derived infection.

Results: 38 of the 133 kidney transplants performed at our institution during the study period met inclusion criteria. Mean age was 53.7 ± 11.6 years. 79% were male. 63% were African American, 21% Hispanic/Latino ethnicity. Median waitlist time was 1148.5 days (IQR = 1567.5). 10% were retransplants. 21% had a history of chronic HCV. Recipient blood type was as follows: 26% Type A, 16% Type B, 11% Type AB and 47% Type O. Mean %cPRA was 19.9 ± 33. Mean % KDPI was 39.7 ± 17.7. The incidence of DGF was 39%. Two recipients experienced biopsy proven acute rejection. There were no graft loss or deaths during the study period. No disease transmission was noted.

Conclusion: Our findings suggest a high immunologic risk population who received IRD kidney transplants had favorable transplant outcomes, and were not at an increased risk for disease transmission post-transplant. Future long-term studies are warranted to fully evaluate this risk.

267 | The relationship between early changes in immunosuppressive therapy and hematologic adverse events in lung transplant recipients

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Introduction: Immunosuppressive regimens prevent rejection after lung transplant but are associated with thrombocytopenia and leukopenia. There is no effective method to predict the occurrence or severity of these hematologic events.

Research Question or Hypothesis: To characterize the rate and severity of hematologic events associated with changes to standard immunosuppressive therapy in lung transplant recipients.

Study Design: Single-center, observational study using an institutional registry of lung transplant recipients.

Methods: 424 adult lung transplant recipients transplanted from 2004 to 2019 were included. Those with missing medication or hematologic laboratory data were excluded. Standard immunosuppressive therapy consisted of tacrolimus, mycophenolate, and prednisone. Changes to this regimen were categorized as 1) Changing tacrolimus to cyclosporine, 2) Changing mycophenolate to azathioprine, 3) Introduction of everolimus, all within the first year post-transplant. Demographics and baseline hematologic values were characterized. Primary outcomes were occurrences of thrombocytopenia (platelets <100x10^9/L) and leukopenia (WBC < 3000x10^9/L) one year post-transplant. Kaplan-Meier methods and Cox-regression were conducted to assess the outcomes using SPSS (IBM Corp.) version 26.

Results: The majority of patients were white (92%) and male (57.5%). The most common transplant diagnosis was idiopathic interstitial pneumonia (30.2%). The overall rate of thrombocytopenia was 36% (154/424) and for leukopenia, 59.7% (253/424). Kaplan-Meier analysis demonstrated that patients who were switched to cyclosporine (P = 0.031) or received everolimus (P < 0.001) had a shorter time to a subsequent thrombocytopenic event (platelets <100x10^9/L). Controlling for transplant diagnosis and baseline thrombocytopenia, receiving cyclosporine (P = 0.006), azathioprine (P = 0.034), or everolimus (P < 0.001) was associated with thrombocytopenia. Time to subsequent leukopenic event (WBC < 3000x10^9/L) was shorter with early everolimus exposure (P = 0.011). Controlling for baseline leukopenia, receiving cyclosporine (P = 0.001) or everolimus (P < 0.001) was associated with leukopenia.

Conclusion: Early use of cyclosporine or everolimus was associated with higher rates of thrombocytopenia and leukopenia. Further prospective studies are needed to confirm these findings and explore effectiveness with early immunosuppressive changes.

268 | Assessing the appropriateness of label-recommended dose conversion from immediate-release tacrolimus to envarsus XR

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Introduction: Extended-release tacrolimus (XR tac) (Envarsus XR®) has become an attractive alternative to immediate-release tacrolimus (IR tac) because of its dosing frequency and improved tolerability. The FDA-recommended dosing conversion to XR tac is 80% (range 70-85%) of a patient's total daily dose (TDD) of IR tac. There are limited data on the percent conversion from IR tac to XR tac in a real-world cohort.

Research Question or Hypothesis: What is the average percent conversion of IR tac to XR tac in a real-world cohort of renal transplant patients?

Study Design: This was a single center, pre-post retrospective cohort study of renal transplant patients who were converted to XR tac from IR tac during the time period of 08/09/2019 through 09/27/2019.

Methods: A chart review of renal transplant patients followed by the UC Davis transplant clinic was conducted. Patients were included for review if their IR tac was converted to XR tac per-protocol by pharmacists and had two consecutive trough levels drawn after conversion. The primary endpoint was the percent conversion of TDD from IR tac to XR tac. The secondary outcomes were the number of individuals requiring dose adjustments and the incidence of adverse events after conversion. Descriptive statistics was used to assess the data.

Results: Two hundred and five patients were screened for inclusion with 123 patients converted and 50 patients achieving therapeutic troughs. The average age was 55.7 years and 63% were male. The overall average percent conversion was 76.5 ± 0.049. Seven patients (14%) required 1 dose adjustment to achieve therapeutic troughs. There were 0 reported incidences of adverse events.

Conclusion: The average percent conversion from IR tac to XR tac is consistent with the FDA-recommended conversion in a real-world cohort of renal transplant patients. These results emphasize the need for close monitoring and adjustments of doses as well as further investigation as to what factors affect dose conversions.

269 | The impact of medication education led by third-year Pharm.D. Candidates on clinical outcomes and medication safety in post kidney transplant patients

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Introduction: Post-transplant medication management and compliance are extremely important but often challenging. There are no previous studies evaluating the effects of a structured medication education class conducted by pharmacy students in post kidney transplant (KTX) patients. A structured medication class led by 3rd Pharm. D. candidates was recently implemented at our center.

Research Question or Hypothesis: Patients who attended the educational class would have lower rates of hospital readmission and patient-related medication errors and side-effects.

Study Design: Retrospective review of 307 adult KTX recipients transplanted between 7/11/2018 and 3/20/2020.

Methods: A total of 150 patients in the intervention group were compared to 157 historic patients. The primary outcome was the hospital readmission rate. Secondary outcomes were incidence of patient-related medication errors and adverse events defined as related to the medications covered in class reported by patients or noticed by physician post-discharge. Patient medication knowledge as assessed by the KTX pharmacist during the first clinic visit was evaluated and defined as patients' ability to read and interpret information necessary for appropriate medication use and self-management. The level of significance of the primary outcome was α of 0.05. Data were compared using appropriate descriptive statistics with SPSS V25.

Results: The 7-day readmission rate was 7.3% (11/150) in the intervention group, as compared to 15.9% (25/157) in the control group (P = 0.021). No significant differences were found at day 14 or 30. More administration discrepancies and related adverse events were

reported in the intervention group compared to the control group (*P*=NS).

Conclusion: Patients who attended a structured medication education class prior to discharge experienced less readmissions but more medication discrepancies and adverse effects were reported by these patients. Additional structured medication education may allow patients to better assess adverse effects and take more ownership over their medication regimen. A randomized controlled trial is needed to confirm these observations.

270 | Glycemic control immediately following kidney transplant

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Introduction: Immediately after kidney transplantation, patients receive induction immunosuppression to support a maintenance immunosuppression regimen that does not routinely require long-term corticosteroid therapy. Induction therapy at UPMC Presbyterian consists of a 4-day regimen of a biologic antibody-mediated agent and 6-days of corticosteroids. The impact of just 6 days of steroid-induced hyperglycemia immediately following surgery has not been fully studied and requires additional evaluation.

Research Question or Hypothesis: Determine a potential correlation between steroid-induced hyperglycemia immediately following kidney transplant and complications leading to higher 30-day readmission rates.

Study Design: Retrospective cohort quality improvement study at a single academic medical center.

Methods: Patients were stratified based on the presence of DM prior to transplant, and further separated based on presence of controlled or uncontrolled hyperglycemia, defined as < or ≥ 50% of point of care (POC) glucose testing higher than 180 mg/dL respectively throughout the entire inpatient stay. Information obtained from patient charts included baseline patient demographics, graft characteristics, and outcome related data. Outcomes of interest include: 30-day readmission, presence of delayed graft function, length of stay, and frequency of hypoglycemic events.

Results: 694 patients were screened and 443 (63.8%) were included in the analysis. 144 (32.5%) patients had a documented past medical history of DM and 299 (67.5%) did not have a history of DM. Patients with a history of DM and who experienced uncontrolled hyperglycemia during their inpatient stay were more likely to be readmitted within 30-days from discharge compared to those with controlled hyperglycemia (37% v. 23%, *P* = 0.04). No significant differences were found in length of stay, presence of delayed graft function, or incidence of hypoglycemic events.

Conclusion: Patients experiencing steroid-induced hyperglycemia immediately following kidney transplant have higher 30-day readmission rates. Future studies are needed to identify effective strategies to prevent this common complication.

271 | Incidence of cytomegalovirus and the management in kidney transplant recipients maintained on low-dose valganciclovir prophylaxis: Single-center experience

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Introduction: Cytomegalovirus (CMV) in kidney transplant recipients (KTRs) is alarming due to morbidity, pre-mature mortality, and allograft rejection. Universal prophylaxis with valganciclovir has been accepted among transplant recipients at highest risk (CMV D+/R-) of CMV reactivation. Lower-dose valganciclovir (LDVG) (i.e. 450 mg daily) prophylaxis has been explored with similar outcomes to regular dose (i.e. 900 mg daily) in intermediate risk (D+/R+) KTRs; however, efficacy of prophylaxis of LDVG among high risk KTRs remains unknown.

Research Question or Hypothesis: To determine the rate of CMV viremia among high-risk (D+/R-) KTRs who were maintained on LDVG prophylaxis.

Study Design: Single-center, retrospective, chart review.

Methods: All KTRs, aged 18 years of older, with high risk CMV (D+/R-) and receiving LDVG prophylaxis from January 1, 2018 - December 31, 2019 were included. The primary endpoint was incidence of CMV viremia (≥ 200) while on LDVG prophylaxis (6 months). Secondary endpoints included breakthrough viremia, time to viremia, peak viremia load, donor type, induction agent, 90-day readmission, and one-year mortality. Outcomes were analyzed using chi-square or Fisher's exact test as appropriate using an α of ≤0.05.

Results: Of 115 KTRs analyzed, 28 (24.3%) developed CMV viremia with 4 (14.3%) breakthrough cases during their prophylaxis course. Viremia onset occurred at an average of 61.5 ± 71.2 days after prophylaxis completion. Peak viremia levels ranged from 693 to 5,790,000 copies/mL. When comparing patients that did not develop CMV and those that did, deceased donors and basiliximab induction did not differ between the two groups (33 [37.9%] vs. 12 [42.9%]; *P* = 0.6422) and (8 [9.2%] vs. 5 [17.9%] *P* = 0.3001), respectively. Readmission within 90 days and one-year mortality were similar between groups (25 [28.7%] vs. 6 [21.4] *P* = 0.4485) and (0 vs. 2 [7.1%] *P* = 0.0577).

Conclusion: The use of LDVG among high risk KTRs did not result in an increase in CMV viremia or breakthrough CMV.

Women's health

272 | Changes in erythrocyte membrane epoxyeicosatrienoic, dihydroxyeicosatrienoic, and hydroxyeicosatetraenoic acids during pregnancy

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Introduction: Pregnancy is associated with many changes in physiological processes such as the alteration of arachidonic acid (AA) metabolism and formation of eicosanoids. This study explores changes in the formation of metabolites in the AA cytochrome P450 mediated pathway: epoxyeicosatrienoic (EET), dihydroxyeicosatrienoic (DHET), and hydroxyeicosatetraenoic (HETE) acids. The study determines circulating levels in the erythrocyte membranes during the progression of a normal pregnancy.

Research Question or Hypothesis: We hypothesize that altered enzyme activity during normal pregnancy will alter the concentrations of EETs, DHETs and HETEs.

Study Design: EETs, DHETs, and HETEs were extracted from red blood cells (RBCs) and measured in 25 pregnant women at 25 to 28 weeks gestation, 28 to 32 weeks gestation, and 3-4 months postpartum.

Methods: The fatty acids were extracted from RBCs, freed by saponification, purified, derivatized, and finally analyzed using LC-MS. The protein content of the RBCs was determined by BCA (bicinchoninic acid) assay. Reported fatty acid content was normalized to total protein in the RBC sample. Paired, two-sided, Students T-test was used to compare the normalized EET, DHET, and HETE fatty acid content between gestational weeks 25-28 and 28-32, gestational weeks 25-28 and postpartum, and gestational weeks 28-32 and postpartum.

Results: Results show that healthy pregnancy is associated with an increase in 8,9-DHET, 11,12-DHET and 14,15-DHET and a decrease in trans 8,9-EET during the late pregnancy window (28-32 weeks gestation) compared to postpartum. No other significant changes were observed when comparing 25-28 weeks gestation to 28-32 weeks gestation, 25-28 weeks gestation to postpartum, or 28-32 weeks gestation to postpartum.

Conclusion: The increase in 8,9-DHET, 11,12-DHET and 14,15-DHET and decrease in trans 8,9-EET is likely due to several mechanisms including an increase in soluble epoxide hydrolase activity, a decrease in glutathione conjugation, and altered cytochrome P450 enzyme activity that occur during pregnancy.

273 | Characterization and prevalence of adverse drug events from women using mifepristone and misoprostol

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Introduction: Two medications, mifepristone and misoprostol as a combination, are approved by the U.S. Food and Drug Administration (FDA) for medical abortion. However, the prevalence of adverse drug events (ADEs) from using them is not well reported. The objective of this study is to determine (1) the prevalence of ADEs with mifepristone and misoprostol in women, [2] demographics of women who experience ADEs from using the medications, and [3] ADE types, patient outcomes, and their severity levels.

Research Question or Hypothesis: What is the prevalence of ADEs and the characteristics of women who use mifepristone and misoprostol for medical abortion?

Study Design: A descriptive study analyzing data collected from the FDA's Adverse Event Reporting System for all women who experienced ADEs in 2004-2019.

Methods: Data were mined for women for whom misoprostol or mifepristone (generic) was the suspect medication in their ADE reports. Data collected included indications, ADEs (serious and non-serious), patients' age, event date, and concomitant medications. Serious ADEs included death, hospitalization, life threatening, disabled, congenital anomaly, and required intervention; all other ADE's were classified as non-serious.

Results: A total of 3,831 and 4,141 ADEs were reported for women taking mifepristone or misoprostol, respectively, with an average prevalence of 239.4 and 258.8 events per year, respectively. ADEs occurred most in 2014 (n = 889) and least in 2018 (n = 61). Most patients were between the ages 11-40 years and the average age was 27 years. About 55% of the ADEs included concomitant use of doxycycline, azithromycin, and metronidazole. The most prevalent outcomes were non-serious (53.3–65.2%). Serious ADEs occurred 34.8% overall for mifepristone and 46.7% for misoprostol. Death occurred 1.6% (n = 61) and 1.8% (n = 74) and hospitalization 26.7% and 30.3%, respectively.

Conclusion: Women taking mifepristone or misoprostol experienced a wide range of ADEs including hospitalization and death. More robust research is needed to determine accurate safety outcomes for these medications.

274 | MS Pharmacists' interest and perceived barriers to pharmacist-prescribed hormonal contraception

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Introduction: As of July 2020, there are 17 states with regulations that allow pharmacist-prescribed hormonal contraception in effort to increase patient access. In Mississippi (MS) more than half of pregnancies are unintended and it ranked second highest in the nation for teen births in 2018. Understanding MS pharmacists' opinions regarding this service is important to consider when considering changes in regulations.

Research Question or Hypothesis: To evaluate MS pharmacist's interest and perceived barriers to pharmacist-prescribed hormonal contraception

Study Design: Qualitative survey

Methods: Subjects were recruited by sending an email to pharmacists in MS who were members of the Mississippi Pharmacists Association

(MPhA) that asked them to participate in a 14-item Qualtrics survey with anonymized answers. Subjects also received a reminder email two weeks from the original survey distribution date. Descriptive statistics were utilized.

Results: 36 pharmacists agreed to participate in the survey. The majority (77%) believed pharmacists should be allowed to independently prescribe oral hormonal contraception to women 18 years and older, and the vast majority (97%) were interested in continuing education opportunities to learn more about prescribing protocols. The largest perceived barriers to this service were liability concerns, physician resistance and a shortage of pharmacy staff to provide services. More than half (59%) of subjects reported they would feel moderately or extremely comfortable participating in this service if it became available.

Conclusion: The results of this survey demonstrate interest and comfort in pharmacist-prescribing of hormonal contraception from a subset of Mississippi pharmacists. The results also provide helpful information regarding pharmacists' concerns should pharmacy organizations advocate for expansion of MS regulations.

275 | Characterization of discharge instructions and counseling provided to female patients admitted with a venous thromboembolic event attributed to hormonal contraception

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Introduction: Combined hormonal contraceptives (CHC) increase risk for venous thromboembolism (VTE). Following a VTE attributed to CHC, continuation is often contraindicated. Appropriate discharge counseling includes future contraceptive options and contraindications. Inappropriate (or lack of) counseling on contraception increases the risk of unintended pregnancy.

Research Question or Hypothesis: The purpose of this study was to characterize the discharge counseling provided to female patients with a VTE attributed to CHC and to evaluate the opportunity for provider and/or patient education.

Study Design: Retrospective, multi-center, chart review.

Methods: This IRB-approved study included patients from two acute care teaching hospitals admitted 1/1/17-12/31/19 for venous embolism/thrombosis (ICD-10 I82) and/or pulmonary embolism (ICD-10 I26). Females aged 18-51 years old on hormonal contraception at time of admission were included. Patients who were male, pregnant, or on hormone replacement therapy were excluded. Patient demographics, medication use data, and discharge counseling data were collected.

Results: Inclusion criteria was met by 67 patients. Patients had a median age of 30 years; 90% were Caucasian; 48% had a BMI ≥30 kg/m^2; and 48% had ≥ two additional risk factors for VTE. Inappropriate counseling was documented in 19/67 patients (28%); 9/19 (47%) were told to avoid all hormonal contraceptives; 8/19 (42%) had documented continuation of estrogen in the discharge summary (1 continued to refill CHC as verified by external history) and 2/19 (11%) were told to stop a progestin-only method. Of the 19 patients counseled inappropriately, 5 (26%) had documentation recommending followup with an OB/GYN. Discharge counseling was potentially inappropriate in 24/67 patients (35%). The majority had documented anticoagulation discharge counseling performed by pharmacy.

Conclusion: As two thirds of patients received inappropriate or potentially inappropriate counseling for future contraception following a VTE while on CHC, a significant opportunity for improved provider education and optimization of pharmacy-led counseling exists.

276 | Pharmacist prescribed emergency contraception: An analysis of state regulations

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Introduction: Levonorgestrel (LNG) 1.5 mg tablets (Plan B®) are available over-the-counter for emergency contraception (EC), and insurance may cover the cost if it is prescribed. Ulipristal acetate (UPA) 30 mg tablets (Ella®) are prescription only and are more effective than LNG. Affordability of LNG and access to UPA may be improved through pharmacist prescribing. Twelve states/districts have approved pharmacist prescribed self-administered hormonal contraception (HC), but it is unclear if "hormonal contraception" includes hormonal EC in these protocols. Additionally, states with EC prescribing protocols may not be updated to include the newer product, UPA.

Research Question or Hypothesis: Which states allow pharmacists to prescribe EC, how is this authorized, and which products can be prescribed?

Study Design: A descriptive analysis of state board of pharmacy regulations

Methods: Analysis of each state board of pharmacy website was conducted to find publicly available regulations for pharmacist prescribed EC. Each board of pharmacy was emailed a survey to confirm or clarify website information. Data collected included description of pharmacist prescriptive authority and type of EC included in prescribing protocol.

Results: Websites for all 50 states, plus the District of Columbia, were identified. Email surveys were completed for 26 states. Six states authorize pharmacists to prescribe EC through EC-specific statewide protocols or standing orders, and 1 additional state specifically includes EC prescriptive authority via the state-wide standing order for HC prescribing. Three states specify that pharmacists may prescribe LNG and UPA, while 4 states do not specify EC products. Of note, all states, except Alabama and Delaware, have general collaborative practice agreements that could potentially allow individual pharmacists to prescribe EC.

Conclusion: Pharmacist prescribed EC improves affordability of LNG, access to the more effective oral method, UPA, and is underutilized. Pharmacist prescribed HC is expanding in the United States, and opportunities to incorporate EC into these protocols should be optimized.

ADVANCES IN INTERNATIONAL CLINICAL PHARMACY PRACTICE, EDUCATION, OR TRAINING

Education/training

281 | Learning across borders 2.0: Developing a multi-country, interdisciplinary continuing professional development (CPD) program within the Baylor College of Medicine International Pediatric AIDS Initiative (BIPAI)

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Service or Program: BIPAI is a leading provider of maternal and child healthcare around the world. This second iterative CPD curriculum expanded to all healthcare professionals based on feedback from an initial pilot exclusive for pharmacists/technicians. It was developed to enhance clinical competency, foster community, and promote interprofessional education (IPE) across BIPAI-affiliated clinics and government facilities in Lesotho, Botswana, and Tanzania. Based on a blended learning model, it included 13 online modules, assessments, and live virtual sessions. Expert collaborators designed learning materials and facilitated live sessions.
Justification/Documentation: CPD is not a standard requirement or widely available for many health professionals in low- and middle-income countries; this curriculum provided an opportunity to enhance knowledge relevant to their practice while building community with peers. Program evaluation served to assess impact, refine the program, and act as a framework for future initiatives. 26 participants on average completed each module with the change in pre- to post-test scores ranging from +0.5 to +4.14. Out of 62 participants who completed at least one learning module, 17 participants completed at least 9 of 13 modules and earned certificates of completion. Qualitative measures through surveys and participant interviews identified improvements for future programming, high participant satisfaction with delivery and content, and an increased understanding of other members' role on the team.
Adaptability: The program demonstrates a scalable model of blended learning in limited-resource settings. Developed by U.S.-based pharmacists and implemented by subject matter experts, this model can be replicated by other health professionals. Materials were maintained on an online learning platform and virtual meetings hosted on a videoconferencing tool.
Significance: Using technology, the program connected healthcare professionals across countries in an effective way to foster CPD and IPE. It provided an opportunity for U.S.-based professionals to engage in sustainable global health work advancing not only the development of pharmacists but other clinical staff.

282 | Comparative evaluation of a clinical pharmacy case presentation workshop: Online vs. face-to-face

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Service or Program: Following current COVID-19 restrictions on F2F meetings, a one-day case presentation workshop for German-speaking pharmacists that had previously been offered several times F2F was re-designed as online event. The workshop is part of a programme provided by 'Campus Pharmazie', a privately owned institution that offers postgraduate education in Clinical Pharmacy. Participants perform a medication analysis and present and discuss this case at the workshop. Additionally, the tutor provides input and guides a reflection process on clinical reasoning. The objective of this programme is to improve medication review skills.
Justification/Documentation: In April 2020 six pharmacists attended this workshop online since F2F meetings were banned. Of these, five had previously attended the F2F workshop. In the anonymous comparative evaluation 83% confirmed the high professional value and practice-changing potential of the workshop in either format. Although 8 hours is considered a 'long' duration for online events, satisfaction was not significantly different with either format (all *P*-values between .07 and .37). For example, participants stated how strongly they would recommend the workshop with 8.8 (F2F) versus 8.3 (online), resp., out of a maximum of 10 points. While three participants indicated being slightly more hesitant about active participation online (1 point on a 5-point Likert scale each), the majority indicated that their personal learning success was the same, online and F2F.
Adaptability: Although this is a small-sized pilot study, the conformity of participant satisfaction and perceived learning success in F2F and online workshops indicates that one-day case discussion workshops may achieve equal objectives with either format.
Significance: The high value and practice-changing character of the event acknowledged by the participants indicates that the workshops met their objectives. Our results show that active and collaborative case-based online learning in clinical pharmacy is feasible. This may facilitate access of pharmacists to skill-based postgraduate clinical training.

283 | Development of a virtual, global health Advanced Pharmacy Practice Experience in Santo Domingo, Ecuador

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Service or Program: The Shoulder to Shoulder Global Virtual Rotation (STSGVR) is a 6-week Advanced Pharmacy Practice Experience (APPE) for fourth-year University of Kentucky College of Pharmacy (UKCOP) students in collaboration with Centro de Salud Hombro a Hombro (CSHH) in Santo Domingo, Ecuador. This rotation transforms a previously existing international APPE into a virtual experience for training pharmacy students to circumvent the need to travel internationally in order to complete a global health clinical experience. During the rotation, students virtually interact with a CSHH physician during patient consults with interpreter assistance, participate in global health topic discussions relevant to Ecuador, and complete disease state and journal club presentations applicable to CSHH patients. The primary deliverable is a longitudinal, clinical pharmacy initiative project to benefit CSHH.

Justification/Documentation: Travel restrictions imposed during the COVID-19 pandemic excluded fourth-year pharmacy students from completing international APPE rotations during the 2020-21 academic year. Prior to development of STSGVR, no global health APPE accommodated students unable or unwilling to travel abroad. Success for this initiative will be measured by evaluations completed by students and preceptors, an analysis of students' clinical and cultural competency skills pre- and post-rotation, and annualized rates of student participation.

Adaptability: The STSGVR can easily be implemented at Colleges of Pharmacy with preexisting international partnerships for APPE rotations. For significant time zone differences, clinical and cultural experiences can be tailored to allow for a combination of synchronous and asynchronous deliveries.

Significance: Introducing the STSGVR offers pharmacy students the ability to develop clinical and cultural competency skills in an international setting while being remote. Perceptions of clinical pharmacy and health in Ecuador are also enhanced through this innovative method. Furthermore, the STSGVR strengthens the commitment between the UKCOP and CSHH to collaboratively diversify international experiences offered to students during the COVID-19 pandemic and in the future.

284 | Global service learning: A unique educational pathway for community engagement and student scholarship development

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Service or Program: Over the past 15 years, the Purdue Kenya Partnership (PKP) strategically engaged students in service learning (SL) during their global health advanced pharmacy practice experience (APPE) in Eldoret, Kenya to aid their development in community engagement, research, and professional writing. Before completing the APPE, students received training in needs assessment and grant writing, through participation in a practice grant application exercise. Once in country, students worked directly with community partners to collaboratively develop a program that addressed local needs in creative ways utilizing their combined knowledge and skills. Students collaborated with community partners to apply for SL grant funding and disseminate their work through publication. SL projects occurred in partnership with Kenyan students to ensure activities were contextualized around Kenyan norms and to provide learning opportunities for Kenyan students.

Justification/Documentation: SL projects have addressed a wide variety of community needs from electronic prescription entry to sewing, music and art. PKP has established sustainable relationships with five community partners. Students have completed 24 projects and secured a total of $75,010 in funding. There have been 69 student project leads and more than 100 student participants. Students translated the SL activities into 81 posters at regional, national and international meetings and 12 manuscripts.

Adaptability: The skills students learn (teamwork, problem-solving, and creative thinking) can be used in many different professional settings. The PKP SL activities have demonstrated local community impact and have been translated into SL activities at other international APPE sites.

Significance: Integrated SL activities enabled students to deepen their community engagement during a global health APPE and strengthen their research and writing skills. These activities have allowed PKP to develop long-standing community partnerships.

285 | Implementation of virtual surgery advance pharmacy practice experience APPE rotation: Creative solution to combat COVID-19 ramification on pharmacy education

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Service or Program: A virtual four week Surgery APPE rotation was designed by four clinical pharmacy faculties at a college of Pharmacy in Saudi Arabia with the aim of providing pharmacy interns with essential pharmaceutical care experience of peri-operative setting.

All clinical faculties had experience in integrating simulation in pharmacy education and training. The virtual APPE was implemented using Microsoft Teams, where all pre-scheduled activities and meetings with students were performed remotely. The goals of this rotation included: 1. Understand the role of clinical pharmacist in a surgical unit 2. Enhance knowledge of major surgical procedures and medications used specifically in this unit. 3. Improve communication skills in presence of obstacles. This was achieved through integration of surgical themes and activities described in the ASHP guidelines on Surgery/Perioperative Pharmaceutical services series. Virtual activities included Topic discussions, simulated patients case presentations, Journal clubs, drug information questions, and a longitudinal protocol development project of perioperative patients in collaboration with the university hospital.

Justification/Documentation: While the need of clinical pharmacist involvement in the operating room was previously established, the adaptability in clinical practice is slow and sub-optimal. This was further endorsed due to suspending clinical training of pharmacy interns as part of the ramifications of COVID-19 global pandemic on the educational and health sectors. Motivation and outcomes gained by students indicate success of this virtual rotation.

Adaptability: In the presence of a secure, personalized, and professional virtual platform, a distant surgical APPE rotation can be easily adapted by pharmacy schools, preferably with an experience in scenario creation and simulation education.

Significance: Offering a virtual surgical APPE rotation creates an opportunity for pharmacy students to enhance pharmacotherapeutic management skills of peri-operative patients and supplement their clinical communication skills, especially in areas where surgical pharmacy practice is not well established.

286 | Optimizing the use of peer assessment in teaching patient presentation skills

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Service or Program: The National University of Singapore (NUS) offers a four-year Bachelor of Science in Pharmacy degree. Patient presentation skills are taught in the third-year through lectures and tutorials. Each student submits a 10-minute patient presentation audio-recording before tutorial. Pharmacy practice faculty debriefs on patient case and therapeutic plan during tutorial but the ability to provide feedback to each student is limited by class size.

Justification/Documentation: Conducting peer assessment is associated with positive learning outcomes in higher education but the optimal way to do so for teaching patient presentation skills is not defined. Traditionally at NUS, students conduct 1:1 anonymous peer assessment using a rubric after tutorial. However, some students felt peer assessment did not value-add because they had already realized their mistakes from tutorial.

In the last academic year, the class was randomly divided into 2 groups. Group 1 (N = 82) completed peer assessment before tutorial, reviewed feedback and amended their presentations during tutorial. Group 2 (N = 83) completed peer assessment after tutorial. Group 1 did not find assessing their peers more challenging (37% versus 45%, $P = 0.3$). Group 1 mentioned self-reflection and identifying own mistakes in qualitative comments, whereas group 2 commented on reinforcement of knowledge from tutorial. Patient presentation marks at end of semester assessment were comparable (70% versus 71%, $P = 0.8$).

Adaptability: Pharmacy educators may consider using peer assessment for teaching patient presentation skills in the classroom, particularly for large classes. In doing so, educators may challenge students to assess without faculty debrief and to implement feedback.

Significance: Patient presentation skills are essential for pharmacists and teaching such skills is critical for advancing the profession. This study optimizes the use of peer assessment for teaching patient presentation skills and suggests that conducting peer assessment before faculty debrief is feasible and promotes students' self-reflection of their own mistakes.

Infectious diseases

287 | Antimicrobial Stewardship: Where clinical pharmacists make a difference

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Service or Program: Located in Qatar, Al-Wakra governmental hospital has well established ASP, with a team consists of one infectious disease (ID) physician, fifteen clinical pharmacists (CPs), infection control practitioners and microbiologist. In line with IDSA guidelines, the key components of our program are prospective audit of all restricted antibiotics with intervention and feedback, IV to PO conversion and education. A daily list of antibiotics is generated from Cerner and imported it into a shared Excel database whereby CPs track and record pertinent data. Aggregated monthly reports of antibiotic consumption and clinical audit are then shared with stakeholders

Justification/Documentation: Wide-spectrum antibiotics are highly consumed in our hospital according to surveillance data, mostly associated with resistance, adverse events and cost. We aimed to evaluate the appropriateness of restricted antibiotics prescribing in compliance the local policy. CPs document antibiotic indication, fate, interventions and outcomes through drop lists. A total of 1785 antibiotic order reported between July 2019 to June 2020 with 921 performed interventions. Top three interventions were related to antibiotic selection,

dose optimization and duration adjustment. De-escalation and discontinuation rates were 25% & 17% respectively. Compliance with IV to PO conversion improved by 40% from baseline. Overall average appropriate prescribing rate was 80% and prescribers' acceptance rate was 94.3%

Adaptability: Our ASP model engaging decentralized CPs to implement ASP activities offers higher efficiency and adaptability than centralized ASPs solely conducted by ID experts, allowing greater coverage of inpatient services including medical, surgical, critical care, Obs/Gyn and pediatric units. Direct communication between pharmacists and prescribers provided more dynamic head-to –head education. Also, utilizing Excel© for ASP reports reduced the need for intensive IT support or additional financial resources

Significance: Being drug experts, CPs can effectively run the basic functions of ASP through leadership support, ID mentorship, interprofessional collaboration with multidisciplinary teams and continuous education to ensure sustainable success.

Nephrology

288 | Care transition in dialysis: Implementing evidence-based practices to reduce medication errors- pharmacy driven initiative

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Service or Program: This is a clinical pharmacy driven transition of care (ToC) program that targeted reducing medication errors experienced by Hemodialysis (HD) patients upon hospital discharge. At Al-Wakra hospital in Qatar, all HD patients discharged from medical units were included. Our program identified strategies to reduce medication errors based on literature review, cause and effect analysis done by multidisciplinary team (MDT), followed by survey to physicians, Clinical pharmacists (CPs)and nurses. Accordingly, three main interventions were prioritized and communicated to concerned staff through several meetings and email reminders. Interventions include: timely communication between nurses and CPs for discharge medication education; optimizing CPs' involvement in discharge medication reconciliation; and improving hand-off communications between CPs in medical and dialysis units.

Justification/Documentation: Local baseline data indicates that 50% of HD patients discharged from medical units present with at least one medication error. We aimed to reduce this percentage to 0% and successfully achieved it over four months period. From baseline of 0%, marked improvement was achieved in percentage of HD patients communicated to CPs by nurses for discharge education (median 69%); endorsed between CPs in respective units (median 83.5%), and had their discharge medications reconciled by CPs (median 83.5%).

Adaptability: The key to the success of this initiative was MDT involvement, timely communication, proper patients' endorsement, and emphasizing CPs' role in discharge medication reconciliation, which were all tested through several Plan-Do-Study-Act (PDSA) cycles and optimized as needed. Therefore, our transition of care model can be integrated for other high-risk patients (e.g., poly pharmacy; high risk medications etc...).

Significance: Transition of care is the time when 60% of medication errors occur and when they contribute to 72% of all post discharge adverse events. Empowering CPs through communication, training and interprofessional collaborations to lead and run ToC programs is of great significance.

289 | Characterization of clinical pharmacy services provided to dialysis patients in Qatar: Sharing experience

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Service or Program: Several studies report poor quality and gaps in the care of dialysis patients. At al Wakra hospital in Qatar, we have devoted a full-time clinical pharmacist (CP) to dialysis units, in line with evidence supported by American College of Clinical Pharmacy (ACCP) opinion paper. The CP interviews patients, review all medications and lab measurements, communicates with healthcare providers (nurses, dietitians, social workers) to address the patient needs. With the data collected, the CP identifies pharmacotherapeutic problems with recommendations to nephrologists for resolution

Justification/Documentation: Complex medication regimens, poor adherence, and frequent dosage changes often contribute to drug-related morbidity in dialysis patients, where there is a critical need for clinical pharmacy development and implementation. We aimed to characterize our dialysis CP services to help in defining and advancing standards of practice. A total of 1152 dialysis CP interventions were extracted from Cerner over last year. According to drug categories, most interventions addressed anemia, BMD, electrolytes and cardiovascular diseases. Most interventions corresponded to therapy appropriateness, dosing/administration, discrepancies in medication reconciliation and safety issues. The intervention time ranges between 5 to 15 minutes in 71% and 26% of the cases respectively, which justifies the dedicated services.

Adaptability: Our CP services fulfilled the unmet needs for pharmacotherapy optimization in a preventive, rather than a reactive approach. CPs as pharmacotherapy specialists are well suited to improve care of

dialysis patients. Our reported interventions have nephrologists' acceptance rate of 81%, which reflects the approved trust-able contributions of CPs to overall care, eventually leading to positive patient outcomes as supported by evidence in different ambulatory settings

Significance: Characterization of CP services in dialysis highlighted the need to prioritize and expand CP ambulatory activities toward high risk patient's population. We hereby advocate the inclusion of CP as essential member of healthcare teams that serve the growing numbers of dialysis patients worldwide.

Pediatrics

290 | Implementation and impact of pre-clinic telephonic medication reconciliation for paediatric patients with medical complexity

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Service or Program: A pre-clinic medication reconciliation service was implemented for pediatric patients with medical complexity and polypharmacy. Pediatric patients with medical complexity are mostly on routine outpatient follow-up with Complex Homecare Service in KK Women's and Children's Hospital, Singapore. For patients who are on 4 or more chronic medications, or at least 1 high risk medications, a medication reconciliation will be performed by a clinical pharmacist and caregiver's interview will be done over phone prior to their clinic visit. Drug related problems (DRP) identified and recommendations will be discussed with primary care providers at the pre-clinic multidisciplinary meeting, which will subsequently be discussed with patient's caregiver during clinic.

Justification/Documentation: DRP and recommendations were documented on the electronic medication record system. Data was collected from May 2019 to January 2020. 30 telephonic medication reconciliation was performed over 9 months and 35 DRP was identified with average of 1.2 DRP identified per patient. The origin of 60% (21) DRP involved clarification of drug orders and 22.9% (8) DRP involved omission of drug therapy. The three most common pharmacist's recommendations were: Adding drug (25.7%, 9), Drug Information (28.6%, 10) and Modify Dosage Regimen (22.9%, 8). 85.7% (30) of DRP took less than 5 minutes to resolve and all pharmacist's recommendations were accepted by providers.

Adaptability: All clinical pharmacists are trained with medication reconciliation service. Each telephonic medication reconciliation takes average of 30 minutes. Therefore, pre-clinic telephonic medication reconciliation is highly adaptable and should be encouraged in practice which care for patients with high medical resource use. **Significance:** At least 1 DRP was identified in each pre-clinic telephonic medication reconciliation performed by a clinical pharmacist. This has justified the impact of clinical pharmacist in a multidisciplinary team for the provision of holistic care, improving medication adherence, and preventing potentially life threatening events.

CLINICAL PHARMACY FORUM

Adult Medicine

291 | Successfully employing acute care telework services through virtual interventions during the COVID-19 pandemic

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Service or Program: Beginning March 23, 2020, pharmacists typically embedded in acute care teams were deployed to telework due to the 2020 COVID-19 pandemic. On-site shared offices inhibited the ability to practice social distancing. In an effort to conserve personal protective equipment (PPE) and reduce patient and employee exposure to COVID-19, Clinical Pharmacy Specialists (CPSs) were granted remote access to electronically review patient charts and perform daily patient care activities from their homes. Virtual rounding with the medical team was employed utilizing internal instant messaging via Skype® for Business and telephone communication to provide clinical recommendations. Medication orders and labs were written by CPSs via remote access as provided within their scopes of practice. Patient education continued via telephone.

Justification/Documentation: To meet social distancing standards and decrease transmission risk of COVID-19, acute care CPS services were transitioned to telework at STVHCS for the first time. CPS interventions were reviewed for the 6 weeks prior to implementation (Phase I: 2/10/20-3/20/20) and post-implementation (Phase II: 3/23/20-5/1/20). Chart note documentation increased from 533 to 742 total notes (39%) from Phase I to Phase II, respectively. A separate intervention documentation tool (Theradoc®) showed an increase from 350 to 549 interventions (57%) with an estimated additional cost-savings of $24,741.00 in Phase II.

Adaptability: In hospitals that use electronic medical record systems and where limited office space availability or proximity of coworkers is a concern, telework can be used to maintain a vital presence on the medical team while increasing clinical interventions.

Significance: Acute care CPS telework services offer an innovative way to provide effective clinical services and may increase productivity through the use of modern communication modalities.

292 | Implementation of a standardized pharmacist-based inpatient transitions of care program across two hospitals within a health-system

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Service or Program: This program sought to provide a standardized pharmacist-based inpatient transition of care (TOC) program across two hospitals within a health-system. The program targeted patients with high risk of hospital readmission meeting any of the following criteria: diagnosis of heart failure, COPD, diabetes on insulin therapy, or on oral anticoagulation. Patients meeting criteria received the following services: medication reconciliation, medication and disease state education, medication therapy management, discharge counseling, and follow-up phone call. The program was piloted in two hospitals within the health-system. The following were developed to standardize services provided: TOC training checklist, documentation guidelines, mock medication training devices, and medication education rubrics. These training tools were used to ensure a standardized approach to implementing the TOC service amongst multiple clinical pharmacists.

Justification/Documentation: This program met a need by providing medication management and education to high utilizers of the healthcare system in order to reduce frequent readmissions. From January - August 2019, a total of 362 patients were included in the program. The 30 day readmission rate for patients included in the TOC service was 11.8%, which was much lower when compared to published reports of 15% 30-day readmission rate in older adults.

Adaptability: This program is unique because it was implemented in two hospitals across a health-system. In order to organize this, standardized training documents were created so all pharmacists involved were appropriately trained prior to providing clinical services.

Significance: The development of a standardized process for providing inpatient TOC services, including documentation guidelines and medication education tools, helped clinical pharmacists to consistently provide a high level of care to high-risk patients across two hospitals in a health-system. The TOC training checklist establishes a minimum competency for pharmacists to provide patient counseling and education, while also helping to create sustainability where more pharmacists can be trained for involvement in the program.

Ambulatory Care

293 | Orienting refugees to the U.S. Pharmacy system: An educational video series

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Service or Program: Refugee patients face many medication adherence barriers, including low native language literacy and complexities of the English language. Through ACCP ambulatory care PRN grant funding, a series of four educational videos were developed to orient refugees to the U.S. pharmacy system and provide adherence strategies to self-manage medications. The primary use for these videos is to supplement patient education provided during ambulatory care pharmacist visits; however, their design allows for use in additional settings, such as waiting rooms or refugee resettlement agencies. To enable application across the country, the videos have been produced in the top three languages of resettled refugees in the U.S. – Arabic, Nepali, and Somali. The format of the videos and scripts was guided by literature and clinical experience with refugee patients.

Justification/Documentation: These educational videos provide relatable, pharmacy-specific information to refugee patients during clinic appointments, which often lack sufficient time to review the complexities of the U.S. pharmacy system and medication adherence tips. A pre- and post-assessment is available to evaluate knowledge acquisition and patient satisfaction with the videos. Anecdotal information from patients and practitioners is also valuable in assessing effectiveness.

Adaptability: The videos are easy to access via the free platform YouTube, with diverse compatibility across a variety of electronic devices. These five-minute long videos can be shown in clinic, at refugee resettlement agencies, or on the patient's personal device. To ensure they are suitable for refugee patients, the videos utilize native speakers, use simple wording with demonstrations, and employ a realistic, narrative-based format.

Significance: These videos aim to improve medication adherence amongst refugee patients by employing a unique, stepwise demonstration of how to navigate U.S. pharmacy services and manage medications. Additionally, these videos seek to enhance the efficacy and efficiency of healthcare visits and allow practitioners to focus on other aspects of medication and disease management.

294 | Ambulatory care pharmacy practice innovations and collaborative developments in response to COVID-19: A report from the ambulatory care practice and research network (PRN)

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Service or Program: The Ambulatory Care PRN annually reports ambulatory care pharmacy practice innovations developed by PRN

members. In 2020, the ACCP Clinical Pharmacy in Action series was reviewed to disseminate ambulatory clinical models developed to maintain continuity of care during the COVID-19 pandemic and their initial outcomes.

Justification/Documentation: New approaches reported included non-clinic-based drive-through and telehealth services. Hospital- and private clinic-based pharmacist-led teams incorporating technicians and learners developed drive-through anticoagulation and COVID-19 testing and screening utilizing existing parking facilities and driveways. Increased pharmacist video and phone telehealth utilization for medication administration technique education and medication-related problem resolution were also reported. Collaborations were established with local health departments, clinics, shelters, and medical reserve corps units to enhance COVID-19 screening, personal protective equipment fitting, call center services, patient education and follow-up, and homeless assistance services. Patients were reported to express satisfaction and reduced anxiety due to improved convenience, safety, and expediency of drive-through testing, which led to reports of improved time to care, no-show rates, and workflows. Telehealth approaches were reported to help support full-time pharmacist practice hours, with telehealth services generating reimbursement potentially comparable to in-clinic encounters. Student pharmacists reported meaningful and fulfilling experiences.

Adaptability: Prior to the development and deployment of an effective vaccine, COVID-19 is anticipated to have a sustained global impact on patient care access and clinical pharmacist practice and reimbursement. Approaches developed in response to the initial COVID-19 outbreak will likely serve as models for ambulatory pharmacy clinical services nationwide and adapted to a wide range of care needs and specialties.

Significance: Patient-centric, non-clinic-based approaches developed during the COVID-19 pandemic potentially justify continuance of pharmacist telehealth reimbursement and out-of-clinic care services post-pandemic. These approaches may reduce patient barriers to care while expanding ambulatory care pharmacist reach. Expansion of collaboration with public health organizations may also support expanded pharmacist involvement in pandemic initiatives.

295 | Telehealth by clinical pharmacists for patients with diabetes mellitus at an urban federally qualified community health center

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Service or Program: Clinical pharmacist services are an integral part of patient care for many high risk patients with diabetes mellitus in the underserved populations that the Edward M. Kennedy Community Health Center (EMKCHC) serves. Clinical pharmacist telehealth services were developed during the COVID-19 pandemic since non-emergent onsite visits were halted. Visits were predominantly conducted by 3 pharmacists via telephone. The effectiveness of managing patients with uncontrolled type 2 diabetes mellitus (DM) via telehealth was evaluated retrospectively.

Justification/Documentation: Most literature related to pharmacists providing telehealth in patients with diabetes is from the Veterans Administration Healthcare System and is primarily in rural populations. Although services at EMKCHC were developed in response to the COVID-19 pandemic, the problem of access to care is broader. Often patients miss appointments because of work, childcare, and/or transportation issues, and telehealth may improve accessibility. The effectiveness of telehealth visits in patients with A1cs 8% or higher will be measured by: (1) number of patients reached, (2) number of appointments completed, (3) number, type, clinical impact and economic impact of interventions, [4] change in A1C from baseline, and [5] percent of patients at A1C goal and/or FBS 80-130 post-telehealth appointments. Also, potential associations between baseline characteristics and efficacy measures will be evaluated.

Adaptability: Similar remote services could be offered by pharmacists at other CHC's managing DM in underserved populations. Pharmacists offering telehealth services will require secure remote electronic access to medical charts in a private location where protected health information can be contained.

Significance: DM telehealth appointments by pharmacists could be used to improve access to care in CHC organizations. This evaluation also describes the complexity of diabetes care that can be managed by clinical pharmacists via telehealth.

296 | Development and implementation of a multidisciplinary specialty care team infusion program yielding high biosimilar conversion rates

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Service or Program: Kaiser Permanente Washington is an integrated ambulatory care model with over 700,000 members. Clinical Pharmacy Administration developed a novel conversion model including specialty care team members (e.g. prescribers, registered nurses, clinical pharmacists, and infusion staff). Patient contact occurred by various means including telephone, electronic messaging, office visit, or infusion visit. Contact allowed for education on biosimilars and resolution of patient concerns which led to high patient acceptance.

Justification/Documentation: Previous patient experience from infliximab to infliximab-dyyb resulted in 50% conversion in 2017. Low conversion rates were attributed to poor patient acceptance and perceived mandatory conversion due to lack of specialty care team education and support. Reevaluation of the pharmacy

administration-driven process in 2019, led to the development of an integrated approach which engaged multiple members of the specialty care team early in the conversion strategy. In more recent conversion strategies, patient uptake was 97% in bevacizumab-awwb, 93% in trastuzumab-anns, and 88% in rituximab-abbs.

Adaptability: Our process allowed for easy adaptation to other ambulatory care models and expansion to multiple medical specialties. All providers were educated on biosimilars, provided patient talking points, and informed that patients could opt out of conversion. Nurses initiated first patient contact regarding the conversion opportunity. Clinical pharmacists served as medication experts to facilitate additional patient-specific discussion of biosimilar appropriateness. High program success demonstrated the importance of patient-centered conversations about medication conversions.

Significance: The use of biosimilar medications within an ambulatory care model provides increased patient access to high quality affordable healthcare. As biosimilar availability continues to expand, using the entire care team, including clinical pharmacists, is pivotal for future biosimilar conversion success.

297 | An anticoagulation clinic's journey during the COVID-19 pandemic

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Service or Program: In March 2020, clinical pharmacy leadership at Greater Baltimore Medical Center in Towson, Maryland implemented emergent protocols in response to the COVID-19 pandemic to promote safe management of warfarin and DOAC patients in a pharmacy-driven outpatient anticoagulation clinic. The protocols protected patients and staff while increasing access to anticoagulation care. New workflows included pre-appointment telephone screening, an isolation room with trained staff for PUI/COVID+ patients, extended INR monitoring intervals for stable patients, home INR monitoring, telehealth visits, and transition to DOACs for housebound/vulnerable patients who were appropriate candidates.

Justification/Documentation: During the COVID pandemic, anticoagulation patients face unique challenges in receiving appropriate care due to quarantine restrictions, social distancing, and fear. Lack of timely care increases bleeding risk and clotting events. COVID triggered a creative approach by pharmacy leadership to include telemedicine visits to minimize exposure risk and safely manage warfarin and DOAC patients. As a result, financially and clinically sustainable anticoagulation services have been maintained during this pandemic. To date, zero transitioned to DOACs, 16 being home monitored, 6 engaged in telehealth services, and 23 adopted extended INR intervals.

Adaptability: These protocols and workflows are easily replicable in outpatient anticoagulation clinics across the country and can be implemented in other pharmacy-led outpatient clinics with minor modifications. These changes are sensitive to diverse populations and address social determinants of health that burden anticoagulation patients. Unprecedented collaborations between pharmacy and finance are supported by new CMS regulations establishing billable auxiliary (pharmacy) personnel.

Significance: These initiatives ensured continuous care for anticoagulation patients while preventing hospitalizations during a period of overstrained inpatient care. New CMS rules allowed anticoagulation pharmacists to perform and bill for previously unreimbursed services. Pharmacy leadership facilitated the management of outpatient warfarin/DOAC therapy while simultaneously reducing infection risks, and both staff and patients expressed gratitude for the extra measures taken within the anticoagulation clinic.

Clinical Administration

298 | Successful clinical and operational strategies to implement biosimilar conversions in an integrated health system

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Service or Program: Biosimilar conversions were accomplished for 5 molecules in an integrated health system with pharmacy leadership. Filgrastim was converted using inpatient therapeutic interchange. Pharmacist-driven outpatient conversions were accomplished with infliximab, pegfilgrastim, bevacizumab and trastuzumab.

Justification/Documentation: Biosimilar conversion was identified as a significant cost savings opportunity organizationally, with additional reimbursement potential for outpatient-administered items. Our goal was to achieve >80% conversion within 3 months to support of system financial goals. A launch strategy was planned for each conversion based on aspects unique to each agent (inpatient-only use, ordering providers external to our health-system, on-body delivery device and syringe use, biosimilar missing key FDA-approved indications, etc.).

Conversion rates at 3 months were 100%, 82%, 28%, and 61% for filgrastim, pegfilgrastim, infliximab (second conversion attempt), and bevacizumab respectively. Trastuzumab conversion was 67% at 1 month post-launch. On-body device use for pegfilgrastim dropped from an average of 44% to 30% with strict implementation of criteria for use. Lessons learned from each biosimilar conversion were applied to the next conversion and integrated into a working system

biosimilar strategy document. A detailed Excel analytic template was developed for financial savings and revenue enhancement modeling across 340b and non-340b sites.

Adaptability: Our methods and strategies are adaptable to most practice settings.

Significance: Pharmacist-driven biosimilar conversions are achievable across an integrated health-system in a safe, efficacious, patient-centric manner with significant cost savings.

Critical Care

299 | Pharmacist's role in caring for critically ill patients infected with the SARS-CoV-2 virus

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Service or Program: Clinical pharmacists as part of an interdisciplinary team implemented a new clinical service model to care for critically ill patients with COVID-19. Pharmacists created an admission order set in the electronic medical record, a critical drug shortage guidance document with alternatives to intravenous analgesic and sedative medications, and a clinical practice guideline for COVID-19 pharmacotherapy to guide providers in the medication-ordering process. Initiatives were made to preserve personal protective equipment and ensure safe medication administration including the creation of bundled care times and promotion of infusions over intermittent dosing whenever possible. An enhanced venous thromboembolism prophylaxis guideline was created which contained more aggressive, weight-based enoxaparin dosing and a period of anti-Xa monitoring. Finally, critical care pharmacists reviewed the charts of all critically ill COVID-19 patients on a daily basis utilizing a task list containing key interventions to ensure optimal pharmacotherapy. Recommendations were communicated directly with ICU providers and documented in progress notes.

Justification/Documentation: Over the course of seven weeks, clinical pharmacists reviewed the charts of 138 unique patients, made 1487 interventions, and wrote a total of 944 progress notes documenting both patient-specific recommendations and all routine elements reviewed. The majority of patients (94%) received at least one pharmacist intervention. The most common interventions were pharmacokinetic monitoring (49% of patients), home medication management (46%), analgesia/sedation management with and without neuromuscular blockade (43%), venous thromboembolism prophylaxis or treatment dose recommendations (41%), antimicrobial stewardship measures (36%), and optimization of glycemic control (35%).

Adaptability: Residency-trained clinical pharmacists are capable of designing and implementing new processes as part of an interdisciplinary team to help optimize medical care.

Significance: Pharmacists can be key leaders in the implementation of new clinical service models that ensure safe and effective pharmacotherapy while addressing specific challenges associated with providing optimal care during an infectious disease pandemic.

Education/Training

300 | Solving the toxicology mystery: An educational program focused on team-based problem-solving

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Service or Program: To increase skills needed in treating overdoses, clinical faculty designed a toxicology educational program as part of a didactic acute care course at the University of Minnesota College of Pharmacy. The program consisted of main toxicology concept puzzles, which once solved, released clinical clues for a patient case. This hands-on escape room type program allowed teams of third year pharmacy students the opportunity to collect and combine clinical clues to identify a general toxidrome, determine the substance taken and use resources to create a therapeutic plan within a designated time frame. The case included a substance not taught within toxicology lectures, requiring students to apply known concepts to a novel topic and quickly utilize resources to support their learning.

Justification/Documentation: Historically, toxicology is taught in lecture format making the students' application and clinical decision making skills difficult to assess. All teams completing this program successfully identified the toxic substance and created an appropriate therapeutic plan despite having no formal education on this particular substance.

Adaptability: While this program was developed for third year pharmacy students in a didactic setting, it has also been used in the experiential setting with students and pharmacy residents. An emergency medicine pharmacist originally developed this as an in person activity with physical puzzles including various padlocks, paper clues and invisible ink. In the setting of COVID-19, the activity was adapted to an online team puzzle using Google Forms and the Zoom platform. This online adaptability allows its continued use with pharmacy learners as well as interdisciplinary plans to include medical students and residents on emergency medicine rotations.

Significance: Pharmacists play an integral role in the care of overdosed patients. This unique educational program provides learners the opportunity to apply the skills needed for this role in a hands-on active learning format applicable for both didactic and clinical settings.

301 | Adaptation of delivery of SCCP clinical pharmacist roundtable event using a virtual platform due to COVID

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Service or Program: The Student Chapter of Clinical Pharmacy (SCCP) of University of Missouri – Kansas City (UMKC) School of Pharmacy converted their annual Clinical Pharmacist Roundtable event to a virtual platform due to COVID. The Clinical Pharmacist Roundtable event provides student pharmacists the opportunity to learn about different areas of clinical pharmacy, explore rotation and career possibilities and further develop professional networks. During an uncertain time when most student programming was postponed or cancelled, SCCP of UMKC felt it imperative to offer this program to cultivate relationships between the students, school and local clinical pharmacists.

Justification/Documentation: To meet the needs of students, SCCP of UMKC hosted the event via a virtual platform utilizing the small group discussion feature. This allowed rotation of six pairs of pharmacists among small groups of students over three hours. Pharmacists were paired with complementary specialties, such as critical care with emergency medicine. This event was successful with participation of 40 students and 12 pharmacists. An additional benefit of this format was more first-time pharmacist attendees (11), providing new perspectives and networking opportunities.

Adaptability: Due to COVID, schools are relying more on virtual platforms for daily tasks. Hosting events utilizing these platforms maintains responsible social distancing while providing students networking opportunities with local clinical pharmacists. Many platforms allow for small group discussions, encouraging student engagement. Minimal training is required to use these platforms and faculty are qualified to run this type of virtual event. Limited barriers were experienced and the format could successfully be adapted for similar events.

Significance: Understanding the virtual capabilities available to schools and organizations is critical so in extenuating circumstances events may be adapted and offered without interruption. Benefits of virtual platforms include increased participation due to reduced travel demands, reduced organization costs, and cultivation of relationships between community practitioners and schools.

302 | Implementation of a student-coordinated clinical research design elective course in a Pharm.D.curriculum

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Service or Program: A student-coordinated, online clinical research design (CRD) elective was created and co-developed by three 3rd year Pharm.D.students and 3 clinical faculty with experience in research and course development. The CRD course was modeled after ACCP's Clinical Research Challenge (CRC), which provides students the experience of developing research proposals with financial and environmental parameters. Utilizing the 2019 CRC prompt, 3 modules were developed for 12 student pharmacists in the 2020 Spring Semester. Working in groups of 3, each student team was responsible for a journal club presentation, letter of intent, and research proposal. Teams were required to present their journal club and research proposals virtually using Blackboard Collaborate, Panopto, and PowerPoint video technology. Student and faculty coordinators evaluated the completed work and provided feedback to each team during each module.

Justification/Documentation: Feedback from ACCP student members, including previous participants in the CRC, identified gaps and uncertainty related to research knowledge. The CRD elective was developed to enhance students' interest in and skills designing clinical pharmacy research. CRD's online format provided scheduling flexibility for both faculty and students. Feedback from both faculty and student coordinators was provided after each module, and was directed toward improving research knowledge and application, allowing student coordinators to draw upon their experiences as CRC competitors from the previous year.

Adaptability: The CRD elective course was a successful teaching collaboration between students and faculty and represents an ideal opportunity to cultivate future pharmacists' interest in clinical pharmacy research and academia. Current plans are to incorporate feedback from the students and continue with future offerings.

Significance: The CRD elective course represents a unique collaboration between students and faculty. The value of the CRD course was two-fold: students completing the course gained experience developing their research skills while student coordinators gained academic experience as educators.

303 | Evaluation of pharmacy-resident morbidity, mortality, and improvement case conference for medication safety optimization

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Service or Program: Local institutional, interdisciplinary leadership heightened the need for a patient-safety culture aimed at continuous

process improvement (PI). The Pharmacy Education Committee (PEC) evolved didactic case presentations into an action-oriented Pharmacy Morbidity, Mortality and Improvement Case Conference (MMI): a resident-lead, case-based PI learning experience. Residents analyze patient-specific medication safety events to optimize the medication use system via intra- and interdisciplinary operational, clinical, administrative, or informatics/technology enhancements. Programmatic components include: 1) resident-facilitated, 20-minute, dynamic, case-based discussion, 2) objective, measurable, system-based application of PI methods, and 3) written continuing education (CE) for departmental dissemination.

Justification/Documentation: A total of 73 MMI cases between July 2014 and September 2018 were evaluated. Error with harm occurred in 47% of cases encompassing 103 PI opportunities (median 1 [IQR, 1-2] per case). Prescribing was the primary medication error in 40% of cases. (38%), operations change (29%), and informatics/technology enhancement (26%) were common optimizations. Fifty-six (76%) cases included transitions of care, high alert medications, or sound-alike look-alike drugs. Pharmacy personnel claimed over 200 CE hours from 19 written disseminations (4 cases/1 CE hour offering).

Adaptability: MMI provides optimal constructs for pharmacy departments and residency programs striving for improved patient safety, enhanced department communication/education, and pharmacy resident development. PEC provides guidance documents for root cause analysis, quality improvement methodology, and Accreditation Council for Pharmacy Education CE approval. PEC members are mentors and peer-reviewers for internal publication standardization.

Significance: Unlike traditional academic morbidity and mortality conferences based in clinical interest or decision-making education, MMI is an original, preceptor- and resident-championed, multifaceted patient safety endeavor. American Society of Health System Pharmacists (ASHP) resident competencies, ASHP Practice Advancement Initiative, and American College of Clinical Pharmacy Standards of Practice for Clinical Pharmacy are directly fulfilled through MMI. During triennial Joint Commission surveys within the institution, MMI is highlighted as a tangible patient safety initiative.

Endocrinology

304 | Improvement in inpatient diabetes education program after implementation of a discharge telephonic outreach by pharmacy students

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Service or Program: Inpatient diabetes education at our hospital is provided by staff nurses, pharmacists, and dietitians; however, the effectiveness of this education is unclear. From May 2019-March 2020, patients who had a new prescription for insulin filled at discharge via the Meds-To-Beds program were called by student pharmacists 1-2 days after discharge to home. Student pharmacists assessed patients' knowledge regarding diabetes "survival skills" and provided additional or supplementary education, as needed. Student pharmacists involved their pharmacist preceptor, if patients had questions or additional needs beyond insulin education.

Justification/Documentation: Of the 280 patients who had an outpatient prescription filled for insulin from our hospital-based retail pharmacy, students were able to reach 140, or 50% of the patients. 73% of patients required education on at least 1 of the 7 "survival skills"; however, the percentage of patients needing education by the end of the collection period (March 2020) was only 25%. This was likely because staff improved their educational efforts as they received updates regarding the types of interventions made by the pharmacy students.

Adaptability: Inpatient training on administration and safety of insulin should be done prior to discharge in order to assess understanding of the new or changed prescription. Telephone follow-up by pharmacy students allows for previous education adequacy to be assessed and skills to be retaught if necessary. In addition, by assessing knowledge after discharge, pharmacy students can identify common education gaps among patients. These education gaps can be communicated to the inpatient team to improve effectiveness of inpatient diabetes education over time.

Significance: Pharmacy-driven post-discharge telephone follow-ups for patients new to insulin are an effective way to identify patients who need more education to safely and effectively manage their diabetes at home. Improvement in education will likely improve patient outcome, including hospital readmission rates.

HIV/AIDS

305 | Outpatient management of human immunodeficiency virus during COVID-19 pandemic

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Service or Program: Under an established collaborative practice agreement, clinical pharmacists play a critical role in the Program for AIDS Treatment and Health (PATH) Center at The Brooklyn Hospital Center. During The Coronavirus Disease 2019 (COVID-19) Pandemic, a primary goal was to ensure HIV-positive patients maintain viral load suppression. To achieve this while limiting community exposure, a messaging group was established in the electronic medical record allowing nurses to route medication refill requests. The clinical pharmacists performed patient assessments, ordered and assessed labs, conducted TeleHealth visits, sent electronic prescriptions and recommended follow-up periods.

Justification/Documentation: Amidst the pandemic, healthcare systems are being faced with several challenges to overcome.

Among these challenges include combating COVID-19 while providing essential HIV treatment and prevention services. As in-person clinic visits were being limited, the PATH center began leveraging telemedicine platforms. Clinical pharmacists managed patient medication regimens for chronic disease states remotely in an attempt to reduce community exposure and maintain viral load suppression rates, preventing lapses in care and potential viral transmission.

Adaptability: This service can be implemented in an outpatient setting where chronic disease states are managed, especially when circumstances inhibit a patient from presenting to clinic. All clinical pharmacists are PGY-2 trained and board-certified in Ambulatory Care. The majority of the clinical pharmacists are also certified HIV Pharmacists (AAHIVP). Any primary care clinic with an established collaborative practice agreement would be able to implement a pharmacist-driven TeleHealth service.

Significance: In total, there were 211 medication requests with approximately 50% of patients having one or more TeleHealth visits. Viral load suppression rates for pre and post-COVID were 85.3% and 88.6%, respectively (P = 0.280318). Collaboratively, with providers and nurses, clinical pharmacists were able to assist in maintaining viral load suppression rates through the expansion of virtual medication management services during a global pandemic.

Infectious diseases

306 | Integration of a pharmacist-led hepatitis C clinic into a substance-use disorder program

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Service or Program: Catholic Health is a comprehensive healthcare system in western New York and offers outpatient medication-assisted treatment for substance-use disorders with an enrollment of approximately 1,200 patients. The department of pharmacy established a clinical pharmacist-led chronic hepatitis C virus (HCV) clinic at two treatment center locations. Referrals were obtained through multidisciplinary meetings with the substance-use disorder providers. The clinical pharmacist was responsible for HCV monitoring and care under a Collaborative Drug Therapy Management (CDTM) protocol.

Justification/Documentation: Past or present intravenous and intranasal illicit drug use are risk behaviors associated with an increased risk of HCV infection. The HCV clinic was established in a setting which serves patients at an increased risk of HCV infection. The program also worked to overcome barriers which may otherwise hinder access to HCV care by creating a clinic on-site. Barriers to accessing HCV care include logistical difficulties such as transportation, financial concerns and lack of social support. The program thus far has linked seventy-five patients to HCV care with twenty-two patients completing therapy.

Adaptability: An established HCV CDTM protocol allowed for clinical pharmacist integration into an existing substance-use disorder clinic. The multidisciplinary approach and collaboration of the clinical pharmacist with the substance-use disorder team allowed for the success of the program, making it adaptable to similar settings.

Significance: The establishment of this program demonstrates the utility of clinical pharmacists in optimizing HCV care in a substance-use disorder population. Clinical pharmacists were integral members of the multidisciplinary team and provided a valuable role in HCV care. The HCV clinical pharmacists served an integral role in screening, assessing readiness for treatment, medication selection, prior authorization, identification and management of drug-drug interactions and continued assessment of medication adherence under a CDTM protocol.

307 | Implementation of pharmacist-led COVID-19 prevention program in the homeless population

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Service or Program: A COVID-19 prevention program was implemented by clinical pharmacists to prevent the transmission of COVID-19 in homeless shelters in Victorville, CA. The pharmacy team developed policies and procedures based on the CDC's Guidance for Homeless Service Providers. Shelter staff were trained to follow intake and quarantine protocols assessing symptoms of COVID-19 and medical history before integrating new residents. Residents at high risk of COVID-19-related medical complications receive PCR testing by pharmacists. The pharmacy team also provides personal protective equipment (PPE) and sanitation training for shelter staff. Pharmacists continue to provide oversight to external quarantine sites utilized for confirmed positive cases. Through this collaboration with homeless shelters, city officials, and health departments, pharmacists implemented services to prevent the transmission of COVID-19 in the underserved community.

Justification/Documentation: People experiencing unsheltered homelessness may be at risk for infection when there is community spread of COVID-19 due to minimal social distancing, inadequate PPE, and lack of personal hygiene and access to sanitation facilities. With higher rates of chronic diseases, homeless individuals are at increased risk for COVID-19 complications including hospitalizations and death. This program provided testing to 150 homeless individuals and allows shelters to continue housing over 400 individuals in the city.

Adaptability: Pharmacists possess the necessary clinical knowledge and skills required to develop and adopt novel coronavirus prevention. The US Department of Health and Human Services guidance gave pharmacists the authority to order and administer COVID-19 tests. Pharmacists providing services to underserved populations in community and clinic settings can partner with local shelters to implement a similar protocol to prevent COVID-19 spread in the homeless population.

Significance: Pharmacists optimize patient care by providing response planning and medical oversight to underserved communities during a global pandemic. Working alongside partners that serve the homeless community positions pharmacists to play a critical role in infection prevention during the pandemic.

Nephrology

308 | Pharmacy-led telenephrology clinic significantly lowers blood pressure in patients with chronic kidney disease

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Service or Program: In mid-2018, a pharmacist-led, telephone-based, ambulatory hypertension service was implemented in the Nephrology Clinic at the William S. Middleton Memorial Veterans Hospital. Patients with non-dialysis-requiring chronic kidney disease (CKD) were referred for management of difficult-to-control hypertension. All enrolled patients received a blood pressure (BP) monitoring device and self-monitored their BP at home. Patients either personally logged measurements or had them sent automatically via a cloud-based service. Pharmacists conducted phone call appointments with patients every 4-12 weeks depending on the severity of hypertension and adjusted antihypertensive medications accordingly to target recommended BP goals.

Justification/Documentation: Resistant hypertension is common in CKD and increases in prevalence with worsening CKD. Additionally, uncontrolled hypertension contributes to declining kidney function and increases the risk of cardiovascular events. Novel approaches to improve BP control are warranted to help optimize patient outcomes. To analyze the effectiveness of the service, 57 patients had blood pressure data from at least 3 visits (Range: 3-13 visits). Mean ± SD baseline systolic blood pressure (SBP) was 149 ± 12 mmHg and was reduced by 15 ± 14 mmHg ($P < 0.0001$ vs. baseline). SBP was reduced by ≥10 mmHg in 67% of patients and by ≥20 mmHg in 42% of patients. Thus far, 39% of patients sustained a BP <130/80 mmHg and were referred back for management by the referring team.

Adaptability: The described pharmacist-led, telenephrology, ambulatory hypertension service can be adapted for any VA institution or health system where scopes of practice or collaborative practice agreements are allowed.

Significance: Elevated BP is the largest risk factor for worsening renal and cardiovascular outcomes in patients with CKD. Our pharmacist-led clinic produced significant and clinically meaningful reductions in blood pressure. Therefore, innovative approaches that employ pharmacists' knowledge and expertise to reduce blood pressure and improve outcomes are relevant, especially as telehealth becomes a more widely accepted and utilized practice.

Other

309 | Integration of transitions of care pharmacists to a multidisciplinary preoperative assessment team

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Service or Program: At our acute-care hospital, a multidisciplinary team of nursing, laboratory, and anesthesia services works collaboratively to provide pre-operative assessment and testing (PA&T) to designated patients scheduled for surgical procedures. This service was extended and requested pharmacists to provide Transitions of Care (TOC) services including medication history collection and assessment for surgical appropriateness. Pharmacists' assessments focused on potential medication related problems including, but not limited to, dosing administration adjustments or additional laboratory monitoring in the perioperative or post-operative space. Common medications evaluated included anticoagulants, antiplatelets, insulin/antidiabetics, chronic pain medications, anti-hypertensives, and narrow therapeutic index medications. Additionally, pharmacists provided counseling as needed in collaboration with the other team members.

Justification/Documentation: Pharmacists documented and communicated their patient interviews, assessments, and recommendations to the PA&T team as a "pharmacy note" within the patient's electronic medical record. The clinical pharmacy and PA&T leadership team worked together to develop a workflow to integrate the pharmacists into the team. The need for pharmacist collaboration was identified after several patients presented on procedure day with unsafe medications. The pharmacy leadership team developed a template note for pharmacist use to ensure uniformity in the assessment, documentation, and communication to the PA&T team. The service successful facilitated Pharmacy TOC services for 459 patients. Numerous impactful interventions were made, and pharmacists received overwhelming positive feedback from the PA&T team.

Adaptability: Pharmacists experienced in TOC or medication therapy management was recruited to the service. One full time equivalent was utilized Monday-Friday, to help safely transition patients into the surgical space.

Significance: Traditionally, pharmacists are not included in the PA&T of surgical patients. This TOC service provides an innovative method for pharmacists to develop a new touch point with patients prior to their surgical admission and to utilize their drug information and management expertise to positively impact safety within the surgical space.

Peri-operative care

310 | Pharmacist-led vaccine transitions of care coordination following emergent splenectomy hospitalization

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Service or Program: A novel, pharmacist-led process was implemented to enhance post-splenectomy immunization adherence and create revenue. Trauma patients previously received initial immunizations during hospitalization with series completion through community providers. The new process includes electronic medical record (EMR) immunization orders and automatic referral to the hospital-based outpatient pharmacy Transition of Care (TOC) service. TOC activities include completing prior authorizations, patient communication, performing vaccination, and/or establishing vaccines through other providers if pharmacist immunization is not reimbursable.

Justification/Documentation: The Centers for Disease Control (CDC) recommends vaccination against encapsulated bacteria in asplenia populations to reduce overwhelming post-splenectomy infection (OPSI). Multidisciplinary personnel identified a lack of *Meningococcal* serotype B vaccine (MenB) availability in community practice. Ohio Revised and Administrative Codes authorizes pharmacist and pharmacy interns to administer immunizations enabling injections through the hospital-based outpatient pharmacy. Retrospective review of traumatic splenectomy patients from January 2015 through January 2019 identified 95 patients requiring MenB with potential assistance through pharmacy services. Under the new process, 42 patients were referred and 15 (36%) completed between July 2019 and November 2019, with remaining patients being assisted.

Adaptability: Trained outpatient pharmacists possess the necessary skills to administer or coordinate immunization in states with supportive legislature and collaborative practice agreement. This service can bring reimbursement opportunities to ambulatory care practice through: 1) stakeholder conversation, 2) EMR navigation, and 3) pharmacist training. The model has been adapted to include more methods to ensure patients are completing their vaccines via paperwork provided at discharge and follow-up communication.

Significance: Previous literature demonstrates improved compliance with post-splenectomy immunization through pharmacist intervention in a primarily cancer population. This service is the first in a primarily trauma population and promotes in- and out-patient pharmacist led immunization. Immunization completion reduces OPSI risk (i.e., improved patient outcomes, reduced healthcare costs), generates pharmacy revenue, and enhances pharmacy services.

311 | Pharmacist-led transitions of care coordination for extended chemoprophylaxis at a Level-1 trauma center

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Service or Program: A novel, pharmacy-led process was implemented to enhance enoxaparin chemoprophylaxis procurement for patients with acute lower extremity fractures with weight bearing restrictions. The process includes inpatient pharmacy consults, electronic medical record (EMR) order sets, and EMR referrals to the hospital-based outpatient pharmacy Transition of Care (TOC) service. TOC activities include mitigating financial barriers and coordinating dispensing to bedside or procurement upon discharge from inpatient rehab (IPR), skilled nursing facility (SNF), or long-term acute care facility (LTAC).

Justification/Documentation: An amended chemoprophylaxis protocol increased patient volume and risked non-compliance if drug procurement barriers existed. Surgeon anecdote noted patients discharged from secondary facility without enoxaparin resulting in venous thromboembolism (VTE). From August 2019 through March 2020, 662 referrals were completed. Trauma registry data on 487 patients demonstrated even disposition distribution: 172 (35.3%) home, 170 (34.9%) IPR, and 142 (29.2%) SNF/LTAC. The orthopedic service had more patients served (272 [41.1%] vs 390 [58.9%]). Patients primarily received enoxaparin twice-daily [86.4%] with a median (IQR) dose of 30 (30-40) mg.

Adaptability: Trained inpatient pharmacists and outpatient pharmacy personnel possess the skills to promote VTE prophylaxis in orthopedic trauma patients. This service secures patient outcomes through inpatient dose optimization and successful enoxaparin procurement. Enoxaparin dispensing generated revenue from the outpatient pharmacy. The program was further adapted in March 2020 to include automatic inpatient pharmacy consults for enoxaparin dosing,

monitoring, and TOC referrals. Care coordinators, advance practice nurses and physicians are trained to EMR activities.

Significance: Injured patients are at high risk for VTE and subsequent morbidity, mortality, and economic burden. Contemporary practice endorses extended prophylaxis following major orthopedic injury. This is the first service to promote in- and out-patient pharmacy-led chemoprophylaxis management for trauma patients discharging to home or facility. Future observations include evaluation of VTE reduction and revenue.

Pharmacogenomics/pharmacogenetics

312 | Feasibility of clinical pharmacogenomics in a private practice

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Service or Program: A pharmacogenomics pilot program was developed to help integrate pharmacogenomics into an ambulatory care clinic in Northwest Ohio. The program served as an opportunity to educate patients and healthcare providers on pharmacogenomics and provide a unique educational structure for students. Students and faculty identify patients taking multiple medications and provide an overview of pharmacogenomics to patients and discuss the benefits of tailored drug therapy. Students then perform a cheek swab which is sent to the College of Pharmacy lab to identify the frequencies of various alleles in the ambulatory care clinic's patient pool for research purposes only. Future initiatives will incorporate billing insurance and obtaining results from a CLIA certified lab to allow for therapeutic decisions to be made regarding patient therapy.

Justification/Documentation: Ambulatory care settings provide ample opportunity for pharmacists to meet with patients to help tailor their medication regimens; however, pharmacogenomics has not often been utilized in this setting. This service also provides a layered learning approach to train multiple cohorts of students. Relationships have been built with early adopter physicians and the pharmacogenomics service has identified that 40% of patients may benefit from pharmacogenomic testing.

Adaptability: This service is ideal for an ambulatory setting and can be integrated into routine workflow. The target population for this project is primarily internal medicine patients; however, the service could be beneficial for a variety of specialties. The service requires a strong team of physicians and pharmacists as well as support from an associated lab.

Significance: This project has shown that many patients may benefit from pharmacogenomic testing in an ambulatory setting. This initiative could advance the role of clinical pharmacists, allowing for an expansion of services offered and an increase in optimization of patients' medications. Additionally, the service provides experiential opportunities for students to learn about pharmacogenomics and its impact on patient care.

313 | Clinical implementation of *CYP2C19* genotype-guided proton pump inhibitor therapy

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Service or Program: As part of the preemptive clinical pharmacogenomics program at St. Jude Children's Research Hospital (St. Jude), 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). In 2018, CDS alerts for CYP2C19 ultrarapid metabolizers (UMs) were developed to inform proton pump inhibitor (PPI) (omeprazole, pantoprazole, and lansoprazole) dosing to maximize the likelihood of therapeutic efficacy.

Justification/Documentation: PPIs are metabolized primarily by CYP2C19 into inactive metabolites. Patients who are CYP2C19 UMs are at risk for subtherapeutic plasma concentrations and treatment failure with standard doses. Doubling the starting dose of omeprazole, pantoprazole, and lansoprazole in CYP2C19 UMs is recommended to improve efficacy. Among the 5,270 patients genotyped at St. Jude to date, 5% (n = 249) are CYP2C19 UMs. Of these patients, 3% (n = 8) had an order for omeprazole, lansoprazole, or pantoprazole which triggered a CDS alert in the past year. CPIC recently drafted a guideline for *CYP2C19*-guided PPI dosing that includes further recommendations for patients with other CYP2C19 phenotypes beyond CYP2C19 UM. These new recommendations are being implemented at St. Jude, which will have clinical implications for many patients.

Adaptability: St. Jude is one of many institutions worldwide that have adopted CPIC guidelines for clinical implementation. The CPIC guideline for *CYP2C19* and PPIs provides informatics resources, including a *CYP2C19* genotype to phenotype translation table; examples of interpretive consults and CDS language pertaining to *CYP2C19*/PPIs; and workflows for implementing *CYP2C19*/PPIs into the EHR that any institution can modify for its own use.

Significance: *CYP2C19*-guided PPI therapy has the potential to improve clinical outcomes. St. Jude's clinical pharmacogenetics implementation program serves as a model for other institutions that are considering integrating *CYP2C19* genotype into the EHR to guide PPI dosing.

CASE REPORTS

ADR/Drug Interactions

464 | Supratherapeutic INR in a warfarin patient ingesting Marrubium vulgare: A case report

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Introduction: Warfarin a vitamin K dependent anticoagulant whose metabolism through cytochrome P450 enzymes has resulted in extensive documentation of drug-drug interactions. However, data regarding warfarin's effects when used in conjunction with herbal products, such as Marrubium vulgare, commonly known as horehound, is lacking.

Case: An 85-year-old white male with a history of pulmonary emboli presented to clinic for warfarin management. He had been stabilized on warfarin 23 mg/week. His point-of-care INR registered at 4.5. Interview with the patient revealed ingestion of several bags of herbal candy within the last week, the only ingredients of which were horehound and sugar. Warfarin was held per pharmacy algorithm and patient was counseled to moderate intake of horehound candy. At one-week follow-up, his INR returned to 1.6. Three months later, the patient's point-of-care INR registered at 5.1. While his lisinopril had been increased, the patient also admitted to increased intake of horehound candy the week prior. Warfarin was held per the clinic algorithm and the patient was advised to discontinue horehound consumption. At six-day follow-up, the patient's INR returned to 3.1.

Discussion: The interaction between warfarin and horehound was classified as “probable” by The Drug Interaction Probability Scale . A comprehensive literature search revealed no pre-clinical and clinical drug interaction data that may have potentiated the anticoagulant effect of warfarin. The literature search was expanded to include all members of the Marrubium genus, as well as the mint family, Lamiaceae. One case report was isolated describing a woman who consumed higher than usual amounts of peppermint tea and subsequently had an INR of 4.8, though the publishing authors were unable to identify a mechanism for the interaction.

Conclusion: The temporal relationship of INR elevation with ingestion of horehound, as well as supratherapeutic INR with re-challenge, suggests that an interaction may be present between these two products.

465 | Cannabinoid hyperemesis syndrome and the use of haloperidol: A case report

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Introduction: In 2004, cannabinoid hyperemesis syndrome (CHS) was recognized as a new medical diagnosis because of the increasing rates of cannabis abuse. Despite the syndrome's increasing prevalence, many providers are unfamiliar with its diagnosis and treatment, and there is very little data supporting the clinical knowledge and treatment recommendations. Haloperidol has been widely used as an antiemetic for more than 40 years, often despite a lack of evidence-based clinical data on efficacy and side effects. We report the case of a female who presented to the emergency department with suspected CHS treated with haloperidol.

Case: A 34-year-old African American female with a history of diabetes and marijuana use presented to the emergency department (ED) with refractory nausea and vomiting. Her urine drug screen was positive for THC, but the patient denied using marijuana in the last three weeks before this admission and compliance with her current medication regimen. Her vomiting was bilious and sometimes mixed with blood. She denied alcohol use and cigarette smoking. The patient was unresponsive to ondansetron, promethazine, scopolamine, and metoclopramide. When haloperidol 5 mg by mouth every 8 hours was initiated, nausea and vomiting subsided after two days of therapy.

Discussion: Three previous case reports on cannabinoid hyperemesis syndrome reported that haloperidol was able to control nausea and vomiting. However, two of those reports haloperidol was given intravenously, and in the third, the route of administration wasn't provided. To our knowledge, we are the first to show the benefit of haloperidol given by mouth for CHS.

Conclusion: Although the exact mechanism of haloperidol is unknown when treating CHS, our case, along with the three other cases, show its benefit. More extensive clinical trials are needed to confirm the haloperidol's therapeutic role in patients presenting with CHS symptoms.

466 | Did outside hospital administration of propofol contribute to the development of propofol infusion syndrome?

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Introduction: Propofol infusion syndrome (PRIS) is a rare, but fatal complication of propofol that is characterized by metabolic acidosis, rhabdomyolysis, arrhythmias, acute renal, hepatic and cardiac failure and death.

Case: A 22-year-old, 94.7 kg Caucasian male with no significant medical history presented to an outside hospital (OSH) after a ground-level fall during an assault. Patient underwent an emergent craniotomy for intraparenchymal hemorrhage and epidural hematoma, then transferred intubated and sedated to our hospital on propofol 6 mg/kg/hr. Upon arrival, his propofol was decreased to 1.2-2.4 mg/kg/hr (triglyceride 69 mg/dL). Day 2, propofol was increased to 4.8 mg/kg/hr,

midazolam was started, and patient was paralyzed for increased ICP. Day 3, propofol was increased to 6 mg/kg/hr and vasopressors were started (triglyceride 57 mg/dL). Day 4, propofol continued at 4.8-6 mg/kg/hr (triglyceride 270 mg/dL). Day 5, propofol was weaned (triglyceride 596 mg/dL) and shut off after patient suddenly developed a wide complex tachycardia, severe hypotension, metabolic acidosis, elevated cardiac and hepatic enzymes. Day 6, patient developed a bundle branch block, K^+ 5.9 mEq/L, SCr 2.55 mg/dL, CO_2 17 mmol/L, triglyceride 340 mg/dL, AST/ALT 4144/1856 IU/L, CK 56667 IU/L, troponin 6.9 ng/mL, CK-MB 161.3 ng/mL, lactate 6.2 mmol/L, pH 7.14, pCO_2 47 mmHg, pO_2 72 mmHg, B.E.-15 mmol/L. Unfortunately, the patient sustained irreversible complications and shortly passed.

Discussion: Though PRIS is often a diagnosis of exclusion, this patient had several risk factors, including severe head injury, concomitant catecholamine administration and a propofol rate > 4 mg/kg/hr for >48 h. OSH records later revealed patient had received propofol 250 mg IVP for intubation and propofol 4.5 mg/kg/hr post-craniotomy (even though he arrived on 6 mg/kg/hr).

Conclusion: Critically ill patients with severe head injury often receive high-dose propofol for sedation and ICP management. It is important to not only acknowledge OSH medications given, but also to consider the additive amount/doses given, especially with medications like propofol, in which a life-threatening adverse effect can occur at high doses.

Adult Medicine

467 | Utilizing remdesivir to treat novel coronavirus disease 2019 (SARS-CoV-2) in a patient with acute renal failure on hemodialysis: A case report

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Introduction: On May 1, 2020, the US Food and Drug Administration issued an emergency use authorization to permit the use of remdesivir for treatment of adults and children hospitalized with severe SARS-CoV-2. Severe SARS-CoV-2 infection leads to an acute kidney injury in up to 20-40% of critically ill patients. Patients with severe acute renal failure on hemodialysis were excluded from remdesivir trials; as a result, these patients may not be considered for treatment.

Case: A 63-year-old African American male with past medical history of diabetes, hypertension, and vertigo presented with flu-like symptoms and shortness of breath. He was found to be SARS-CoV-2 positive. On arrival he developed acute respiratory distress syndrome and required intubation. Chest x-ray showed bilateral pulmonary opacities. The patient was diagnosed with acute renal failure with a BUN of 89 mg/dL, SCr of 7.8 mg/dL and CrCl of 12 ml/min on admission. The patient received hemodialysis daily until hospitalization day 9, and thereafter on Monday, Wednesday, Friday. The remdesivir loading dose was given on hospitalization day 7 and treatment was typically administered after dialysis, for a total of 5 days. The patient's liver function tests remained within normal limits, AST ranged from 24-28 IU/L and ALT ranged from 23-24 IU/L, throughout the full course of therapy.

Discussion: Current literature dismisses the use of remdesivir in patients with a CrCl less than 30 ml/min. Concerns about the drug's potential toxicity in patients with kidney disease relates to the renal elimination and the potential accumulation of its sulfobutylether-beta-cyclodextrin (SBECD) carrier, causing liver necrosis. The absence of liver function decline in this patient suggests remdesivir, a potentially beneficial agent, may be considered safe when scheduled after hemodialysis.

Conclusion: Remdesivir appears to be safe in patients with acute or chronic renal disease on hemodialysis. Daily liver function tests should be performed in this patient population.

Ambulatory Care

468 | Renal dysfunction with concomitant use of SGLT-2 inhibitors and thiazide diuretics: A case report

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Introduction: This is the first case report that links acute renal dysfunction to sodium-glucose cotransporter-2 inhibitor (SGLT-2i) use in patients already taking thiazide diuretics. It is also the first to describe steps taken to reverse renal dysfunction after the co-administration of these two agents. This will add a unique perspective to the medical literature regarding the safe use of SGLT-2i and may prompt continued research in this area.

Case: A 77-year-old male with type 2 diabetes and pulmonary hypertension being followed for diabetes management. Pertinent medications include basal/bolus insulin, lisinopril-hydrochlorothiazide, and furosemide. The patient's average baseline eGFR was 48 mL/min/1.73m^2 but dropped to 39 mL/min/1.73m^2 after he started empagliflozin one week prior. Due to the temporal relationship, we deemed this acute drop in renal function to be caused by excess volume depletion secondary to empagliflozin initiation. Hydrochlorothiazide was discontinued, and his eGFR increased to 42 mL/min/m^2.

Discussion: The findings of this case are consistent with the current medical literature that describes the possibility of volume depletion with SGLT-2i. In contrast, there is no medical literature that describes holding thiazides in this clinical setting. A strength of this case is that an eGFR was obtained one week after empagliflozin was started while the patient was taking hydrochlorothiazide. Additionally, a follow-up eGFR was obtained approximately one month after hydrochlorothiazide was stopped; this established a temporal relationship. A limitation of this case is that comorbidities and other medications may have confounded the observed outcome. Nonetheless, the hypothesis that

emerges is if thiazides are held prior to SGLT-2i initiation, then there will be a decreased risk of volume depletion and subsequent renal injury.

Conclusion: Initiating SGLT-2i concomitantly with thiazides may increase the risk of acute reductions in kidney function. Moreover, holding thiazides after kidney injury occurs halts acute declines in renal function and may hasten recovery.

Cardiovascular

469 | Acute management of rivaroxaban-induced splenic rupture: A case report

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Introduction: Rivaroxaban has shown similar bleed risk to warfarin when used for prevention of stroke. However, risk of major gastrointestinal bleeding is significantly higher compared to warfarin treatment. Rivaroxaban has also been implicated in a limited number of cases of splenic rupture, with little guidance on management and when to safely reintroduce rivaroxaban for long-term anticoagulation.

Case: A 73-year-old female with a history of atrial fibrillation and COPD presented with upper left quadrant and chest pain. Home medications included albuterol, fluticasone, ipratropium, umeclidinium, metoprolol, trazodone, rivaroxaban 20 mg, and 2 L of oxygen. Initial labs included hemoglobin 14.7 g/dL and hematocrit 42.6%. While the chest pain was initially relieved after the administration of nitroglycerin, aspirin, ondansetron, and IV fluids by EMS, the left upper quadrant pain persisted. An abdominal CT revealed splenic laceration with hemoperitoneum, leading to a diagnosis of splenic rupture. Rivaroxaban was immediately discontinued and subsequently reversed with 4-factor prothrombin complex concentrate and 2 units of packed red blood cells.The patient underwent emergent splenectomy and required vasopressor support until extubation 2 days after surgery. Rivaroxaban 20 mg was restarted 6 days postoperatively without complications and the patient was discharged home 6 days later.

Discussion: There are approximately 4 previous case reports of spontaneous splenic rupture in patients receiving rivaroxaban. Naseem et al attributed the cause to the combination of rivaroxaban and aspirin 100 mg, while our patient had no confounding agents that alter bleed risk. Similar to our patient, all previous reports have occurred in elderly patients. Use of the Naranjo adverse drug reaction probability scale (n = 6) showed a probable relationship between rivaroxaban and splenic rupture.

Conclusion: Reversal of rivaroxaban via institution protocols should be prioritized upon diagnosis of spontaneous splenic rupture to attenuate bleeding. After splenectomy, rivaroxaban can be safely restarted within 1 week in the absence of overt bleeding.

Critical Care

470 | A negative outcome following alteplase administration prior to ECMO in a kidney transplant patient with cardiac arrest: A case report

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Introduction: Limited evidence addresses patient outcomes after administration of systemic thrombolysis during cardiac arrest with subsequent need for extracorporeal membrane oxygenation (ECMO); positive outcomes are more likely to be reported. This case illustrates the importance of discussing the possibility of ECMO before administering systemic thrombolysis during a code.

Case: A 52-year-old man status-post kidney transplant had a witnessed cardiac arrest in the surgical ICU on post-operative day 3 after developing sudden-onset chest pain and shortness of breath. Twenty-two minutes after the start of the arrest, 50 mg of alteplase was administered intravenous push for suspected pulmonary embolism (PE). Five minutes later, the possibility of ECMO was discussed and the patient was placed on veno-arterial ECMO. His ECMO course was plagued by low flows, hypotension, and hypovolemia due to hemorrhagic shock. Seven hours after ECMO was started, CPR was reinitiated and continued for 69 minutes prior to the decision to cede further resuscitation efforts due to futility. Autopsy findings included an immediate cause of death as acute MI with extensive retroperitoneal hemorrhage.

Discussion: The role of ECMO during cardiac arrest is emerging, therefore little is known about the safety of ECMO initiation post-systemic thrombolysis. Although systemic thrombolytics are not administered routinely in cardiac arrest given their cost and lack of data indicating benefit, clinical practice guidelines recommend considering them for suspected PE, but do not discuss the role of ECMO. Our patient was at risk for bleeding, however it was decided the risks of systemic thrombolysis were justifiable, given the patients' severity of illness and poor prognosis. Based on the Naranjo Algorithm, it is possible the patient hemorrhaged from receiving alteplase with subsequent ECMO cannulation.

Conclusion: The healthcare team should discuss the possibility of ECMO during cardiac arrest *before* administering systemic thrombolysis, due to poor patient candidacy for subsequent cannulation from increased risk of catastrophic bleeding.

471 | Adalimumab-associated hypokalemia and rhabdomyolysis in a patient with Crohn's disease: A case report

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Introduction: Adalimumab is a tumor necrosis factor alpha antibody that is approved for use in Crohn's disease (CD). Common adverse effects include headache, infections, and dermatologic complications. Cases of severe hypokalemia and rhabdomyolysis associated with adalimumab have not been reported.

Case: A 59-year-old male with a 20-year history of CD presented with elevated creatine phosphokinase (10,118 U/L), hypokalemia (2.0 mEq/L), and hypocalcemia (5.5 mg/dL). The patient reported muscle pain and weakness in the extremities beginning 2 days prior to admission. His symptoms of CD had been well-controlled with budesonide and mesalamine. However, he experienced an exacerbation 1.5 weeks prior to admission, which was subsequently resolved after receiving a loading dose of adalimumab. Upon admission, serum levels continued to trend downwards to a nadir of 1.7 mEq/L potassium, 5.3 mg/dL calcium, 0.48 mEq/L magnesium, and 2.0 mg/dL phosphate, despite administration of fluids and electrolytes. The patient was admitted to the intensive care unit (ICU) for close monitoring and aggressive electrolyte replacement. On day 4 of hospitalization, rhabdomyolysis improved, and the patient was transferred to a non-ICU unit.

Discussion: While hyperkalemia is a consequence of rhabdomyolysis, our patient uniquely presented with hypokalemia, which led us to hypothesize that electrolyte deficiencies caused by adalimumab may be the etiology of rhabdomyolysis. Although electrolyte abnormalities have been linked to uncontrolled CD, there are very few reports of severe imbalances leading to subsequent muscle damage.

Conclusion: Hypokalemia and rhabdomyolysis are potential adverse events of concern associated with adalimumab. There are no previous reports of severe symptomatic cases. Prescribers should be aware of these complications of adalimumab therapy since patients with CD are at a higher risk for electrolyte disturbances.

472 | Methylene blue rescue? A case report of a toxic amlodipine overdose

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Introduction: Patients presenting with amlodipine toxicity have a high mortality and may not respond to the standard of care (insulin, vasopressors, calcium). Amlodipine causes profound vasodilatory shock in overdose secondary to its peripheral selectivity and induction of nitric oxide synthase. Methylene blue (MB) has displayed efficacy in the treatment of vasoplegia during cardiac bypass, sepsis, and anaphylaxis. However, there is little human data on MB use in amlodipine overdose.

Case: A 55-year-old female with a history of hypertension, anxiety, and depression presented to a hospital after ingestion of "half a bottle" of amlodipine. Progressive hemodynamic collapse and respiratory failure requiring intubation and vasopressor support prompted transfer to a higher level of care. Adjunctive high-dose insulin at 8 units/kg/hr, 10 mg of glucagon, 6 grams of calcium chloride, 13 sodium bicarbonate pushes (50 mEq each) and 14 grams of lipid emulsion therapy were added with ongoing difficulty of maintaining adequate hemodynamics. Vasopressors titrated to epinephrine 100 mcg/min, norepinephrine 130 mcg/min, phenylephrine 130 mcg/min, and vasopressin 0.08 units/min. At 26 hours post ingestion, MB was initiated at 1 mg/kg bolus over 20 minutes, followed by 0.25 mg/kg/hour infusion. One hour after, the blood pressure increased from 67/51 mm Hg to 111/56 mm Hg and her pulse rate remained at 61 beats/min. Three hours after initiation, the patient decompensated and could not be resuscitated.

Discussion: Administration of methylene blue provided a transient effect on blood pressure. No noticeable adverse effects were documented, albeit she did not survive very long after administration. It is uncertain whether the delay in methylene blue initiation or administration of lipid emulsion prior could have affected the efficacy of methylene blue.

Conclusion: Methylene blue provided a transient improvement in hemodynamics, but its role in amlodipine toxicity has yet to be determined.

Infectious Diseases

473 | A case series of cidofovir use for severe adenovirus pneumonia in immunocompetent patients

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Introduction: Adenovirus pneumonia is often severe and associated with high mortality, particularly in immunocompromised patients. Most patients are managed solely with supportive care because most antivirals lack clinical activity against adenovirus. However, data suggest potential benefit with cidofovir for adenovirus pneumonia in immunocompromised patients, but data in immunocompetent patients are limited.

Case: This case series describes the use of intravenous cidofovir for severe adenovirus pneumonia in two immunocompetent patients. Patient 1 was a 64-year-old, 80 kg male with no significant past medical history (PMH) who presented with fever, respiratory symptoms, and extensive lobar consolidation on chest imaging. He developed respiratory failure requiring intensive care unit (ICU) admission, mechanical ventilation, and vasopressors. Cidofovir 5 mg/kg based on total body weight was administered with probenecid and fluids as directed on day 3. Patient 2 was a 32-year-old, 119 kg male with a PMH of diaphragm paralysis who presented with fever, respiratory

symptoms, and opacities on chest imaging. He developed respiratory and renal failure that required ICU admission, mechanical ventilation, venovenous extracorporeal membrane oxygenation, continuous venovenous hemofiltration, and vasopressors. Cidofovir 5 mg/kg based on adjusted body weight was administered with probenecid and fluids as directed on day 9 and 16. Patients 1 and 2 both demonstrated symptomatic improvement and were discharged without further complications on day 11 and day 33, respectively. Both patients did not experience any cidofovir-related adverse effects, including nephrotoxicity and myelosuppression.

Discussion: Although cidofovir has shown potential benefit in treating adenovirus infections in immunocompromised patients, use in immunocompetent patients remains controversial due to limited data available. Based on our findings, cidofovir provided symptomatic improvement without development of cidofovir-related adverse effects.

Conclusion: Cidofovir may be beneficial for treatment of severe adenovirus pneumonia in immunocompetent patients where limited treatment options exist. Additional data are needed to investigate and confirm our findings.

474 | Cytomegalovirus co-infective bacterial endocarditis in a renal transplant patient: A case report

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Introduction: Cytomegalovirus (CMV) infection is a common complication in solid organ transplant recipients. CMV endocarditis is a rare presentation and has not been reported in a renal transplant recipient.

Case: A 46-year-old man with a history of deceased donor renal transplant in 2013, diabetes, hypertension, and acute cellular rejection in 2014 treated with corticosteroids and thymoglobulin, presented with a 5-day history of progressive dyspnea, orthopnea, and productive cough. Home medications included prednisone, tacrolimus, and mycophenolate. Prior to admission, he received amoxicillin-clavulanate for an upper respiratory tract infection. Due to suspicion of acute heart failure, a transthoracic echocardiogram was performed revealing severe aortic regurgitation with suspicion of aortic valve infective endocarditis, which was confirmed with a transesophageal echocardiogram. The patient underwent valve replacement and the native valve was sent for further testing. Blood and valve cultures remained sterile, but *Streptococcus mitis* was identified via 16S rRNA gene sequencing. On hematoxylin-eosin stained slides of the aortic valve tissue, viral inclusions suggestive of CMV were identified, which was confirmed by immunohistochemical staining. CMV DNA was not detected in serum using quantitative real-time PCR. The patient received ceftriaxone and IV ganciclovir followed by valganciclovir for 6 weeks each with subsequent improvement. Approximately 6 months later, he was hospitalized with culture-negative prosthetic valve endocarditis and succumbed to his illness.

Discussion: Cardiovascular CMV disease has been described but only two cases of valvular involvement have been reported. In one, CMV endocarditis was diagnosed in a patient with uncontrolled HIV and a history of intravenous drug abuse. In the other, CMV endocarditis was identified post-mortem in an immunocompromised critically ill patient. Performance of pathologic analysis of valve tissue can assist in identifying CMV involvement, even in the setting of concomitant bacterial endocarditis.

Conclusion: CMV should be considered as a potential pathogen for endocarditis in immunocompromised hosts.

475 | Combination therapy for disseminated strongyloidiasis with associated vancomycin-resistant enterococcus meningitis: A case report

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Introduction: Severe *Strongyloides* infections have case-fatality rates approaching 90%. In disseminated strongyloidiasis (DS) the parasites larval form can invade numerous organs. In rare cases, DS has caused enterococcal meningitis. In patients with vancomycin-resistant *Enterococcus faecium* (VRE) meningitis, combination therapy and antibiotic central nervous system (CNS) penetration should be considered. We report a case of DS with concurrent VRE meningitis.

Case: A 61-year-old male presented with encephalopathy, fevers, tachycardia, hypoxemia, and leukocytosis. Initial differential diagnosis included alcohol withdrawal, stroke and meningitis. A viral panel, sputum, blood and CSF cultures were collected upon admission. The patient was empirically initiated on acyclovir, vancomycin and meropenem. CSF cultures showed preliminary growth of gram positive cocci in pairs. On day 3, the CSF culture finalized positive for VRE. The VRE susceptibility report was intermediate to linezolid and susceptible to daptomycin with a minimum inhibitory concentration of 4 mcg/mL. Antibiotics were adjusted to daptomycin 12 mg/kg, linezolid and tigecycline until quinupristin/dalfopristin could be obtained. On day 5, the ova and parasite culture returned positive for *Strongyloides stercoralis* and ivermectin was initiated. On day 12, repeat cultures returned negative. Despite negative cultures, the patient expired on day 17 from secondary sequel.

Discussion: CNS penetration and synergistic combination therapy should be considered in patients with VRE meningitis. Due to linezolid's CNS penetration (18-36%), it is the treatment of choice. Comparatively, CNS penetration for daptomycin is estimated 5% and it is unknown for tigecycline and quinupristin/dalfopristin.

The susceptible dose-dependent breakpoint of ≤4 mcg/mL, established by the Clinical and Laboratory Standards Institute, requires a daptomycin dosage of 8-12 mg/kg/day for serious *E. faecium* infections. Although data are limited, the variable CNS penetration of anti-VRE agents may warrant combination therapy.

Conclusion: Due to the high mortality rate associated with DS, combination therapy and drug penetration should be considered in patients with concurrent VRE meningitis.

476 | **Carbapenem resistant Enterobacter cloacae infection: A case report of failed treatment with ceftazidime-avibactam in a morbid obese patient with growing resistance patterns**

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Introduction: The 2019 Antibiotic Resistance Threats Report from the Center for Disease Control (CDC) and Prevention named Carbapenem-Resistant Enterobacteriaceae (CRE) an urgent threat requiring aggressive action. Newly approved beta-lactam/beta-lactamase inhibitors are used to treat CRE with unknown success rates. *Enterobacter cloacae* resistant to ceftazidime-avibactam and ceftolozane-tazobactam is reported here in a case report of an obese patient with such growth in both wound and sputum cultures validating the need of new and successful options for aggressive treatment.

Case: A 51-year-old morbid obese (BMI 56.31 kg/m^2) patient was readmitted to the hospital with myxedema coma and resolving cellulitis. The patient was intubated with rapid correction of his thyroid hormone levels with intravenous levothyroxine and liothyronine. Initially, the patient was treated with vancomycin and piperacillin-tazobactam deescalated to levofloxacin for a ventilator-associated pneumonia with growth of pan-sensitive *Serratia marcescens*. Post therapy, patient developed fevers with rising white blood cell counts leading to the initiation of meropenem and vancomycin with pan-cultures including wound and sputum, of which grew carbapenem resistant *Enterobacter cloacae*. Amikacin (sensitive) plus ceftazidime-avibactam (unknown) was started following sensitivity reporting. Testing was ordered for ceftazidime-avibactam, ceftolozane-tazobactam and meropenem-vaborbactam. Fevers continued throughout therapy with addition of meropenem to regimen. Due to decline, care was withdrawn prior to sensitivity reports demonstrating resistance to ceftazidime-avibactam and ceftolozane-tazobactam.

Discussion: Current literature does not report use ceftazidime-avibactam in morbid obese patients demonstrating success. Treatment of CRE infections continues to be a trial and error as effective therapy is unavailable. Testing presents a challenge as newer agents are not routinely reported. Testing strategies should be adopted to allow for rapid testing and reporting of newer agents post CRE results.

Conclusion: Empiric use of ceftazidime-avibactam with amikacin and meropenem in carbapenem resistant *Enterobacter cloacae* did not yield success. Rapid testing may allow better therapy selection to improve patient outcome.

Pediatrics

477 | **Case Report: Management of uncontrolled hypertension with a phentolamine continuous infusion in a pediatric patient**

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Introduction: This case contributes information to the literature which is currently lacking. It describes the successful use of a phentolamine continuous infusion to treat uncontrolled hypertension non-responsive to traditional pharmacologic management in a pediatric patient.

Case: A 4-month-old male patient in heart failure was experiencing uncontrolled hypertension. Due to the lack of hemodynamic stability, he could not be listed for heart transplant. He received multiple antihypertensive agents as both intermittent and continuous infusions over the course of multiple days without the achievement of normotension. It was requested to administer intravenous phentolamine as a continuous infusion to achieve hemodynamic stability. Within 8 hours of initiation of the phentolamine infusion the patient achieved desired hemodynamic goals and was listed for heart transplant. The continuous phentolamine infusion was administered over the next 4 days to maintain normotension and on day 4 the patient underwent successful orthotopic heart transplant.

Discussion: There is limited information on the use of phentolamine in hypertensive crises outside of the setting of perioperative management of pheochromocytoma. Additionally, there is limited information on using a continuous phentolamine infusion in any setting and even more limited in pediatric patients. In this case of uncontrolled hypertension, intervention using traditional pharmacologic agents was unsuccessful, necessitating the utilization of non-traditional methods. Due to its vasodilatory properties on smooth muscle via potent non-selective alpha-adrenergic receptor blockade, phentolamine may be useful as an intravenous agent for treatment of hypertensive crises non-responsive to traditional management in pediatric patients.

Conclusion: The main take-away is that a phentolamine continuous infusion was successful in treating a pediatric patient with uncontrolled hypertension. This demonstrates an unconventional methodology in the management of uncontrolled hypertension non-responsive to traditional pharmacologic strategies in a critically ill pediatric patient.

Psychiatry

478 | **Successful treatment of extrapyramidal symptoms with amantadine in a child: A case report**

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Introduction: Children and adolescents are more susceptible to extrapyramidal symptoms (EPS) of antipsychotics. In such cases, it may not be reasonable to choose an alternative antipsychotic to that which stabilized the patient's symptoms. Therefore, the patient may require EPS treatment. Benztropine, a histamine receptor antagonist, is the typical agent used for EPS in the pediatric population, but may cause intolerable anticholinergic effects. Amantadine, a dopaminergic agent, is a reasonable alternative for EPS studied in the adult population, however, there is limited data to support use in the pediatric population.

Case: A 12-year old female with a history of conduct disorders presented with increased aggression resulting in harm to staff, requiring restraints. The patient was treated with aripiprazole prior to admission which had failed to control her outbursts and aggressive behavior. She was stabilized on risperidone, however, she experienced neck stiffness, rigidity in her arms, and cogwheeling of her wrists. She was then treated with benztropine without complete resolution of EPS, and developed blurry vision six days after initiation which was determined to be a result of the medication. Benztropine was discontinued and amantadine was initiated. Within three days, the patient's blurry vision had resolved and there was complete resolution of EPS which was maintained through 11 days until discharge.

Discussion: Amantadine has been used off-label in treatment of EPS in adults, and in autism spectrum disorder and attention deficit hyperactivity disorder in children and adolescents. However, this is the first report of use for treatment of EPS in a child. This case demonstrates that amantadine may be safe and effective for the treatment of EPS in children.

Conclusion: Amantadine was safe and effective in treating EPS associated with risperidone in a child. It may be considered when benztropine causes adverse effects, or is not successful in completely resolving EPS.

479 | Topiramate-induced renal calculus in a patient with schizoaffective disorder: A case report and review of the literature for drug-induced renal calculi

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Introduction: Renal calculi are a common adverse effect of many medications across different classes. The best treatment recommendation is discontinuation of the medication followed by medical interventions to dislodge the calculi. However, psychotropic therapy is highly individualized in a psychiatric setting and discontinuing or switching medications may negatively impact the mental health of the patient. There is a need to identify pharmacologic and non-pharmacologic methods to prevent and treat renal calculi in this patient population.

Case: A 27-year-old African American female with schizoaffective disorder and unspecified convulsions was admitted into the state psychiatric hospital due to suicidal statements. Her past medications included fluphenazine, benztropine, diphenhydramine, and topiramate. A urinalysis upon admission revealed turbid urine and calcium oxalate crystals which were indicative of renal calculus development. Her current psychotropics included fluphenazine, olanzapine, and benztropine. Topiramate was not restarted upon admission and current progress notes indicate no recent renal calculus development. If topiramate was medically necessary to continue, renal calculus prevention would be needed. A literature search reveals an extensive amount of medication classes that can cause renal calculi, along with prevention and treatment methods.

Discussion: Many medication classes such as anticonvulsants, carbonic anhydrase inhibitors, vitamin D analogs, antigout agents, fluoroquinolone antibiotics, potassium-sparing diuretics, protease inhibitors, and antimetabolites have been shown to cause drug-induced renal calculi. Pharmacists play a critical role in recognizing these medications and recommending treatment and prevention options for renal calculi. Research has shown that dietary modifications and medications such as thiazide diuretics, potassium citrate, and allopurinol are effective in preventing calculus formation. Treatment options include alpha-1 antagonists and select medical procedures.

Conclusion: Pharmacists should be aware of medications that induce calculi, as well as the prevention and treatment methods available. Proper medication reconciliation and assessment can identity sources of calculi and prevent its occurrence. Pharmacist-driven interventions can improve patient care and outcomes.

Transplant/Immunology

480 | Tacrolimus dose adjustments when discontinuing protease inhibitor-based HIV regimen: A case report

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Introduction: People living with HIV (PLWH) are at increased risk of development of kidney disease and renal failure. PLWH who require a renal transplantation face unique challenges in medication management due to extensive drug-drug interactions which require frequent immunosuppressive medication monitoring.

Case: A 41-year-old male living with HIV received a kidney transplant in 2016 and presented to an HIV Clinical Pharmacist 2 years later for routine follow up and medication management. His antiretroviral regimen consisted of raltegravir, etravirine, darunavir, ritonavir, and he received tacrolimus and prednisone for maintenance of immunosuppression. Due to CYP 3A4 inhibition from darunavir and ritonavir, the patient's maintenance tacrolimus dose was 0.5 mg PO once weekly. His tacrolimus trough levels were within the goal range of 5 to 10 ng/mL and the patient's HIV viral load was undetectable. To optimize the patient's HIV regimen, decrease pill burden, and reduce drug-drug interactions, the team decided to switch to bictegravir/tenofovir alafenamide/emtricitabine. The patient was instructed to hold

tacrolimus for 5 days after switching HIV regimens. After the washout, even though his tacrolimus dose was increased to 0.5 mg PO BID, his tacrolimus trough was still subtherapeutic. He was increased to tacrolimus 1 mg BID for two weeks, which yielded a tacrolimus trough on the low end of his goal. When he was increased to 2 mg BID, he achieved two therapeutic troughs, and eventually the tacrolimus was titrated to 1 mg BID, which remains his optimal dose.

Discussion: There is no conclusive guidance on how to adjust tacrolimus doses when starting or discontinuing potent CYP 3A4 inhibitors. When switching this patient's HIV regimen, his tacrolimus dose required careful adjustment to prevent subtherapeutic tacrolimus concentrations.

Conclusion: It is critical that patients who are starting or discontinuing potent CYP 3A4 inhibitors or inducers receive prompt dose adjustment and close monitoring of tacrolimus trough concentrations.

ENCORE PRESENTATIONS

ADR/Drug Interactions

481E | Does clopidogrel decrease the efficacy of carboxylesterase-1 prodrugs?

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482E | Heparin induced thrombocytopenia with thrombosis: A case study

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484E | Ciprofloxacin/dexamethasone precipitate formation case report

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Cardiovascular

485E | P2Y12 inhibitor monotherapy after a short dual antiplatelet therapy vs. 12-monthdual antiplatelet therapy in patients undergoing percutaneous coronaryintervention: A meta-analysis

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Critical Care

486E | Case control study of risk factors for hyperchloremia in neurocritical care patients

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Presented at the American Society of Health-System Pharmacists (ASHP) Midyear Clinical Meeting, Las Vegas, NV, December 8-12, 2019.

487E | Nursing perceptions of sleep assessment in the intensive care unit

Mojdeh Heavner, Pharm.D., BCPS, BCCCP, FCCM[1], Sophia Jobe, BA[2], Julie Hurley, MSN, BSN[3], Brian Le, BSN[4], Christine Kantner, BSN[4], Jason Heavner, MD, FCCP[5], Carl Shanholtz, MD[2], Avelino Verceles, MD, MS[2] and Emerson Wickwire, PhD[6]

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Education/Training

488E | Factors influencing pharmacy faculty behavior, perceptions and challenges with determining authorship credit

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Annual Meeting, American Association of Colleges of Pharmacy, virtual, July 20, 2020.

489E | Assessment of APPE grading schemes used by ACPE accredited pharmacy schools and colleges

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Presented at the Annual Meeting of American Association of Colleges of Pharmacy, Chicago, IL, July 13-17, 2019

490E | Assessment of a lecture series to prepare Doctor of Pharmacy candidates for postgraduate training

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Kanaan AO, Carey K, Durand C, Dawson A, Cabrera A, Willett K. Assessment of a lecture series to prepare Doctor of Pharmacy candidates for postgraduate training. AACP Meeting. Chicago, IL July 2019

Endocrinology

491E | Endocrine education within clinical sciences curricula at United States schools and colleges of pharmacy

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Gastroenterology

492E | Prescribing patterns and predictors of anticoagulant choice in patients with portal vein thrombosis or splanchnic vein thrombosis

Ashley N. Fox, Pharm.D.[1], Jennifer Walling, Pharm.D.[2], Muhammad Bajwa, MD[3], Grant H. Skrepnek, Ph.D., RPh[4] and Ryan E. Owens, Pharm.D.[5]
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Presented at The ASHP Midyear Clinical Meeting, Las Vegas, NV, December 8-12, 2019.

Geriatrics

493E | **Emerging models of care: The impact of pharmacist-led medication management in a transitional care program**

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Innovation in Aging, Volume 3, Issue Supplement_1, November 2019, Page S708. Presented: The Gerontological Society of America's 71st Annual Scientific Meeting, Austin, Texas, from November 13-17, 2019.

494E | **Socioeconomic and geographical characteristics of medicare beneficiaries accessing medication therapy management (MTM) services**

Joshua Chou, Pharm.D., MS, BCGP[1], Karen Pellegrin, PhD, MBA[2], Catherine E. Cooke, MS, Pharm.D.[3], Barbara Zarowitz, Pharm.D., BCGP, BCPS, FCCP, FASCP[4], Alexandra Hanlon, PhD[5], Alicia Lozano, MS[5] and Nicole Brandt, Pharm.D., MBA, BCPP, BCGP, FASCP[4]
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Presented at the 2020 Pharmacy Quality Alliance Meeting, Baltimore, MD, May 6-7, 2020.

Hematology/Anticoagulation

495E | **Effectiveness and safety of rivaroxaban in patients with cancer-associated venous thromboembolism**

Olivia Costa, Pharm.D.[1], Christine Kohn, Pharm.D.[1], Gary Lyman, MD[2], Nicole Kuderer, MD[3], Thomas Bunz, Pharm.D., PhD[4] and Craig Coleman, Pharm.D.[1]
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Presented at: International Society of Thrombosis and Haemostasis 2020 Congress. Virtual Congress July 12-14, 2020.

HIV/AIDS

496E | **Incarcerated patients living with HIV: Are we appropriately managing ASCVD risk?**

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Presented at IDWeek, Chasing the Sun Virtual Conference, Oct 21-25, 2020.

497E | **Immunity to HAV and/or HBV among inmates living with HIV**

Nivedha Poondi, Pharm.D. Candidate[1], Jysheng Hou, Pharm.D. Candidate[2], Sarah Michienzi, Pharm.D.[3], Mahesh Patel, MD[4] and Melissa Badowski, Pharm.D., MPH, FCCP, BCIDP, BCPS, AAHIVP[5]
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Presented at Infectious Diseases Society of America (IDSA) IDWeek. Virtual Meeting. October 21-24, 2020.

Infectious Diseases

498E | Safety And Efficacy At 48 Weeks After Switching From Tenofovir Disoproxil Fumarate (TDF) To Tenofovir Alafenamide (TAF) in chronic HBV Patients With Risk Factors For TDF use

Hie-Won Hann, MD, Professor[1], Mindie Nguyen, MD[2], Scott Fung, MD[3], Calvin Pan, MD[4], Natarajan Ravendhran, MD[5], Myron Tong, MD[6], Edward Tam, MD[7], *Kris Mennen, RPh*[8], Leland Yee, PhD[8], Belinda Jump, MD[8], Yang Liu, MD[8], George Wu, PhD[8], Huy Trinh, MD[9], Charles Phan, MD[10], Mandana Khalili, MD[11], Xiaoli Ma, MD[12] and John Flaherty, Pharm.D.[8]

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Presented at the American Association for the study of Liver Disease November 8-12, 2019, Boston, MA.

499E | Efficacy of human-simulated exposures of meropenem/vaborbactam (MVB) and meropenem (MEM) against OXA-48 β-lactamase-producing enterobacterales in the neutropenic murine thigh infection model

Christian Gill, Pharm.D., Tomefa Asempa, Pharm.D. and David Nicolau, Pharm.D., FCCP, FIDSA

Center for Anti-Infective Research and Development, Hartford Hospital, Hartford, CT

Presented at IDWeek, Philadelphia, PA, Oct 2020.

500E | Ex vivo impact of autologous blood transfusion (ABT) on concentrations of antibiotics used for surgical prophylaxis

Maxwell Lasko, Pharm.D.[1], Allison Conelius, CCP, LP[2], Oscar Serrano, MD, MBA[3], David Nicolau, Pharm.D., FCCP, FIDSA[1] and Joseph Kuti, Pharm.D., FIDP[1]

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Presented at IDWeek, Philadelphia, PA, Oct 2020.

501E | Decolonization strategies and MRSA infection rates in a neurosurgical ICU at an academic medical center

Madison Salam, Pharm.D. Candidate[1], Ron Neyens, Pharm.D.[2], Nicole Bohm, Pharm.D.[2] and Erin Weeda, Pharm.D.[1]

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Presented at Making a Difference in Infectious Disease (MAD-ID), Orlando, FL, May 27-30, 2020. (Virtual).

502E | Efficacy and safety of antiviral treatment fo rCOVID-19 from evidence in studies of SARS CoV-2 and other acute viral infections:a systematic review and meta-analysis

Wei Liu, PhD[1], Pengxiang Zhou, MPharm[1], *Ken Chen, MPharm*[2], Zhikang Ye, MPharm[3], Fang Liu, MSc[4], Xiaotong Li, MSc[4], Na He, MSc[4], Ziyang Wu, BSc[4], Qi Zhang, MSc[4], Xuepeng Gong, PhD[5], Qiyu Tang, BSc[4], Xin Du, BSc[4], Yingqiu Ying, MSc[4], Xiaohan Xu, MSc[4], Yahui Zhang, BSc[4], Jinyu Liu, PhD[5], Yun Li, MSc[6], Ning Shen, MD[4], Rachel J. Couban, MA[3], Quazi I. Ibrahim, MSc[3], Gordon Guyatt, MD[3] and Suodi Zhai, BSc[1]

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503E | Treatment of *Legionella Pneumophila* using omadacycline versus moxifloxacin: Subanalysis results from a phase 3 randomized, double-blind, multicenter study (OPTIC)

Mauricio Rodriguez, Pharm.D., BCPS, BCCCP, BCIDP[1], Salim Surani, MD, FCCP[2], Antonio Anzueto, MD[3], Surya Chitra, PhD, MBA[4] and *Kyle Gunter, Pharm.D., MBA, BCPPS, CNSC*[5]

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Presented at Chest 2020, American College of Chest Physicians, Virtual Event, October 18-21, 2020.

504E | **Targeted substitution of omadacycline in place of standard of care for CABP treatment is associated with a risk reduction of *clostridioides difficile* infection and financial cost savings in the acute care setting**

Mauricio Rodriguez, Pharm.D., BCPS, BCCCP, BCIDP[1], Surya Chitra, PhD, MBA[2], Kelly Wright, Pharm.D.[3] and Thomas Lodise, PhD, Pharm.D.[4]

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Presented at IDWeek, Infectious Disease Society of America, Virtual Meeting, October 21-25, 2020.

505E | **Subinhibitory concentrations of omadacycline inhibit Staphylococcus aureus hemolytic activity in vitro**

Alisa Serio, PhD[1], Ken Tanaka, PhD[2], *Kelly Wright, Pharm.D.*[3] and Lynne Garrity-Ryan, PhD[4]

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Presented at IDWeek 2020, Infectious Disease Society of America, Virtual Meeting, October 21-27, 2020.

506E | **Addition of sulfamethoxazole-trimethoprim (SMX/TMP) to daptomycin persistent MRSA bacteremia with β-lactam allergy: A case report**

Su Lee, Pharm.D., M.S.[1], Romic Eskandarian, Pharm.D.[2], Regina Rho, Pharm.D.[3] and Elizabeth Maslow, M.D.[4]

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Presented at CSHP Seminar, Anaheim, CA, Oct 17-20, 2019.

507E | **Compassionate use of remdesivir in pregnant women with severe COVID-19**

Thomas A. Hahambis, PA-C, MHS[1], Richard M. Burwick, MD[2], Sigal Yawetz, MD[3], Kathryn E. Stephenson, MD[4], Ai-ris Collier, MD[4], Pritha Sen, MD[4], Brian Blackburn, MD[5], Erna M. Kojic, MD[6], Adi Hirshberg, MD[7], Magdalena E. Sobieszczyk, MD[8], Kristen Marks, MD[9], Shawn Mazur, MD[10], Oriol Manuel, MD[11], Gregory Morlin, MD[12], Adam Dezure, MD[1], Susanna Tan, MD[1], Yang Zhao, PhD[1], Jason Hindman, Pharm.D., MBA[1], Anand Chokkalingam, PhD[1], Christoph C. Carter, MD, PhD[1], Moupali Das, MD[1], Diana M. Brainard, MD[1], Tilly Varughese, MD[13], Matthew Sims, MD, PhD[14], Samit Desai, MD[15], Geeta Swamy, MD[16], Jeanne Sheffield, MD[17], Rebecca Zash, MD[4] and William R. Short, MD[7]

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Presented at Burwick, IAS Virtual Conference, 10-11 July 2020.

508E | **A pharmacoepidemiologic evaluation of echinocandin use**

Jinhee Jo, Pharm.D.[1], Joshua Hendrickson, Pharm.D.[2], Anne Gonzales-Luna, Pharm.D., BCIDP[2], Nicholas Beyda, Pharm.D., BCPS[2] and Kevin Garey, Pharm.D., MS[3]

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Presented at ID week, Oct 21-25, 2020.

509E | **Significant decline in carbapenem use with multifaceted antimicrobial stewardship program (ASP) interventions**

Sandeep Gupta, MD[1], Ashlesha Kaushik, MD[2], Erin Lettow, Pharm.D.[3], Jenna Lundsgaard, Pharm.D.[3], Corey Thieman, Pharm.D.[3], Fekadu Fullas, PhD[3] and Michael Padomek, Pharm.D.[3]

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Presented at ID WEEK (Infectious Diseases Week, Infectious Diseases Society of America Annual Meeting to be held October 21-25, 2020.

Medication Safety

510E | Adverse outcomes associated with current agents used to treat dementia-related psychosis: A case-control Medicare database study

Nazia Rashid, Pharm.D., MS[1], James B. Wetmore, MD, MS[2] and Victor Abler, DO[1]
[1]*Medical Affairs, ACADIA Pharmaceuticals, Inc., San Diego, CA,* [2]*Chronic Disease Research Group, Minneapolis, MN*

Presented at American Society of Consultant Pharmacists virtual meeting in 2020.

511E | Drug utilization patterns of current agents used to treat dementia-related psychosis: A Medicare database study

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Presented at American Society of Consultant Pharmacists virtual meeting in 2020.

512E | Severe anion gap metabolic acidosis associated with sodium thiosulfate in the management of patients with calciphylaxis and end stage renal disease

Sonya Kedzior, Pharm.D.[1] and Ali Olyaei, Pharm.D[2]
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Presented at American Society of Health-System Pharmacists, Las Vegas, NV, Dec 11, 2019.
Presented at IDWeek 2020 [Virtual], October 21-25, 2020.

Neurology

513E | Brivaracetam abolishes the photoparoxysmal response more rapidly than levetiracetam post-i.v. Infusion in a majority of patients with photosensitive epilepsy: A randomized, double-blind, crossover study

Ronald Reed, BS Pharm, Pharm.D., FCCP, FAES[1], William Rosenfeld, MD, FAES[2], Susan Lippmann, MD, FAES[2], MJC (Rene) Eijkemans, PhD[3] and Dorothee Kasteleijn- Nolst Trenite, MD, PhD, MPH[4]
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Presented, 73rd Annual Meeting, American Epilepsy Society, December 6th-10th, 2019, Baltimore, MD, (Abstract #1.302).

Other

514E | *"Standard of care: A national three profession survey of healthcare state agencies"*

Matthew Hendricks, Pharm.D. Candidate 2021, Nicole Bailey, Pharm.D. Candidate 2021, Jason Li, Pharm.D. Candidate 2021 and Deeb Eid, Pharm.D.
Ferris State University College of Pharmacy, Big Rapids, MI

Presented at the 116th National Association of Boards of Pharmacy 2020 Annual Meeting, Virtually, June 23, 2020.

Pharmacoeconomics/Outcomes

515E | Hospital and emergency department utilization in US veterans with hyperkalemia

Csaba P. Kovesdy, MD[1], Elvira Gosmanova, MD[2], *Steven D. Woods, Pharm.D.*[3], Jeanene J. Fogli, PhD, RD[3], Christopher G. Rowan, PhD[4], Jared L. Hansen, MStat[5] and Brian C. Sauer, PhD[5]
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Presented at the American Diabetes Association 80th Scientific Sessions. Chicago, IL, June 12-16, 2020.

Pharmacokinetics/pharmacodynamics/drug metabolism/drug delivery

516E | Phase 2 STRIVE clinical trial of rezafungin for treatment of candidemia and/or invasive candidiasis demonstrates consistent trough concentrations across diverse patient populations

Shawn Flanagan, PhD[1], Christopher M. Rubino, Pharm.D., BCPS[2] and Taylor Sandison, MD, MPH[1]
[1]*Cidara Therapeutics, Inc., San Diego, CA,* [2]*Institute for Clinical Pharmacodynamics, Latham, NY*

Presented at IDWeek 2020 [Virtual], October 21-25, 2020.

Pulmonary

517E | **Procalcitonin for antibiotic prescription in chronic obstructive pulmonary disease exacerbations: Systematic review, meta-analysis, and clinical perspective**

Ken Chen, MPharm[1], Katherine A. Pleasants, Doctor of Pharmacy[2], Roy A. Pleasants, Doctor of Pharmacy[3], Tatsiana Beiko, Doctor of Medicine[4], Ronald G. Washburn, Doctor of Medicine[2], Zhiheng Yu, Master of Pharmacy[5], Suodi Zhai, BSc[5] and M. Bradley Drummond, Doctor of Medicine[6]

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Pulm Ther https://doi.org/10.1007/s41030-020-00123-8.

518E | **Tolerability, safety, and lung function response of revefenacin and formoterol via nebulization in patients with moderate to very severe chronic obstructive pulmonary disease: A subgroup analysis of a phase 3 trial**

Thomas M. Siler, MD[1], Edmund J. Moran, PhD[2], *Tamara Goldberg, Pharm.D., BCPS*[2], Chris N. Barnes, PhD[2] and Glenn D. Crater, MD[2]

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Presented at Accepted at CHEST 2020, October 18, 2020.

519E | **Revefenacin improves lung function regardless of baseline symptom status in chronic obstructive pulmonary disease: A post hoc analysis of phase 3 trials**

Thomas M. Siler, MD[1], Gary T. Ferguson, MD[2], *Brian Roslund, Pharm. D., BCPS*[3], David Lombardi, PhD[3] and Glenn D. Crater, MD[3]

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Presented at the American Thoracic Society Annual Meeting, August 5-10, 2020.

520E | **Lung deposition of two bronchodilators in subjects with COPD when administered via standard jet nebulizer or Handihaler using functional respiratory imaging (FRI)**

Glenn D. Crater, MD[1], Edmund J. Moran, PhD[1], *Asma Lat, Pharm.D.*[1], Jonathan Ward, PhD[2], Dennis Belmans, MSc[3] and Cedric Van Holsbeke, MSc, PhD[3]

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Presented at European Respiratory Society Annual Meeting, September 7-9, 2020.

521E | **A time and motion (T&M) pilot study of nebulized COPD therapy in US inpatient (IP) and long-term care (LTC) settings**

Erwin De Cock, MSc[1], Grace Leung, MPH[2], Grant Maclaine, .[3], Hemal Shah, .[4], Brooks Kuhn, MD[5] and *Bryan Nichols, RPh*[6]

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Presented at the Society of Hospital Medicine Annual Meeting, August 11, 2020

522E | **Depression in COPD: Does antidepressant use influence rate of exacerbation or early hospital readmission?**

Ryan E. Owens, Pharm.D.[1], J. Brock Harris, Pharm.D,.[2], Jamielynn Sebaaly, Pharm.D.[2], Robert Barrons, Pharm.D.[2] and *J. Andrew Woods, Pharm.D.*[2]

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Presented at American Thoracic Society Annual Meeting, Virtual August 5-10, 2020.

SYSTEMATIC REVIEWS/META-ANALYSIS

ADR/Drug Interactions

523 | **Hydroxychloroquine safety: A systematic review and meta-analysis of randomized controlled trials**

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Background: Hydroxychloroquine (HCQ) has been used for malaria, rheumatoid arthritis, systemic lupus erythematosus, and is currently being examined for COVID-19. No previous meta-analysis has evaluated its adverse events (AEs) versus placebo. The aim of this meta-analysis is to compare the safety of HCQ versus placebo.

Methods: Two authors independently searched PubMed and EMBASE databases until March 19, 2020 for randomized controlled trials (RCTs) of adults comparing the AEs of HCQ versus placebo used for any indication. Studies missing one of these criteria were excluded. Peto odds ratios (Peto ORs) and 95% confidence intervals (CIs) were calculated based on random-effects models. The heterogeneity (I^2) was evaluated using Cochran's Q test, and risk of bias was assessed by Cochrane risk of bias tool for RCTs.

Results: Nine RCTs (eight were double-blind) with a total of 916 patients were included. HCQ caused significantly more skin pigmentation than placebo (Peto OR, 4.64; 95% CI, 1.13 to 19.00; I^2 = 0%). The increase in other AEs did not reach statistical significance: rash (Peto OR, 1.11; 95% CI, 0.3 to 3.77; I^2 = 0%); gastrointestinal AEs (Peto OR, 1.43; 95% CI, 0.55 to 3.72; I^2 = 15.17%); headache (Peto OR, 1.94; 95% CI, 0.65 to 5.78; I^2 = 9.99%); dizziness (Peto OR, 1.32; 95% CI, 0.49 to 3.52; I^2 = 0%); fatigue (Peto OR, 2.13; 95% CI, 0.76 to 5.98; I^2 = 0%); and visual AEs (Peto OR, 1.61; 95% CI, 0.76 to 3.41; I^2 = 0%). Cardiac toxicity was not reported.

Discussion: The main strength is including RCTs (most were double-blind), minimizing risk of bias and confounding factors. Limitations include that all patients were outpatients, and the cardiotoxicity risk was not clearly evaluated.This meta-analysis of RCTs found a significantly higher risk of skin pigmentation in HCQ users versus placebo, but no statistically significant differences in other AEs.

Other: No funding, conflict of interest, or registration is applicable for this study.

Adult Medicine

524 | Safety and efficacy of intravenous hydralazine and labetalol for the treatment of asymptomatic hypertension in hospitalized patients: A systematic review

Katie DeBiasio, Pharm.D. Candidate 2021, Jocelyn Cawoski, Pharm.D. Candidate 2021, Scott Donnachie, Pharm.D. Candidate 2021, Elizabeth Timanus, Pharm.D. Candidate 2021, Branden D. Nemecek, Pharm.D., BCPS, Courtney A Montepara, Pharm.D., David E. Zimmerman, Pharm.D., BCPS, BCCCP, Anthony J. Guarascio, Pharm.D., BCPS and Jordan R Covvey, Pharm.D., PhD, BCPS
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Background: Guidelines for the inpatient management of asymptomatic hypertension (HTN) recommend the use of oral antihypertensives. In clinical practice, intravenous (IV) antihypertensives are occasionally utilized without supporting evidence. The objective of this study was to evaluate literature examining the safety/efficacy of IV hydralazine/labetalol in hospitalized patients with non-emergent, asymptomatic HTN.

Methods: The PRISMA guidelines were utilized to structure the systematic review. A search strategy composed of drug-, inpatient-, and HTN-related terms was conducted utilizing PubMed, Embase, and Scopus databases through May 2020. Terms relating to pregnancy were excluded. Full-text, English-language articles describing IV labetalol and/or hydralazine for asymptomatic HTN in an inpatient setting including clinical outcomes (i.e. vitals, adverse effects, healthcare utilization) were included. Studies were screened/extracted using DistillerSR by two reviewers at each stage and were evaluated qualitatively for bias.

Results: From 3362 records identified, a final set of 10 articles were included. Four studies focused on labetalol (40%), five studies on hydralazine and labetalol (50%), and one study on hydralazine (10%). The included studies presented a variety of outcomes but several trends were identified, including appropriate reduction in average blood pressure in eight (80%) studies, increased risk of adverse drug reactions (bradycardia, hypotension, excessive BP reduction, etc.) in six studies (60%), and increased length of stay in two studies (20%).

Discussion: The studies identified in this review raise concerns regarding the safety of IV hydralazine and labetalol in asymptomatic HTN. Despite broad clinical experience with these drugs, their utility in improving outcomes associated with asymptomatic HTN needs further investigation. A strength of this review included the narrow focus on a commonly encountered clinical scenario. Limitations of this review included heterogeneity of studies and inability to fully represent hospitalized patients.

Other: No external funding was utilized, and authors have nothing to disclose. This review was not registered with any database.

525 | The clinical impact of rifamycins on the efficacy and dosing of opioid agents: a systematic review

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Background: Opioids are one of the most commonly prescribed analgesic medications. Their narrow therapeutic index and metabolism through cytochrome p450 (CYP) enzymes can result in serious adverse effects when used concomitantly with interacting therapies. The objective of this study was to assess the impact of rifamycins with clinically-relevant CYP-inducing properties on clinical outcomes associated with opioids.

Methods: A systematic review following the PRISMA criteria was performed using PubMed, Scopus, and OVID Embase from database inception to January 2020. Only full-text, peer-reviewed, English language articles addressing clinical outcomes (e.g. pain or surrogate markers for pain, withdrawal, psychomotor response) from concomitant rifamycin and opioid therapy were included. Pharmacokinetic/dynamic studies, animal studies, surveys/questionnaires, reviews,

textbook chapters, editorials, and data only available as abstracts were excluded. Full-text screening/extraction was performed by two reviewers utilizing Covidence web application and all studies were qualitatively evaluated for bias.

Results: This systematic review isolated 12 articles, including eight studies and four case reports. Rifampin (n = 11, 92%) and rifabutin (n = 2, 17%) were the rifamycins studied along with seven different opioids: oxycodone (n = 3, 25%); methadone and stereoisomers (n = 3, 25%); morphine (n = 2, 17%); and oral transmucosal fentanyl citrate, buprenorphine, codeine, and tramadol (n = 1 each, 8%). Data demonstrated that rifampin decreased the effects of all therapies except for fentanyl administered buccally. Rifabutin, however, was found to have no impact on buprenorphine therapy despite decreasing the effects of methadone.

Discussion: The studies evaluated in this review show that a decrease in opioid effects can be appreciated with concomitant rifamycin therapy, revealing the importance of agent selection and monitoring. A strength of this review was its focus on clinical outcomes. Limitations included varied durations of therapy across studies that may not have fully appreciated potential enzyme induction effects.

Other: There is no external funding, disclosures or registration to report.

Keywords: rifamycins; rifampin; rifabutin; opioid analgesics; methadone; morphine; fentanyl

Ambulatory Care

526 | Risk stratification using coronary artery calcium as a predictive tool to guide aspirin utilization for primary prevention: A systematic review

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Background: Atherosclerotic cardiovascular disease (ASCVD) remains the leading cause of mortality in the United States. This may be due to gaps in risk stratification and delays in implementing preventable strategies. Aspirin is recommended for a select group of adults at higher ASCVD risk but not at increased bleeding risk for primary prevention. It remains unclear how practitioners should risk stratify these patients. Coronary artery calcium (CAC) score (CACS) has been used for stratification when traditional risk factor tools are uncertain. The purpose of this review is to evaluate if CAC could be used to guide aspirin use for primary prevention.

Methods: A literature search utilizing PubMed, OVID, and Cochrane was conducted through June 2020 to capture articles assessing the effect of CACS on the initiation of aspirin for primary prevention. Any article published in English with patients 18 years or older with no ASCVD was included. Studies excluded were those with a diabetic population and that used alternative predictive tools. All articles were screened and assessed by two investigators independently to reduce bias.

Results: The search yielded 2,175 citations; 8 articles were included for review. Four articles were cohort studies, three were systematic reviews, and one was a meta-analysis. Three articles referenced CACS as a powerful prognostic tool for aspirin initiation. Three articles discussed that CACS greater than zero were associated with greater odds of aspirin initiation. Two articles reported that CAC ≥100 resulted in an estimated net benefit from aspirin. Although, one article emphasized that this was robust when CAC ≥400.

Discussion: Most studies in this review showed that CAC serves as a valuable tool for aspirin utilization for primary prevention. However, a general consensus on which CAC cutoff to use in practice is still lacking.

Other: There is no funding, conflicts of interest, or registrations to report for this study.

527 | Comparison of direct oral anticoagulants versus warfarin in morbidly obese patients with venous thromboembolism: A systematic review and meta-analysis

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Background: Post-hoc analyses of direct oral anticoagulants (DOACs) pivotal trials of venous thromboembolism (VTE) do not report on patients with weight > 120 kg or BMI > 40 m^2/kg, limiting the evidence to scarcely available retrospective studies. The aim of this meta-analysis is to compare DOACs to warfarin in morbidly obese VTE patients.

Methods: PubMed, Google Scholar, Cochrane library databases and conference abstracts were searched for relevant studies through April 30^{th,}2020. Studies were included if patients were > 18 years old with BMI > 40 kg/m2 or weight > 120 kg receiving DOACs for VTE with warfarin comparator group. Publication bias was assessed graphically using funnel plots. Quality of study was assessed using Newcastle-Ottawa-scale for cohort studies. Heterogeneity of the results was evaluated using the I^2 statistic. Pooled odds ratio with 95% confidence interval (CI) was calculated using random-effects model for VTE recurrence and major bleeding outcomes.

Results: A total of 367 studies were reviewed for relevance. None of the phase III clinical trials for VTE report on this subset of patients. Total of 5 retrospective studies and 1 conference abstract were included in the meta-analysis of which 1 study (Perales 2019) was excluded from major bleeding analyses as they did not report it separately and 1 study included unpublished data (Patil 2020) for VTE recurrence. No statistically significant difference in the VTE recurrences (odds ratio:1.064; 95% CI 0.927 to 1.222; P = 0.376, I^2 = 0%) and major bleeding (odds ratio:0.718; 95% CI 0.513 to 1.004; P = 0.053, I^2 = 0 %) was observed between DOACs and warfarin groups.

Discussion: DOACs may be a reasonable alternative to warfarin in morbidly obese patients for prevention of VTE recurrences.

A randomized controlled trial specifically comparing different DOACs with warfarin is needed to further confirm the findings of our meta-analysis in this patient population.
Other: NA

Cardiovascular

528 | A meta-analysis of risk factors for bleeding and clinical ineffectiveness during clopidogrel therapy

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Background: There is a need for a comprehensive assessment of risk factors to help clinicians balance the risk of thrombosis with the risk of bleeding during clopidogrel therapy. The objective of this study was to perform a meta-analysis to identify and quantify risk factors for bleeding and clinical ineffectiveness associated with maintenance clopidogrel use in adult patients.
Methods: A meta-analysis was conducted in four phases by seven reviewers: (1) search for relevant randomized controlled trials (RCTs) from four databases (MEDLINE, EMBASE, Ovid, and Cochrane) from inception to June 2020, (2) abstract and full paper screening to include papers that focused on clopidogrel, risk factors, and relevant outcomes, (3) bias assessment using Cochrane assessment tool and data extraction, and (4) synthesis and data analysis using random effects model.
Results: Screening of 7,109 articles yield 52 RCTs. Twenty-seven potential risk factors were identified for two outcomes: bleeding and ineffectiveness.
Discussion: Our study provides a comprehensive list of all potential risk factors for clopidogrel from RCTs. The risk of bleeding is significantly higher when patients use clopidogrel concomitantly with aspirin or for greater than 6 months. Clinicians can use this list to evaluate the benefit and risk of clopidogrel therapy.
Other: Funding sources: #ULI TR002529
Conflict of Interest: N/A
Registration number: N/A

529 | Antithrombotic therapy in patients after transcatheter aortic valve replacement: a network meta-analysis

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Background: The objective of this systematic review with network meta-analysis was to evaluate the optimal antithrombotic regimen in patients after transcatheter aortic valve replacement (TAVR).
Methods: We searched MEDLINE, Embase, and CENTRAL (inception to April 2020) without language restriction using the query: (TAVR or aortic stenosis) and (platelet aggregation inhibitors or anticoagulants). Included were randomized controlled trials (RCTs) that compared any antithrombotic combination and reported ≥1 outcome of interest. The primary outcome was all-cause death. Secondary outcomes were stroke/transient ischemic attack (TIA) and major bleeding based on Valve Academic Research Consortium criteria. Two reviewers independently screened articles, extracted data, and evaluated trials using the Cochrane Risk of Bias tool. We performed Bayesian network meta-analyses (WinBUGS, version 1.4.3) to estimate probability of each intervention being best based on mean surface under the cumulative ranking curve, and calculate odds ratios (OR) and 95% credible intervals (CrI).
Results: From 24 articles, we included 6 RCTs (N = 2501), including 1 unpublished RCT. Comparisons included: aspirin versus dual antiplatelet therapy (DAPT) (3 trials), anticoagulant+aspirin versus DAPT (1 trial), anticoagulant+clopidogrel versus anticoagulant (1 trial), and

Table 1 List of risk factors and outcomes

Outcomes	Risk factors	#	ORs	CIs
Major bleeding	Duration (>6 months)	8	1.74	1.21 - 5.50
	Aspirin	3	2.83	2.04 - 3.94
Any bleeding	600 mg clopidogrel	2	1.24	1.09 - 1.42
	Duration (>6 months)	8	1.44	1.08 - 1.92
	150 mg/d of clopidogrel	5	1.37	1.14 - 1.64
	Aspirin	4	2.91	2.15 - 3.94
	PPIs	3	0.33	0.18 - 0.61
Ineffectiveness	Reduced renal function (mild)	2	2.51	1.71 - 3.68
	Reduced renal function (moderate to severe)	2	4.76	3.18 - 7.14

anticoagulant versus DAPT (1 trial). Mean age was 79-83 years and 49% were female. Median follow-up was 6 months. Aspirin ranked best for all-cause death and major bleeding, and second best for stroke/TIA. DAPT ranked best for stroke/TIA. Anticoagulant+aspirin ranked worst for all-cause death and major bleeding, and second worst for stroke/TIA. Anticoagulant ranked worst for stroke/TIA. DAPT was significantly better versus anticoagulant+aspirin for all-cause death (OR 0.59, 95% CrI 0.39-0.87) and major bleeding (OR 0.51, 95% CrI 0.28-0.91).

Discussion: Overall risk of bias was low. Most comparisons were imprecise. Direct/indirect meta-analyses were generally consistent except for comparisons of anticoagulant to DAPT and anticoagulant +aspirin. In post-TAVR patients, aspirin appears to provide the optimal balance of thrombotic and bleeding events.

Other: This review was unfunded and not registered.

530 | The safety and efficacy of rivaroxaban and apixaban in patients with increased body weight: a systematic review

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Background: Rivaroxaban/apixaban are direct oral anticoagulants increasing in popularity as convenient alternatives to warfarin. Current guidelines recommend against use or to monitor drug-specific levels in obese patients, which may not always be feasible. Accordingly, the objective of this study was to examine literature evaluating the safety/efficacy of rivaroxaban/apixaban in patients with increased body weight.

Methods: A systematic literature review (guided by PRISMA) was performed through June 2020 using PubMed, Embase, and Scopus. Search term clusters included drug and weight-related concepts (overweight/obese, body mass index [BMI], waist circumference). DistillerSR was utilized to process search results. Studies met inclusion if they analyzed bleeding and/or thrombosis in patients with increased body weight receiving rivaroxaban/apixaban. Case reports/series, pharmacokinetic/dynamic analyses, and commentaries were excluded. Bias was examined qualitatively across studies.

Results: A total of 1822 abstracts and 200 full-texts were screened to produce a final set of 20 studies for qualitative review. Of these, 12 (60%) contained comparisons between patients of increased versus normal body weight, while eight (40%) included only patients of increased body weight. The definition of 'increased body weight' varied amongst the studies, including 11 (55%) that utilized BMI, 5 (25%) using a combination of BMI and body measurement, 2 (10%) that relied on body measurement alone, and 2 (10%) that used obesity-related ICD codes. Eleven (92%) of the 12 comparative studies found similar rates of safety/efficacy outcomes with rivaroxaban/apixaban.

Discussion: The literature reports similar bleeding/thrombotic risk for rivaroxaban/apixaban in patients of increased body weight compared to patients of normal weight. Strengths of this review are the comprehensiveness of indications included and the focus on clinical outcomes. Limitations include varying definitions of increased body weight across studies. Future prospective controlled studies are needed to further define guidelines for use in this population.

Other: There are no conflicts of interest, funding sources, or registrations for this systematic review.

Critical Care

531 | Impact of individual antimicrobial stewardship interventions in the intensive care unit: A systematic review and meta-analysis

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Background: Antimicrobial stewardship (AMS) involves the use of interventions designed to promote appropriate selection, dosage, and duration of antimicrobial treatment. Evidence for the global use of AMS suggests reduced antibiotic utilization in hospitalized patients, but evidence of survival benefit is limited, particularly when stratified by intervention type. Our meta-analysis sought to address whether specific AMS interventions were associated with improved short-term mortality in critically ill patients, as compared to standard of care (SOC).

Methods: A systematic literature search strategy was performed using PubMed/Medline, Cochrane Library, EMBASE, Google Scholar, and Web of Science. Studies were included if all of the following criteria were met: (1) Critically ill patient population; (2) AMS interventions were defined and assessed; (3)SOC comparator; and (4) short-term (≤90 days) all-cause mortality was reported as a clinical outcome. Secondary outcomes include hospital-acquired *C. difficile* infection. Two investigators screened titles and abstracts for potential study inclusion. Once completed, full-text review of potential studies was performed. Any conflicts for inclusion of studies were resolved by a third investigator. Risk of bias was assessed. An *a priori* subgroup analysis based on population type (adult/pediatric), AMS intervention type, and prospective study design was performed.

Results: After screening and review, 48 studies were included. (n = 41, adult; n = 7, pediatrics). Among adult studies, AMS was associated with improved short-term all-cause mortality (Odds Ratio [OR] = 0.87,95% Confidence Interval [CI]: 0.80-0.96). However, when evaluated by AMS intervention type, AMS was not associated with improved short-term all-cause mortality: Biomarker-guided protocol (OR 0.93; 95% CI: 0.81-1.06); Multi-modal AMS (OR 0.87; 95% CI:

0.73-1.04); Audit and Feedback (OR 0.90; 95% CI: 0.73-1.12). No difference in the incidence of *C. difficile* infection was observed (OR 0.66; 95% CI: 0.38-1.15).
Discussion: In this study, the global performance of AMS was associated with improved short-term all-cause mortality, however no specific AMS intervention was associated with improved mortality.
Other: PROSPERO Registration:CRD42020158477

Emergency Medicine

532 | Thiamine dosing for the treatment of alcohol-induced Wernicke's encephalopathy: A systematic review

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Background: The objective of this systematic review was to evaluate existing evidence on thiamine dosing specific to alcohol-induced Wernicke's Encephalopathy. Currently, limited data exist and lack consistent evidence on the most reasonable thiamine dosing strategies. The intent was to determine which thiamine replacement regimen was most appropriate from the literature reviewed with an emphasis on the time to resolution of symptoms. This was done to provide recommendations for future research while also developing a comprehensive reference for healthcare professionals.
Methods: A systematic review was conducted using PubMed, Scopus, and ProQuest Central and included reports in human subjects of thiamine supplementation for confirmed alcohol-induced Wernicke's Encephalopathy. Doses of parenteral thiamine greater than 100 mg daily were included, while regimens only consisting of oral supplementation were excluded. Findings within the studies were qualitatively analyzed.
Results: Six publications were included which yielded 262 patient cases. Many the studies utilized parenteral thiamine regimens, but two utilized a combination of both oral and parenteral therapy. With each patient, thiamine administration, despite the duration, route, or dose, displayed some sort of symptomatic improvement, whether it be complete recovery or not, with minimal side effects.
Discussion: Within the 6 publications assessed, there was no homogeneity in patient presentation, dosing strategies, and onset to the resolution of symptoms. Dosing strategies ranged from 5 mg per day given intramuscularly to 500 mg every 8 hours given intravenously, with some patients receiving additional oral thiamine supplementation. Furthermore, the duration of therapy ranged from 1 day to 3 weeks, with one study providing no mention of the duration of therapy. Further research is necessary to provide an appropriate dosing strategy of thiamine for alcohol-induced Wernicke's Encephalopathy.
Other: The authors declare there is no conflict of interest nor funding.

Health Services Research

533 | The effectiveness of telepharmacy anticoagulation service in the ambulatory care setting: A systematic review and meta-analysis

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Background: Pharmacist-managed anticoagulation services have been shown to improve patient outcomes. However, the effectiveness of an anticoagulation service managed via telepharmacy (TP) has not been clearly demonstrated. This systematic review and meta-analysis aims to compare the effectiveness of TP anticoagulation services to face-to-face (FTF) anticoagulation services in the ambulatory care setting.
Methods: A literature search for studies assessing the effectiveness of TP services was conducted using PubMed, EMBASE, and Cochrane CENTRAL databases, from inception through May 2020. Studies that compared TP to FTF anticoagulation services in the ambulatory care setting were included. Outcomes of interest included thromboembolic events, major bleeding, minor bleeding, any bleeding, warfarin international normalized ratio (INR) time in therapeutic range (TTR), frequency of extreme INR, anticoagulation-related emergency department visits, anticoagulation-related hospitalization, any hospitalization, and mortality. Relative risk and weighted mean difference were calculated using the DerSimonian and Laird random-effects model. The modified Downs and Black scale was used to assess methodological quality and risk of bias.
Results: Overall, 9 studies (1 randomized controlled trial and 8 observational studies) involving 7709 patients were included in the systematic review, and 7 studies (7466 patients) were included in the pooled meta-analysis. Compared to FTF services, TP was associated with a lower risk of any bleeding and any hospitalization, with a relative risk of 0.65 (95% CI 0.47 to 0.90, P = 0.01, Cochran Q P = 0.84) and 0.59 (95% CI 0.39 to 0.87, P = 0.01, Cochrane Q P = 0.85), respectively. There was no statistically significant difference in TTR or the risk of major bleeding, minor bleeding, or thromboembolic events between the two groups.
Discussion: TP appears to be at least as effective as FTF anticoagulation services. However, additional randomized controlled trials are warranted to further validate these findings due to the high number of observational studies included.
Other: Funding: none; Conflict of interest: none; PROSPERO registration: submitted.

534 | **The impact of cultural interventions on medication adherence in hispanic adults with hypertension or heart disease in the United States: A systematic review**

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Background: Medication adherence is lower in Hispanics compared to non-Hispanic whites and is associated with inadequate communication and cultural interventions from health care providers. The American Heart Association encourages health professionals to implement culturally competent interventions to enhance the treatment and prevention of heart disease in Hispanics despite limited evidence on clinical implementation. The objective of this study is to systematically review the impact of cultural interventions on medication adherence in Hispanics with hypertension or heart disease in the United States (US).
Research Question: Among Hispanics with hypertension or heart disease in the US, do cultural interventions impact medication adherence?
Methods: Medline, Scopus, and Cochrane Central Register of Controlled Trials were searched from January through March 2020. Studies included cultural clinical trials influencing medication adherence in Hispanic adults with hypertension or heart disease in the US. The risk of bias was assessed using the Effective Public Health Practice Project (EPHPP) Tool for Quantitative Studies.
Results: After screening 1,556 articles, 9 studies fulfilled the inclusion criteria: 5 randomized controlled trials, 3 randomized clinical trials, and 1 quasi-experimental study. Participant characteristics included 1,665 females, 1,279 males, an age range of 44-76 years and 2,061 Hispanics. Cultural interventions included 4 health literacy programs (n = 440), 3 motivational interviewing strategies (n = 2,403), and 2 mobile health medical regimen programs (n = 101). Four interventions (n = 1,821) provided by bilingual health professionals were most effective in improving medication adherence. Seven studies (n = 2,794) used self-reported measures to evaluate adherence levels (64-95.8%). Although comparators were not required, 5 studies compared Hispanics to other racial groups (n = 1,386).
Discussion: Some cultural interventions are associated with increased adherence, supporting the influence of patient-provider language concordance. Additional efforts are necessary to standardize objective and validated methods to determine the impact of cultural interventions on medication adherence.
Other: Source of funding: None. Conflict of Interest: None. Registration number: PROSPERO CRD42020165957.

HIV/AIDS

535 | **Neurotoxicities in the treatment of HIV between dolutegravir, rilpivirine, and dolutegravir/rilpivirine: A meta-analysis**

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Background: Antiretroviral therapy (ART) may carry neurotoxic effects. For example, the ART combination of dolutegravir and rilpivirine has a warning for depressive disorders and other neurotoxicities due to rilpivirine. While dolutegravir has been linked to neurotoxicities, it does not currently warrant the same precaution as rilpivirine. It is also unknown if these agents differ in neurotoxicities compared to efavirenz based treatments. Therefore, the primary objective was to compare the risk of neurotoxicities (i.e., depression, anxiety, insomnia, dizziness, suicidal behavior) among patients treated with rilpivirine, dolutegravir, and dolutegravir/rilpivirine. Secondary objectives were to compare the risk between these agents and efavirenz based therapy.
Methods: PubMed, AIDSinfo.nih.gov, and ClinicalTrials.gov databases were searched between 1999 and May 2020. Inclusion criteria were randomized controlled trials. Data focused on adult participants (i.e., 18 years of age or older) receiving dolutegravir 50 mg, rilpivirine 25 mg, or combination dolutegravir 50 mg/rilpivirine 25 mg once daily. Randomized control trials were assessed using Jadad scoring criteria. RevMan Manager5.3 software was used to determine the adverse drug event risk ratios. RevMan Manager5.3 risk ratios were computed using dichotomous data type, Mantel-Haenszel statistical method, random effects analysis, and a 95% confidence interval.
Results: Twenty studies with a minimum duration of 48 weeks and average Jadad score of 4 were included (n = 10,998). Primary objective demonstrated a relative risk (RR) synergistic effect on depressive symptoms for dolutegravir/rilpivirine (RR = 2.82; CI[1.12,7.10]) when compared to dolutegravir (RR = 1.10; CI[0.88,1.38]) and rilpivirine (RR = 1.08; CI[0.80,1.48]). Secondary objectives showed no difference between dolutegravir, rilpivirine, and dolutegravir/rilpivirine to efavirenz. Additionally, excluding efavirenz studies, dolutegravir and dolutegravir/rilpivirine yielded increased depression (RR = 1.34; CI [1.04,1.74]).
Discussion: The combination of dolutegravir/rilpivirine appears to increase the risk of depressive symptoms. Despite the increase, the clinical significance is unknown and needs further study. Additionally, neurotoxicity risk appears similar between dolutegravir, rilpivirine, or dolutegravir/rilpivirine ART when compared to efavirenz based ART.
Other:
Funding: None
Registration: (CRD42020190519)

Infectious Diseases

536 | **Glucocorticoids use and risk of death in patients with corona virus disease 2019 (COVID-19): A systematic review and meta-analysis**

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Background: The impact of glucocorticoids on the risk of mortality among patients with Corona Virus Disease 2019 (COVID-19) is still debatable. Therefore, we aimed to conduct a systematic review with meta-analysis to determine the association between glucocorticoids use and risk of mortality among patients with Corona Virus Disease 2019 (COVID-19).

Methods: Three databases (Google scholar, PubMed, and Cochrane) and cross-referencing were searched for all epidemiological studies in COVID-19 patients with definite outcome (death or discharged). The primary outcome was mortality, and the main exposure was receiving glucocorticoids after hospital admission while the metric for combining studies was the odds ratio (OR). A random-effects model was used to pool results of selected studies, while the Q and I^2 statistic were used to assess the heterogeneity and inconsistency, respectively. A test of funnel plot asymmetry was used to assess potential small-study effects.

Results: Seven studies involving 1488 patients with COVID-19 were pooled for final meta-analyses. Overall, the odds of death were 2.96 times higher among patients who received glucocorticoids as compared with those who did receive glucocorticoids (OR = 2.96, 95% CI, 1.51–5.82) after hospital admission. Statistically significant heterogeneity and inconsistency were found (Q = 28.7, $P < 0.10$, I^2 = 79%). Tests of funnel plot asymmetry indicating potential small-study effects.

Discussion: Receiving glucocorticoids in COVID-19 patients may be associated with an increased risk of mortality. However, further studies are urgently needed to make definitive recommendations

Other: COVID-19; Glucocorticoids; Death; Meta-analysis

537 | Efficacy and safety of eravacycline: A systematic review and meta-analysis

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Background: Eravacycline is a recently approved fluorocycline for treatment of complicated intra-abdominal infections (cIAIs). We conducted this meta-analysis to evaluate its efficacy and safety.

Methods: Two investigators searched PubMed, EMBASE, and three trial registries until June 22, 2020 for randomized controlled trials (RCTs) comparing the efficacy and safety of eravacycline versus comparators. Studies missing one of these criteria were excluded. We estimated odds ratios (ORs) with 95% confidence intervals (CIs) using random-effects models and evaluated heterogeneity (I^2). Risk of bias was assessed by Cochrane risk of bias tool for RCTs.

Results: Three RCTs (1128 patients) with cIAIs were included. There were no significant differences in clinical response in the modified intention-to-treat (ITT) population (OR, 0.91; 95% CI, 0.62 to 1.35; I^2 = 0%), microbiological ITT population (OR, 0.93; 95% CI, 0.62 to 1.41; I^2 = 0%) and clinically evaluable population (OR, 0.98; 95% CI, 0.55 to 1.75; I^2 = 0%) or all-cause mortality (OR, 1.18; 95% CI, 0.16 to 8.94; I^2 = 0%). Eravacycline was associated with significantly greater odds of total AE (OR, 1.55; 95% CI, 1.20 to 1.99; I^2 = 0%) and nausea (OR, 5.29; 95% CI, 1.77 to 15.78; I^2 = 1.70%) but the increase in vomiting was not significant (OR, 1.44; 95% CI, 0.73 to 2.86; I^2 = 1.70%). There were no significant differences in serious AEs and discontinuation due to AEs.

Discussion: The main strength is including RCTs, minimizing bias risk and confounding factors, while the major limitation is that all patients had cIAIs. Future RCTs should be conducted in other infection types. This meta-analysis found similar clinical efficacy and mortality with eravacycline compared to carbapenems for the treatment of cIAI. However, the odds of totals AE and specifically nausea occurred more with eravacycline, while no significant differences were observed in vomiting (although numerically higher), serious AEs, and drug discontinuation due to AEs.

Other: No funding, conflict of interest, or registration is applicable.

538 | Evaluation of the efficacy of erythromycin compared to other macrolides in adults or adolescents with community-acquired pneumonia (CAP): Systematic review and meta-analysis of randomized controlled clinical trials

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Background: Macrolide drugs like erythromycin, clarithromycin and azithromycin are the preferred treatment in Community Acquired Pneumonia. However, it's debatable whether erythromycin is more effective than other macrolides. The aim of this meta-analysis is to compare the clinical efficacy of erythromycin with other macrolides. The rate of clinical success (clinical cure and improvement) was our primary outcome. The secondary outcomes were the rate of clinical cure, radiological success, bacteriologic success.

Methods: We did a systematic review and meta-analysis of RCTs in patients treated with Macrolides for CAP. We searched PubMed, EMBASE and Cochrane Library databases up to January 08, 2020. Risk ratios with 95% confidence intervals using random effects models and evaluated heterogeneity were performed. Bias risk was assessed using the Cochrane risk of bias tool.

Results: We included four RCTs, which compared the clinical efficacy of erythromycin versus clarithromycin in adult patients with CAP. The total patients were 472. The clinical success rate was significantly lower with erythromycin than clarithromycin (RR, 0.79; 95% CI, 0.64 to 0.98; *P*-value = 0.033; I^2 = 20.27%). A significantly lower rate of clinical cure occurred with erythromycin compared to clarithromycin (RR,0.67; 95% CI, 0.48 to 0.92; *P*-value = 0.014; I^2 = 8.75%). The rate radiologic success was significantly lower in the erythromycin than

clarithromycin (RR, 0.84; 95% CI, 0.71 to 0.97; *P*-value = 0.045; I^2 = 20.12%).

Discussion: Erythromycin is less effective than clarithromycin. In addition, erythromycin associate with high rate of discontinuation of the treatment course, due to gastrointestinal adverse reactions. Therefore, erythromycin can be used to treat CAP when other macrolides cannot be used. This is the first meta-analysis that compared the efficacy of macrolide monotherapy in patients with CAP. Unfortunatley, no studies compared the efficacy of azithromycin monotherapy versus other macrlides monotherapy.

Other: Authors declare no COI nor funding. There is no registration number for this study.

Other

539 | Systematic review of vaccination hesitancy in the minority population in relation to the potential for COVID vaccine uptake

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Background: Vaccine hesitancy in the minority patient population is a potential threat to future herd immunity that is paramount in reducing the burden of the COVID pandemic. Potential limitations to the pending COVID vaccination need to be identified early to inform interventions to increase awareness and vaccine uptake once available. This review aims to (1) identify essential studies and derive individual barriers of vaccination hesitancy in the minority patient population; and (2) outline gaps in comprehending the vaccination hesitancy of minority patient populations for analysis and interventions in the development of the COVID vaccine.

Methods: This systematic review was performed according to the methodology recommended by the PRISMA guidelines during the period of January 2010 to July 2020. The research was conducted using the electronic database: PubMed. Following the PRISMA approach, 694 articles were identified, and 60 articles were selected and analyzed for significant barriers to minority patient population vaccination hesitancy.

Results: The majority of studies included patients from North America, age 18 years or greater. This study identified racial differences in vaccine uptake, attitudes, trust/confidence, and hesitancy. Distinguishing that Black, Latinx, Asian and multiracial respondents were less likely than White respondents to receive routine vaccinations.

Discussion: Differences in socio-economics, cultural, personal opinion, and many other factors were analyzed in this review. Potential interventions to reduce vaccination hesitation should be utilized. Such as ensuring recruitment of diverse trial population and funding to increase social justice and equity work that fuel dismantling health disparities. In addition there is a need to help promote vaccination education and awareness to potential mitigate barriers in the minority patient population to increase the potential for herd immunity that maybe instrumental in decreasing the burden of the COVID pandemic.

Other: no funding and no conflict of interest

Pain Management/Analgesia

540 | Liposomal bupivacaine (Exparel) in breast surgery: A systematic review

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Background: Adequate post-surgical pain control provides better patient outcomes and decreased length-of-stay (LOS). Liposomal bupivacaine (LB), FDA-approved for post-surgical analgesia provides longer duration than non-liposomal bupivacaine at significantly higher cost. This systematic review compares LB to non-liposomal anesthetics (NLA) in breast surgery.

Methods: A literature search of MEDLINE, the Cochrane library, and Academic Search Premier with keywords mammoplasty, breast, bupivacaine, Exparel, and liposomes was conducted. Studies included randomized controlled trials dated May 2020 or earlier in patients undergoing breast surgery with a primary outcome of pain, opioid use, and/or LOS reported, in which LB was compared to a defined NLA. The Cochrane Risk of Bias Tool was used to assess quality.

Results: Four studies met inclusion criteria (n = 163 patients). The type of surgery varied: two included abdominal based reconstruction, one implant-reconstruction, and one cosmetic subpectoral augmentation. Two studies used LB 266 mg and two 130-133 mg. LB and NLA (0.25% bupivacaine) were given as an infiltrate prior to wound closure. One study included an OnQ-pump arm and a historical control. Pain scores did not differ between LB and NLA in two studies while two showed statistical decrease in pain: 0.08-0.58 over 24 hours. Three studies reported opioid use in milligram-morphine-equivalents (MME); one showed no difference, one a difference of 16 MME over 24 hours and the other 39 MME over 72 hours, favoring LB. Three studies reported LOS, which did not differ in two but was significantly shorter with LB vs NLA in one (29.8 hrs vs 46.7 hrs, P = 0.035). All trials enrolled less than 50 patients per arm. None of the surgeons were blinded.

Discussion: Results are difficult to interpret because of varying patient populations and dosages. In addition, statistical results may not be clinically relevant. In conclusion, superior efficacy of LB over NLA cannot be stated.

Other: No funding was received; authors report no conflict-of-interest.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

541 | Population pharmacokinetics of vancomycin in pediatrics: A systematic review

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Background: Vancomycin is commonly used to treat gram-positive bacterial infections in the pediatric population, but dosing can be challenging. Population-based PK (PopPK) modelling can improve individualization of dosing regimens. The primary objective was to describe popPK of vancomycin and factors that influence PK variability in pediatric patients.

Methods: Systematic searches were conducted in Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, International Pharmaceutical Abstracts and the grey literature without language or publication status restrictions from inception to October 10, 2019. Any observational study that described popPK analyses of vancomycin in pediatric patients (< 18 years of age) were included. Risk of bias was assessed using National Heart, Lung and Blood Institute Study Quality Assessment Tool for Observational Cohort.

Results: Sixty-six observational studies (12 prospective and 54 retrospective studies of 9,098 patients with 26,355 vancomycin concentrations) were included. The mean age was 2 years (range: newborn to 18 years), serum creatinine was 47 ± 33 μmol/L, creatinine clearance was 103 ± 59 mL/min/1.73m^2. Most studies found that vancomycin pharmacokinetics was best described by one-compartment model (70%). There was wide range of clearance and volume of distribution (V_d) values (range: 0.01-0.3 L/kg/h, 0.2-1.5 L/kg, respectively) with inter-individual variability as high as 95% and residual variability up to 41%. Most significant covariates for clearance were weight, age, and serum creatinine or creatinine clearance; for V_d was weight. Variable dosing recommendations were suggested.

Discussion: Numerous popPK models of vancomycin were derived, however, external validation of suggested dosing regimens and analyses in subgroup pediatric populations such as dialysis patients are still needed before a popPK model with best predictive performance could be applied for dosing recommendations. Significant intra- and inter-individual PK variability were present, which demonstrated need for ongoing therapeutic drug monitoring and site-specific derivation of pharmacokinetic models for vancomycin.

Other: No conflict of interests nor funding. Not registered.

Psychiatry

542 | QTc prolongation in patients with severe mental illness: A systematic review of cases

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Background: There is no consensus for assessment and management of patients with severe mental illness (SMI) who are at risk for cardiac morbidity and mortality due to antipsychotic-associated QTc prolongation. The objective of this review was to assess methods for risk scoring, QT correction calculation, and clinical management in patients with QTc prolongation.

Methods: A search was performed in PubMed for case reports that described QTc prolongation in adult patients with schizophrenia or bipolar disorder taking an antipsychotic. Reports that were published in North America between 2000-2020 were eligible. Mayo, Tisdale, and RISQ-PATH risk score tools were used. Case data was abstracted and validated by author team.

Results: Fifteen cases were included. The average patient was a middle-aged female taking a second-generation antipsychotic for schizophrenia with baseline and maximum QTc values of 431 msec and 541 msec, respectively. The Mayo scoring tool identified 15(100%) cases as "high risk," Tisdale identified 8(53%) cases as "moderate risk" and the remaining 7(47%) cases as "low risk," and RISQ-PATH identified 7(47%) cases as "not low risk" and the remaining 8 (53%) cases as "low risk." Three cases reported the utilized QT correction formula (20%, 3/15 used Bazett).The most common intervention to address antipsychotic-associated QTc prolongation was switching to a different antipsychotic (33%, 5/15). One third of patients experienced Torsades de Pointes. There was significant variation in the quality and detail of each report, many of which did not disclose QTc correction formula used, heart rate, and other data.

Discussion: The results show a lack of standardization for QTc prolongation risk assessment and management in patients with SMI. Limitations include the varying level of detail in the reports, specifically elements of the risk scoring tools and reporting bias inherent in case reports. This review's strength is the real-world data representing actual clinical practice.

Other: No funding source or registration to report.

Substance Abuse/Toxicology

543 | Buprenorphine induction in the absence of opioid withdrawal to treat opioid use disorder: A systematic review

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Background: Waiting for opioid withdrawal symptoms prior to buprenorphine induction to treat opioid use disorder may be intolerable. Nontraditional strategies have emerged. We aim to systematically

review the efficacy and safety of buprenorphine induction that omits waiting for opioid withdrawal symptoms.

Methods: We conducted a systematic literature search of MEDLINE and Cochrane Central Register of Controlled Trials from 1996 through April 10, 2020, augmented with searches in Google Scholar and www.clinicaltrials.gov. A study was included if it was an original investigation (any study design) in patients with either substance use disorder or chronic pain, taking a full mu opioid agonist, transitioning to buprenorphine without traditional preceding withdrawal, and reported withdrawal during induction as an outcome. Two investigators independently screened citations and full-text articles for inclusion, collected data using a standardized data collection tool, and assessed study risk of bias. We qualitatively synthesized results.

Results: We included 15 articles, all of which were case reports/series, reporting 24 unique cases. The median age was 42.5 years, 54.6% were males and 62.5% had a history of heroin use. Most inductions occurred in the outpatient setting (54.2%) and applied Bernese microdosing (41.7%) followed by bridging with a buprenorphine patch (29.2%), rapid micro-induction (12.5%) and other strategies. Full transition to buprenorphine was completed in 87.5% of cases and 58.3% experienced some withdrawal. Two cases experienced moderate to severe withdrawal. Relapse and retention were rarely reported.

Discussion: Evidence describing alternative methods for buprenorphine induction are limited to case reports/series. . Evidence of higher quality is needed to understand if nontraditional strategies are effective and safe during induction and related to long-term outcomes of retention and relapse.

Other: Authors declare no conflicts of interest. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

544 | Adjuvant therapies in severe benzodiazepine-refractory alcohol withdrawal syndrome: A systematic review

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Background: Benzodiazepines are considered the first-line treatment in alcohol withdrawal syndrome (AWS), however withdrawal which doesn't abate with benzodiazepines alone is considered resistant alcohol withdrawal (RAW) or refractory AWS. The objective of this systematic review was to compare phenobarbital, propofol, and dexmedetomidine as adjuncts to standard of care in AWS patients.

Methods: PubMed, EBSCOhost, and ClinicalTrials.gov were searched for studies that evaluated patients with AWS managed with adjuvant phenobarbital, propofol, or dexmedetomidine. Eligible study designs were retrospective cohort studies, randomized controlled trials, and case control studies comparing one of the adjunct therapies to benzodiazepines alone. Outcomes evaluated include 24-hour benzodiazepine requirement, ICU length of stay, bradycardia, hypotension, and requirement for mechanical ventilation. Studies with multiple adjuvant therapies or without outcomes of interest were excluded. Only English language texts were included with no limitation to the year of publication. The last search was performed on July 16, 2020.

Results: Seventeen studies included 14 retrospective cohort studies and three randomized control trials. Data represent inconsistent effects on outcomes.

Discussion: This review suggests the adjuvant therapies have advantages and disadvantages. Phenobarbital was not found to impact the effectiveness of AWS management. Propofol may increase ICU length of stay though may largely be driven by requirement for mechanical ventilation. Analysis of dexmedetomidine identified the potential for increasing ICU length of stay, though analysis was largely driven by retrospective studies of lower quality. Differences in AWS severity, intervention dosing, and patient comorbidities are likely to impact the results of efficacy and safety outcomes. Thus, it is difficult to assess the external validity of the conclusions drawn from these studies. Further head to head studies should assess these adjuvant therapies in AWS management. Studies of monotherapy use, excluded from the review, may also limit conclusions drawn.

Other: No funding was provided and the study protocol was not registered.

Women's Health

545 | Systematic review of black cohosh (cimicifuga racemosa) for management of polycystic ovary syndrome-related infertility

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Background: Polycystic ovary syndrome (PCOS) is a common cause of female infertility. This systematic review examines the efficacy and safety of black cohosh (cimicifuga racemosa) for women with PCOS-related infertility.

Methods: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were used. A search of Medline, Embase, International Pharmaceutical Abstracts, Cumulative Index of Nursing and Allied Health Literature, and ScienceDirect spanning origin to May 28, 2020 was conducted using the search terms and permutations “black cohosh” and “PCOS.” Inclusion criteria were: reporting on efficacy or safety of black cohosh; studied in women with PCOS; full record in English; and, primary literature. Abstract-only records were excluded. Eligible records were evaluated for risk-of-bias (ROB) via the revised Cochrane risk-of-bias tool for randomized studies. A search of the term “PCOS” in the National Clinical Trials database and the International Clinical Trials Registry (CTR) Platform was conducted in June 2020.

Results: The database search returned 182 records; 158 were screened after deduplication. Inclusion criteria was met by two randomized controlled trials (RCTs). Review of 1321 records in the CTR resulted in three studies, none of which had publications. The two RCTs demonstrated significantly lower luteinizing hormone and greater endometrial thickness in short-term use of black cohosh, with or without clomiphene citrate (CC), compared to CC monotherapy. One reported improved pregnancy rates using black cohosh plus CC ($P < 0.01$). There were no differences in adverse events. One RCT had greater ROB due to lack of power and limited supporting evidence of the authors' conclusions.

Discussion: There is no high-quality evidence to support the effectiveness of black cohosh in improved pregnancy rates in women with PCOS-related infertility. Short-term use of black cohosh appears to be safe. The three studies from the CTR may contribute to future decision-making.

Other: This study was neither funded nor registered.

546 | Higher circulating cortisol in the follicular vs. luteal phase of the menstrual cycle: A meta-analysis

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Background: Although results of animal research show that interactions between stress and sex hormones are implicated in the development of affective disorders in women, translation of these findings has been scarce. As a basic step toward advancing this field of research, we analyzed findings of studies which reported cortisol levels in healthy women in the follicular vs. luteal phase of the menstrual cycle.

Methods: We conducted a literature search in PubMed, Web of Knowledge and PsychInfo, and included eligible studies published through December 5th, 2019. Studies were considered eligible if a baseline value was provided prior to a laboratory intervention, if an experimental design evaluating a disease state included a healthy control or if an intervention included a placebo control. Publication bias was assessed using the "ranktest" function in R.

Results: The analysis included data from 35 final studies, involving 778 study participants. Most of the studies included participants in their 20s, with a BMI below 25. In line with our hypothesis, our meta-analysis found that women in the follicular phase had higher cortisol levels than women in the luteal phase, with an overall Hedges' g of 0.13 ($P < 0.01$). There was no evidence of publication bias.

Discussion: For decades, literature on cortisol has yielded mixed results with respect to its concentration in the follicular vs. luteal phase of the menstrual cycle. Implementing a comprehensive search of high-quality studies spanning a period of almost 50 years of research, we show that circulating cortisol levels are higher in the follicular phase. This research advances our understanding of basic physiology and serves as an important contrast to the findings of future studies evaluating stress and sex hormones in women with affective disorders.

Other: Funding: NIH/NIMH R21MH119642 (PI: Hamidovic). The authors declare that the research was conducted in the absence of any conflict of interest.

547 | Quantitative meta-analysis of heart rate variability finds reduced parasympathetic cardiac tone in women compared to men during laboratory-based social stress

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Background: Heart rate variability (HRV) is the inter-beat interval variation between consecutive heartbeats and an autonomic reflection of emotional regulatory abilities to flexibly respond to challenges, such as psychosocial stress. Whereas there are known sex differences in stress-induced hormonal and emotional responses, we identified a gap in our understanding of sex-specific autonomic cardiac control during stress.

Methods: We assessed HRV prior to, during and after administration of a public speech task in healthy participants according to sex. We conducted a literature search in PubMed, Web of Knowledge and PsychInfo, and included eligible studies published through July 26th, 2019. Included studies had to measure HRV in healthy volunteer adults using an electrocardiogram or a portable device during a psychosocial stress task involving public speaking. Publication bias was assessed using the "ranktest" function in "metafor" package.

Results: Data from 17 studies was included in the analysis. Study participants included in this meta-analysis averaged 29 years of age. The ratio of men to women was 0.9:1, with 440 men and 489 women. Our meta-analysis found that during stress, women had lower HRV than men, with an overall Hedges' g of 0.29 ($P < 0.0001$) and 0.29 ($P = 0.0003$) for fixed and random effects models, respectively. We did not find significant heterogeneity or evidence of publication bias.

Discussion: In the present meta-analysis, we found that across studies comparing HRV in men and women, women show reduced HRV during acute social stress challenge. This finding addresses a gap in the literature related to sex-specific autonomic cardiac control during stress and contributes to a greater understanding of sex-specific physiologic reactivity to social evaluative stressors.

Other: Funding: NIH/NIMH R21MH119642 (PI: Hamidovic). The authors declare that the research was conducted in the absence of any conflict of interest.