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ABSTRACTS

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VPS ORIGINAL RESEARCH

Adult Medicine

1 | Utility, Safety, and Necessity of As Needed Electrolyte Replacement Orders: A Multi-Center Medication Use Evaluation

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Introduction: Electrolyte disorders are common in patients admitted to the hospital, this, along with the improper treatment of electrolyte disorders has been associated with increased morbidity and mortality. Electrolyte supplementation is commonly ordered as single-use, point-of-care orders in response to daily laboratory values. However, some physicians prefer to have as needed (PRN) electrolyte orders available on the electronic medical record, which enables repletion when below the goal set by the physician.

Research Question or Hypothesis: The goal of this medication use evaluation is to evaluate the usage and appropriateness of PRN electrolyte repletion orders.

Study Design: Retrospective, chart review

Methods: Adult patients admitted to the Methodist LeBonheur Healthcare system between June 1st, 2020 and June 30th, 2020 with active orders for PRN electrolyte replacement were included. For each PRN electrolyte order, daily labs were assessed for the first five days to determine PRN electrolyte order appropriateness. An order was considered appropriately given if the associated electrolyte value was within the range to be replaced as indicated on the order comments. Point-of-care electrolyte orders were also assessed to determine if orders were given on top of or given instead of the PRN electrolyte orders.

Results: Of the 3,000 patients screened, 300 patients were included with a total of 464 PRN electrolyte orders. Of the PRN electrolyte orders assessed, the majority were potassium with 331 (71%), followed by magnesium 93 (20%), phosphorus 18 (4%), and calcium 13 (3%). Across the 464 electrolyte orders, 59% of orders were given appropriately. A supplemental order was given instead of the PRN electrolyte order 304 times and in addition to the PRN order 141 times. There were 22 cases of electrolyte overcorrection, none of which resulted in patient harm.

Conclusion: Although PRN electrolyte orders did not decrease the amount of point-of-care electrolyte orders utilized, there was no increased risk of patient complications.

2 | Perceptions of Inpatient Internal Medicine Pharmacists at a Large Quaternary Academic Medical Center

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Introduction: Inpatient pharmacists at The Ohio State University Wexner Medical Center (OSUWMC) are involved in many essential aspects of patient care. Internal medicine (IM) pharmacists serve as an educational resource, and provide clinical responsibilities such as drug level monitoring, antibiotic stewardship, pharmacotherapy optimization, medication reconciliation, and more.

Research Question or Hypothesis: The goal of this study was to evaluate the perceptions of inpatient IM pharmacists at OSUWMC.

Study Design: This was a cross sectional, observational study that involved a non-validated mixed Likert scale, ranking, and free text electronic survey that was distributed to attending physicians and medical residents at OSUWMC. Descriptive statistics were used to analyze results.

Methods: Attending physicians and medical residents who rounded on a teaching service that included an IM pharmacist during the academic year 2020-2021 and completed the entirety of the survey were included. Questions involved Likert scale ranking of preferred pharmacist services, assigning confidence levels to a pharmacist's abilities to perform to select services, and preference for pharmacist presence on rounds.

Results: A total of 47 physicians and medical residents initiated the survey, with 43 surveys completed and included. The majority (74%) of responses were from attending physicians. The most preferred service was medication reconciliation (74%) with majority (84%) of responses indicating 5 out of 5 confidence in a pharmacist's ability to perform an admission medication history. All respondents (100%)

rated 5 out of 5 for confidence in a pharmacist's ability to perform drug level monitoring. Physicians and residents (95%) preferred having a pharmacist on rounds.

Conclusion: IM pharmacist inclusion in patient care was preferred by the IM physicians and residents at OSUWMC. Results demonstrate that IM pharmacists are a respected and valuable addition to interprofessional teams and should be included to help manage all patients, especially those at admission requiring medication history/reconciliation and those requiring drug level monitoring.

3 | Comparative analysis of pharmacologic treatments for new onset insomnia in hospitalized adult patients

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Introduction: New-onset insomnia occurs more frequently in the inpatient setting due to a variety of factors. Non-pharmacologic interventions can be effective in treating insomnia in the inpatient setting, to prevent adverse outcomes, but further research is needed to identify optimal pharmacologic interventions.

Research Question or Hypothesis: Is there a difference in treatment outcomes of patients initiated on melatonin and trazodone for the treatment of new-onset insomnia in non-ICU hospitalized patients?

Study Design: A retrospective chart review was conducted for adult patients admitted to a non-ICU general medicine or surgical floor at a community teaching hospital between July 1, 2020 and June 30, 2021.

Methods: Patients were included if they were initiated on a scheduled melatonin or trazodone for the treatment of new onset insomnia. The primary outcome was the percentage of patients needing additional therapy defined as, administering an additional sleep aid between 2100-0600 or utilizing more than 1 sleep aid agent during hospitalization. Secondary outcomes included rate of adverse events such as difficulty awakening, daytime sleepiness, serotonin syndrome, falls, and delirium.

Results: Of 158 included patients, 132 received melatonin and 26 received trazodone. Male sex, hospital length of stay, and administration of drugs that could cause insomnia were similar between sleep aids. Percentage of patients needing an additional sleep aid during hospitalization (19.7% vs. 34.6%; p=0.09), and patients prescribed a sleep aid at discharge (39.4% vs. 46.2%; p=0.52) were similar between sleep aids, respectively. Rates of adverse events were similar between sleep aids.

Conclusion: There was no significant difference between the two agents in terms of the primary outcome, even though a higher rate of patients treated with trazadone for new-onset insomnia during hospitalization required an additional sleep aid compared to those treated with melatonin. No difference in adverse events was observed.

4 | Venous thromboembolism prophylaxis with enoxaparin versus unfractionated heparin in patients with low body weight

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Introduction: Enoxaparin and unfractionated heparin (UFH) are commonly utilized for venous thromboembolism (VTE) prophylaxis; however, few studies have evaluated prophylactic anticoagulation in low body weight patients. No study to date has directly compared enoxaparin to UFH for VTE prophylaxis in low body weight patients.

Research Question or Hypothesis: In patients weighing < 55 kg, is there a difference in the risk of bleeding and risk of VTE in patients receiving any dose of UFH vs. any dose of enoxaparin?

Study Design: This is an institutional review board exempt multicenter retrospective chart review.

Methods: Hospitalized patients with total body weight of less than 55 kg who received prophylactic enoxaparin or UFH for at least three days from January 1, 2019 to June 30, 2021 were included. Patients were excluded if they had a VTE or bleed documented prior to VTE prophylaxis, received concomitant oral anticoagulants, had a diagnosis of thrombophilia or coagulopathy, platelet counts less than 50,000 cells/microliter, or end-stage renal disease requiring dialysis. The primary efficacy endpoint was the rate of VTE, and the primary safety endpoint was the rate of bleeding. Secondary endpoints included rates of major bleeding and clinically relevant minor bleeding.

Results: Four-hundred instances of VTE prophylaxis were included for analysis. One (0.4%) VTE event occurred in the enoxaparin group versus 4 (2.5%) VTE events in the UFH group ($p = 0.334$). Bleeding rates were similar between the groups (12% vs 11%; $p = 1$). Bleeding rates for enoxaparin 40 mg and 30 mg daily were 14.7% and 7.6% ($p = 0.134$), respectively.

Conclusion: For patients less than 55 kg, no difference in VTE or bleeding was found between prophylactic enoxaparin and UFH. No statistically significant difference in bleeding was found between patients receiving higher and lower doses of enoxaparin.

5 | Efficacy of Apixaban Loading Doses Post Parenteral Anticoagulation for Venous Thromboembolism

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Introduction: For hospitalized patients, VTE are treated with parenteral anticoagulants, then an oral anticoagulant prior to discharge. Recent studies have shown that apixaban is associated with a lower bleeding risk. The data on whether to start apixaban loading dose for full 7 days or to give apixaban loading dose after parenteral anticoagulant to make a total of 7 days loading dose is lacking. Our study aims to fill this gap in literature.

Research Question or Hypothesis: The anticoagulation effects will not be different among patients receiving apixaban loading dose after parenteral anticoagulants to have a total of 7 days loading dose versus receiving 7 days of loading dose of apixaban after parenteral anticoagulants.

Study Design: Retrospective study at the Emory University Hospital Midtown from 1/1/2019 to 6/30/2020.

Methods: Non-ICU patients who received parenteral anticoagulants for less than 7 days and received apixaban loading dose were divided into two groups: 1) Patients received apixaban loading dose for less than 7 days, and 2) Patients who received apixaban loading dose for 7 days. Primary outcomes include bleeding events, recurrent VTE, and death due to cardiovascular diseases.

Results: Ninety-eight patients were included in the study after reviewing 453 electronic medical records. Of which, 7.2% of patients in group 2 experienced bleeding event compared to 10% of patients in group 1. Zero case of recurrence VTE in group 1 while there were 5 cases in group 2 (7.2%). One case of cardiovascular death reported in group 1 while there was none in group 2.

Conclusion: This study demonstrates that there were less bleeding events and more VTE recurrence in group 2. However, due to the sample size, it is difficult to determine whether the result is truly reflective of the true population. Therefore, further investigation will be done with a larger sample group.

Ambulatory Care

6 | Real-World Impact of Continuous Glucose Monitoring in Non-Insulin Treated Type 2 Diabetes

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Introduction: Continuous glucose monitoring (CGM) improves glycemic outcomes in insulin-treated type 2 diabetes. However, the real-world impact of CGM on non-insulin treated type 2 diabetes is uncertain.

Research Question or Hypothesis: Does CGM improve hemoglobin A1c (HbA1c) of uncontrolled, non-insulin treated, type 2 diabetes as compared to routine diabetes care?

Study Design: Retrospective cohort study using TriNetX Research Network.

Methods: Cohorts were constructed including adults with non-insulin treated type 2 diabetes and HbA1c ≥7% among CGM users (n=922) versus non-CGM users (n=922). Propensity score matching (1:1) balanced cohorts for known confounders. The primary outcome was proportion of patients with last measured HbA1c <7%. Secondary exploratory outcomes included the composite of myocardial infarction, cerebrovascular disease, and heart failure; microvascular disease; and all-cause mortality; assessed within 7 years from baseline. Logistic regression evaluated risk ratio (RR) with 95% confidence interval (CI), and Kaplan-Meier curves were used to evaluate timing of outcomes. A-priori two-sided alpha <0.05 determined statistical significance. Statistical analyses were conducted with the TriNetX Research Platform. This study was exempt from institutional review as it assessed de-identified records.

Results: At baseline, mean age was 59 years in both cohorts. Mean HbA1c was lower among CGM users (8.19% ± 1.64) versus CGM non-users (8.47% ± 1.68). Glycemic control (HbA1c <7%) favored CGM users (RR, 95% CI; 1.98,1.71-2.29). There was no difference in the composite cardiovascular outcome (RR, 95% CI; 0.93,0.69-1.25). Risk of microvascular disease favored CGM non-users (RR, 95% CI; 1.17,1.02-1.34), while risk of all-cause mortality (RR, 95% CI; 0.37,0.18-0.76) favored CGM users.

Conclusion: The association of CGM with improved glycemic control and a potential mortality benefit lends credence to its use for uncontrolled, non-insulin treated, type 2 diabetes. Given improved glycemia, the association of CGM use with microvascular risk may represent confounding by indication. These findings warrant confirmation in a randomized controlled trial.

7 | Expanding the scope at medication management service clinics through a patient recruitment initiative

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Introduction: Warfarin prescribing has declined as DOACs become preferred. The DOACs require less monitoring and clinic visits, thus widening the scope at anticoagulation clinics is critical. Expanded medication management services (MMS) can include polypharmacy visits to address medication-related problems (MRPs). There are gaps in literature regarding methods to promote MMS beyond previously established services.

Research Question or Hypothesis: A novel patient recruitment initiative (PRI) targeted toward primary care providers will increase the number of non-anticoagulation (non-AC) referrals received by MMS clinics (previous anticoagulation clinics).

Study Design: Prospective quasi-experimental study to compare the number of non-AC referrals before and after PRI.

Methods: PRI included a live educational presentation (or written materials for those who could not attend), followed by monthly reports indicating the number of MRPs individualized to participating providers. The PRI targeted 24 providers from five clinics. The primary

outcome was the number of non-AC referrals. Secondary outcomes included: 1) primary diagnosis of referrals and 2) number of identified MRPs. Wilcoxon signed rank test was used to test the primary outcome with JMP Pro v.16, and additional tests were selected based on data types. The level of significance was defined at 0.05.

Results: The increase in number of non-AC referrals per study provider was 0.33±0.7 after PRI (mean±SD; p=0.01). Providers who attended the presentation had a higher increase of referrals, versus those who only received written materials (p=0.03). Polypharmacy referrals were 12% pre-PRI and 38% post-PRI; the primary reason for referrals changed after implementing PRI (p=0.002). The number of MRPs per visit differed based on the primary diagnosis for referrals (p=0.004), and it was the highest with polypharmacy visits (4.4 ±0.6 MRPs).

Conclusion: The PRI significantly increased non-AC referrals to MMS clinics, and the impact on referrals was greater from providers who attended the presentation. Polypharmacy visits were identified as a key opportunity to detect MRPs.

8 | Impact of clinic-provided home blood pressure monitors during COVID-19 pandemic on blood pressure in underserved adults over 50 years old

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Introduction: While virtual primary care appointments were essential during COVID-19 pandemic, routine vitals were not available, prohibiting the assessment of hypertension control. As a potential solution, a federally qualified health center in Omaha, Nebraska, provided validated home blood pressure monitors (HBPM) to patients at no-cost.

Research Question or Hypothesis: Did providing a validated HBPM to underserved patients over the age of 50 during COVID-19 result in lower blood pressure (BP) compared to those without a HBPM?

Study Design: Retrospective, cohort study using data from electronic health records.

Methods: This study included patients over 50 years old with hypertension or elevated BP. Intervention patients were provided a HBPM between 3/16/2020 and 9/15/2021 (index date). Primary outcome was change in systolic BP (SBP) and diastolic BP (DBP) from baseline to 6-month follow-up. Baseline characteristics and outcomes were compared between groups using inferential statistics as appropriate for the data. Multivariable linear regression analyses were used to assess the association of receiving a HBPM and BP change controlling for baseline BP and other confounders.

Results: A total of 60 HBPM and 121 comparison patients were included. Mean (sd) baseline SBP did not differ between HBPM and comparison patients at 146 mmHg (26.0) and 147 mmHg (23.8) respectively, p = 0.858. Mean (sd) baseline DBP was lower in the HBPM group at 79 mmHg (13.5) vs 84 mmHg (12.5), p=0.013. SBP change from baseline was -13.7 mmHg (28.7) and -12.8 mmHg (26.2) (p = 0.832) while DBP change was -3.6 mmHg (12.7) versus -5.7 (14.2) (p = 0.346) in HBPM and comparison groups respectively. In multivariable analysis, the HBPM group had a significantly greater reduction in SBP at follow-up versus comparison patients (coefficient: -7.20 [95% CI -13.79, -0.62]).

Conclusion: HBPM was a useful tool for maintaining or improving BP in underserved patients during COVID-19.

9 | PCMH Pharmacist Impact of Quality Care Measures for Patients with Uncontrolled Type 2 Diabetes (T2D)

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Introduction: Pharmacist management of diabetes when working under a collaborative practice agreement (CPA) in the patient-centered medical home (PCMH) setting has been associated with increased achievement of clinical and process outcomes. Few studies have evaluated pharmacists' impact on the simultaneous attainment of multiple diabetes quality care measures at the population health level.

Research Question or Hypothesis: Are patients with uncontrolled type 2 diabetes (T2D) seen at a PCMH clinic affiliated with an academic medical center more likely to meet multiple diabetes quality care measures with a pharmacist on their care team compared to patients without a pharmacist on their care team?

Study Design: Retrospective, cross-sectional study

Methods: Inclusion criteria included adults 18-75 years old from January 2017 through December 2020 with a diagnosis of T2D on index date, hemoglobin A1C (A1C) >9%, and an office visit with a PCMH provider within 24 months before index date. outcomes were: A1C ≤9% per last recorded value during observation period; composite of A1C ≤9% and yearly labs; and composite plus statin prescription for patients 40-75 years old. A Chi-square test was utilized to compare the two groups.

Results: Identified were patients in the usual care cohort, mean baseline A1C 10.7% and age 54, and 207 patients in the pharmacist-managed , mean baseline A1C 11.1% and age 55. Patients managed by PCMH pharmacists were more likely to have an A1C of ≤9% compared to usual care (70.1% vs 45.4%; p<0.0001), a composite of measures met (28.5% vs 16.8%; p<0.0001), and a composite of measures met for patients 40-75 years old (36.2% vs 17.3%; p<0.0001).

Conclusion: Diabetes management by pharmacists working under a CPA is associated with better attainment of composite quality measures. However, opportunity exists for improving the comprehensiveness of diabetes care as a means to improving outcomes.

10 | Sodium-glucose cotransporter-2 inhibitor efficacy in patients with heart failure with reduced ejection fraction manages within a safety net health network

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Introduction: The 2021 American College of Cardiology consensus statement recommends the use of SGLT-2 inhibitors in patients with heart failure (HF) with a left ventricular ejection fraction of less than 40% regardless of the presence of diabetes. JPS Health Network serves a diverse community in Tarrant County with varying ethnicity, demographic, socioeconomic and cultural backgrounds along with providing healthcare access for low-income and uninsured patients. This study will illuminate the efficacy of SGLT-2 inhibitors in reducing HF related readmission rates among JPS Health Network patients with HF.

Research Question or Hypothesis: In addition to guideline directed medication therapy (GDMT) in patients with heart failure with reduced ejection fraction (HFrEF), will sodium-glucose cotransporter-2 inhibitors (SGLT-2 inhibitors) reduce related hospital readmission rates among JPS Health Network patients?

Study Design: A retrospective, electronic chart review was completed at JPS Health Network assessing 107 patients with HFrEF from January 2019 to October 2021. Patients included in the study were 18 years or older with a diagnosis of HFrEF and receiving GDMT concurrently with a SGLT-2 inhibitor. Patients who received a SGLT-2 inhibitor with GDMT were compared to the control group consisting of patients on GDMT without a SGLT-2 inhibitor.

Methods: The reduction in 30 day hospitalization readmission rates among patients receiving a SGLT-2 inhibitor was the primary outcome of interest. The primary and secondary outcomes were evaluated using a logistic model with univariate pre-filtering.

Results: There was a significant difference in the proportion of 30 day hospital readmissions in the SGLT-2 patient group. Of the patients receiving only GDMT, 29.1% had a 30 day readmission whereas only 7.7% of patients who additionally used an SGLT-2 inhibitor were readmitted (p-value = 0.0058).

Conclusion: The addition of SGLT-2 inhibitors to GDMT in patients with HFrEF significantly reduced 30 day hospital readmissions compared to patients only receiving GDMT.

11 | The effect of a novel pharmacist-run sickle cell management clinic

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Introduction: Hydroxyurea is the first line disease modifying agent for the treatment of sickle cell disease. Robust outpatient monitoring of hydroxyurea is crucial to ensure efficacy and safety. A pharmacist-run sickle cell management clinic for hydroxyurea monitoring is a novel type of clinic that has not been previously evaluated.

Research Question or Hypothesis: What was the frequency of dose adjustments and interventions, and the change in healthcare utilization for patients seen in a pharmacist-run sickle cell management clinic?

Study Design: Retrospective cohort study

Methods: All patients seen in the pharmacist-run sickle cell management clinic between 3/31/20 and 1/26/21 were included in the study and they were followed through 1/12/22. The frequency of hydroxyurea dose adjustments and the type of interventions made were described. A paired two sample t-test was used to compare the number of immediate care center (ICC) visits, emergency department (ED) visits, and admissions 3 months before the first pharmacist visit and 3 months after the patients had been followed for 6 months for each patient compared to themselves.

Results: Fifty-seven patients had 283 visits during the study period. Hydroxyurea was adjusted during 28% of the visits. The most frequent interventions included counseling on a non-hydroxyurea medication (13.5% of visits) and vaccine counseling (13.2% of visits). There was no significant change in the mean number of ICC (2.5 vs 1.8) and ED (0.6 vs 1.4) visits, but there was a significant reduction in admissions (0.94 vs 0.5, p=0.002) during a 3-month period before and a 3-month period 6 months after following in the clinic.

Conclusion: Pharmacists can play an important role in a sickle cell management clinic by adjusting hydroxyurea doses and counseling on medications and vaccines. Sickle cell patients had a reduction in admissions after following in the clinic for 6 months.

12 | Dulaglutide and semaglutide prescribing and monitoring practices amongst primary care providers and clinical pharmacy specialists for veterans living with and without diabetic retinopathy

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Introduction: Despite a lack of guideline consensus on diabetic retinopathy (DR) monitoring, package inserts for glucagon-like peptide-1 receptor agonists (GLP1-RA) dulaglutide and semaglutide recommend more frequent monitoring in patients with pre-existing DR due to increased risk for DR complications. Yet, avoiding these agents in patients with diabetes and baseline DR could prevent receipt of their proven therapeutic benefits.

Research Question or Hypothesis: Is there a difference in dulaglutide and semaglutide prescribing and monitoring amongst veterans with and without DR between primary care providers and clinical pharmacy practitioners (CPP)?

Study Design: This quality improvement project is a single-center, retrospective record review of veterans with type II diabetes initiated on dulaglutide or semaglutide between January 1 and July 1, 2021.

Methods: Presence of baseline DR, agent prescribed, and prescriber type were collected for primary outcome analysis. Additionally, DR monitoring plan implementation, DR severity, and demographic data were collected. DR monitoring plans were categorized as patient education to schedule eye examination, ophthalmologist/optometrist consultation, or delaying therapy pending eye examination. Implementation was defined as receiving a dilated retinal examination by December 22, 2021. Using Microsoft Excel, primarily descriptive statistics were obtained. The primary outcome was analyzed using a chi-squared test. Alpha was set at 0.05.

Results: There was no statistically significant difference found in prescribing rates of dulaglutide and semaglutide for veterans living with or without DR between prescriber types (p = 0.365). Most once-weekly GLP1-RA were prescribed by a CPP (n = 162). Of the 202 veterans reviewed, 30 had documented DR at therapy initiation (n = 27 prescribed by CPP). Of the twenty-nine DR monitoring plans documented, only 22 were implemented.

Conclusion: There was no difference in prescribing between disciplines. Most veterans with baseline DR had a documented DR monitoring plan, but providers must improve plan implementation to ensure safe once-weekly GLP1-RA use.

13 | Impact of COVID-19 on hypertension and diabetes clinical outcomes of uninsured patients in a primary care setting

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Introduction: The Coronavirus Disease 2019 (COVID-19) pandemic caused a rapid shift in outpatient pharmacy services from in-person (IP) to telehealth (TH) visits. The impact of this on glycemic and blood pressure control in uninsured, low socioeconomic populations is not well described. Research is needed on the impact of clinical service visit modalities changes, spurred by the COVID-19 pandemic, on clinical outcomes.

Research Question or Hypothesis: To ensure therapy goals for uninsured patients at an urban free clinic were maintained during the pandemic, we compared the proportion at blood pressure (BP) goal (<130/80 mmHg), at A1C goal (<7%), and visit trends 1 year before and after the Declaration of National Emergency (DNE) on March 13, 2020.

Study Design: Retrospective chart review.

Methods: This retrospective chart review collected the number of missed or canceled visits, IP and TH visits, and average days between visits. Data from visits between March 13-September 13, 2019 (pre-pandemic), January 31-April 24, 2020 (during pandemic), September 13, 2020-March 13, 2021 (post-pandemic) to assess hypertension (HTN) and diabetes (DM) control were also collected. Descriptive statistics, paired t-tests, and Cochran's Q tests were used to analyze the data.

Results: Seventy eight patients were included. Visit modality changed from all IP visits before to mostly TH visits after the DNE. Missed appointments decreased (2.63+2.5 v 1.69+1.8 visits per patient, *p* 0.011) while completed appointments remained consistent (5.31+2.1 v 5.81+2.4, *p* 0.058). 30% patients had controlled HTN at each time interval with no change between time intervals (*p* 1.00). 40-64% patients had controlled DM over the time intervals with no overall change in DM control (*p* 0.061).

Conclusion: Visit modality shifts due to the COVID-19 pandemic reduced missed appointments but did not impact clinical patient outcomes related to HTN and DM control.

14 | Impact of Pharmacist Targeted Hyperlipidemia Interventions in Prevention of Atherosclerotic Cardiovascular Disease in Patients with Diabetes Mellitus

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Introduction: Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of morbidity and mortality in diabetes. The American Diabetes Association recommends specific groups of patients receive statin therapy; a moderate-intensity statin is recommended in patients 40-75 years old without ASCVD, and a high-intensity statin or addition of ezetimibe to reduce LDL by ≥50% is recommended in patients at high ASCVD risk. The American Association of Clinical Endocrinology recommends a low-density lipoprotein cholesterol (LDL-C) goal <100 mg/dL in patients with diabetes.

Research Question or Hypothesis: Clinical pharmacist intervention improves lipid treatment outcomes in patients with diabetes for primary prevention of ASCVD.

Study Design: Single-center, prospective cohort, pre-post analysis

Methods: Patients 40-75 years old with diabetes with upcoming primary care provider (PCP) visits were identified via a daily report. Key exclusion criteria included ASCVD and pregnancy. Pharmacist recommended a lipid panel if last results were not obtained in the previous 12 months. Results were used to optimize lipid-lowering therapy based on guideline recommendations and patient-specific factors. These recommendations were communicated to the patient's PCP via message in the electronic medical record between January 1, 2021 and February 28, 2022. The primary outcome was the pre-post comparison of patients achieving an LDL-C goal <100 mg/dL, assessed via Chi square test.

Results: 325 patients were included in the final analysis. The proportion of patients with an LDL-C that was current and at goal improved from a baseline of 39.6% to 48% (p=0.03). Patients on a moderate- or high-intensity statin improved from 84.3% to 88.3%, and those on statin plus ezetimibe therapy increased from 2.1% to 5.5%. 576 recommendations were sent with a 42% acceptance rate.

Conclusion: Clinical pharmacist intervention significantly improved the proportion of patients with LDL-C that was both current and at goal in patients with diabetes and without ASCVD.

15 | Evaluating Availability of Glucose Data During In-person versus Telemedicine Visits in an Endocrinology Specialty Clinic

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Introduction: Blood glucose (BG) data are essential for diabetes management. Before Coronavirus Disease 2019 (COVID-19) pandemic, BG data would be obtained as patient fingerstick BG logs, or insulin pump and/or continuous glucose monitor (CGM) data downloaded from patients' devices during in-person visits. Transition to telemedicine during the pandemic altered clinic workflow and challenged access to BG data. This study compares availability and sources of BG data in telemedicine versus in-person endocrinology visits.

Research Question or Hypothesis: Hypotheses: 1) BG data availability was higher for in-person versus telemedicine visits. 2) More fingerstick BG logs were available for in-person visits. 3) Availability of pump and/or CGM data was higher during in-person versus in-person visits.

Study Design: This was an observational retrospective study conducted via chart review.

Methods: We randomly screened adult diabetes management clinic visits at Banner – University Medicine Endocrinology Clinic from 6/1/2019 to 12/13/2019 (in-person, Group A) and 6/1/2020 to 12/31/2020 (telemedicine, Group B). Incomplete visits were excluded. Chi-square test was used for between group comparison.

Results: Out of the 766 screened visits, 200 were included in Group A and 199 in Group B. Overall, availability of BG data (from all noted sources) was higher for Group A (79%) than Group B (46.2%), P<0.001. More fingerstick BG logs were available for Group A (78.5%) than Group B (21.5%), P<0.001. Availability of insulin pump and/or CGM data was not statistically significant between the two groups (54.1% vs 45.9%, P=0.210).

Conclusion: The higher overall BG data availability for in-person visits was driven by that of fingerstick BG logs. Pump and CGM data availability did not differ between groups suggesting that those data were successfully shared with the clinic for telemedicine visits. Enhancing ability to share fingerstick BG data for telemedicine visits should be considered. Future studies are needed to assess availability of clinically relevant data.

16 | Development of a Polypharmacy-Based Outreach System for Pharmacist-Led Annual Wellness Visits

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Introduction: Less than 20% of Medicare beneficiaries receive an Annual Wellness Visit (AWV) each year. Employing non-physician professionals to perform AWVs is one strategy to overcome the underutilization. Previous studies suggested polypharmacy as a way to operationalize pharmacy-led AWVs. However, the effectiveness of using a simple electronic medical record (EMR) outreach to recruit patients, with a goal of addressing medication-related problems (MRPs) and impacting quality measures, has not been fully investigated yet.

Research Question or Hypothesis: Do numbers of polypharmacy-based outreach correlate with numbers of pharmacist-led AWV appointments within a healthcare system?

Study Design: Prospective cross-sectional study using EMR records

Methods: Outreach was conducted from December 2021 to February 2022 by either pharmacists or non-pharmacist team members via EMR messaging in six primary care clinics. Targeted patients were: AWV-eligible Medicare beneficiaries with ≥7 medications. Patients who were ≥90 years of age, had their last primary-care visit >1 year, or `did not have an active EMR portal were excluded. The number of scheduled AWV visits were tracked as the primary outcome, and types of interventions made were collected for the secondary objective. Spearman correlation between the number of the outreach and AWV appointments was evaluated, using JMP Pro v.16, with significance level at 0.05.

Results: The number of outreaches correlated to the number of AWVs scheduled (Spearman's rho=0.83, p=0.04) and MRPs identified (Spearman's rho=0.89, p=0.02). A total of 108 AWVs were conducted with 21 medications and 114 labs ordered, 15 referrals and 38 imaging/procedure placed, 16 vaccines given, 27 care gaps addressed, and 190 MRPs identified. Reported barriers to scheduling AWVs included appointment availability and COVID-related changes in workflow.

Conclusion: The number of polypharmacy-based outreaches conducted was correlated with the number of pharmacist-led AWV appointments and MRPs identified during the visits. Although pharmacists have demonstrated proficiency at conducting AWVs, additional challenges were identified to operationalize pharmacy-led AWVs.

17 | Evaluation of Pharmacist-Delivered Clinical Services and Reimbursement

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Introduction: Many states have rules giving pharmacists authority to practice as providers, including North Dakota (ND). However, provision of and patient access to these high-level services remains limited. There are no data describing pharmacist-delivered clinical outpatient services in ND, nor are there data on pharmacists' billing codes utilized.

Research Question or Hypothesis: This study describes the clinical services being provided by pharmacists in ND and identifies reimbursement practices and sustainability.

Study Design: An exploratory quantitative electronic survey was generated and disseminated to pharmacists with an active ND license. Pharmacists were asked to describe their practice setting and identify clinical services they provided. Participants selected options from a pre-generated list or provided free text responses, then indicated how they received reimbursement for these services. Finally, participants noted if they felt reimbursement amounts were sustainable.

Methods: Quantitative outcomes were summarized using frequencies and percentages.

Results: A total of 235 pharmacists (23%) completed the survey. Most respondents identified as community/retail pharmacists (42%). Respondents identified 24 different medication optimization services, most frequently Medication Therapy Management (MTM): Comprehensive medication review (11.9%) and immunizations (11.4%). Respondents most frequently bill Medicare Part D for MTM (21.5%), although 19.7% perform no billing for clinical services. Fewer than 3% of respondents use higher level billing codes like those used by medical providers (Evaluation and Management Codes). Most respondents who receive reimbursement feel it is not adequate to sustain or support services (70.2%).

Conclusion: Several billable clinical service opportunities exist in ND, with MTM and immunizations most reported. More work is necessary to address the lack of adequate reimbursement and allow for greater service implementation and expansion. The data obtained provides a baseline for future projects to assist pharmacists in expanding reimbursable care delivery models.

Cardiovascular

18 | Cardiovascular Outcomes of SGLT2 Inhibitors Across Sex or Race in Patients with/out Diabetes and Heart Failure

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Introduction: Heart failure (HF) and type 2 diabetes mellitus (T2DM) are leading causes of cardiovascular morbidity/mortality. The risk of developing HF is greater in Black and Hispanic communities compared to White communities, with Black women being disproportionately more affected than others. Although sodium-glucose co-transporter type 2 inhibitors (SGLT2i) significantly decrease the risk of HF hospitalization (HHF), major adverse cardiac events (MACE), and/or cardiovascular death (CVD) in patients with/without T2DM and HF, their efficacy across sex or race is not well documented.

Research Question or Hypothesis: Determine if the efficacy of SGLT2i in patients with/out T2DM and HF is similar across sex and race.

Study Design: Sub-analysis of outcomes data from published trials.

Methods: Outcome data were extracted from 6 large, landmark, randomized, placebo-controlled clinical trials published between 2015-2020 (EMPA-REG OUTCOME, DAPA-HF, EMPEROR-Reduced, DECLARE–TIMI 58, EMPEROR-Preserved, VERTIS CV). Random effect meta-analysis was used to compare relative risk (RR) of outcomes in SGLT2i treated patients versus placebo across sex (46,888 patients) or race (29,536 patients).

Results: Compared to placebo, SGLT2i significantly reduced RR of HHF, MACE, or CVD in men (0.82, 95% CI [0.77-0.87], p<0.00001, I^2=0%) and women (0.76, [0.69-0.85], p<0.00001, I^2=0%). Outcomes were also decreased significantly in White (0.84, [0.78-0.90], p<0.00001, I^2=0%) and Asian patients (0.67, [0.58-0.77], p<0.00001, I^2=0%). Black patients (0.74, [0.52-1.06], p=0.10, I^2=54%) and other races (0.73, [0.42-1.26], p=0.26, I^2=38%) did not show statistically significant reductions in RR.

Conclusion: Addition of SGLT2i to standard therapy reduces the RR of cardiovascular outcomes for both sexes and White and Asian patients. The lack of significant risk reductions in Black patients and other races could be due to their underrepresentation in clinical trials and other factors. Our research suggests that development of patient recruitment strategies should emphasize diversity and inclusion to replace health disparities with effective and equitable care in HF.

19 | Initiation of oral antihypertensives in hospitalized patients with hypertensive urgency: a descriptive study

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Introduction: In hypertensive urgency, current literature recommends initiation or optimization of oral (PO) antihypertensives, but there is limited guidance on how to implement.

Research Question or Hypothesis: How does the initiation timing of PO antihypertensives relate to blood pressure (BP) reduction in hypertensive urgency?

Study Design: A retrospective descriptive study was conducted using electronic medical records of adult patients admitted to an urban teaching hospital with hypertensive urgency from November 2018-2021.

Methods: Patients were included if they had at least one systolic BP (SBP) ≥180 mmHg or diastolic BP (DBP) ≥120 mmHg and received a PO antihypertensive medication within 48 hours of hospital presentation. The primary outcomes were the percentage change in SBP at 12-24 and 24-48 hours. Secondary outcomes included change in DBP and mean arterial pressure (MAP), time to three consecutive goal SBPs, and administration of intravenous (IV) antihypertensives. Patients were stratified by quartiles (Q1-4; early to late initiation) based on time to first PO antihypertensive. ANOVA, Chi-square, Kruskal Wallis, and pairwise Mann-Whitney tests were utilized to compare across quartiles.

Results: A total of 220 patients were included, with a mean age of 64 years, and the majority of patients being White/Caucasian (47.7%) or Black/African American (47.3%). At 12-24 and 24-48 hours, patients in Q1 experienced the greatest SBP reduction (median: 22.9% [interquartile range (IQR) 13.1-30.5%] and 22.5% [IQR 15.8-32.9%], respectively). There was a reduction in DBP and MAP across groups, with patients in Q1 consistently having statistically larger reductions than Q4. Across quartiles, patients in Q1 achieved three consecutive goal SBPs the earliest (median: 13.1 hours [IQR 7.0-21.5%]). Finally, the administration of IV antihypertensives was similar across quartiles (median: 0-1 doses per patient).

Conclusion: In this analysis, earlier administration of PO antihypertensives was associated with larger sustained reductions of BP among patients with hypertensive urgency.

20 | The Prevalence of Cardiovascular Diseases in Type 2 Diabetes Mellitus Patients in Saudi Arabia and the Implementation of New Guidelines Directed Therapies

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Introduction: Type 2 diabetes mellitus (T2DM) management evolved in the 20th century from the focus on blood sugar control to enhancing cardiovascular outcomes and preventing diabetic nephropathy with new therapies, including sodium-glucose cotransporter-2 inhibitors (SGLT-2i) and glucagon-like peptide-1 receptor agonists (GLP1-RA).

Research Question or Hypothesis: How prevalent are atherosclerotic cardiovascular diseases (ASCVD) in T2DM patients in Saudi Arabia, and how many patients are eligible to receive either SGLT-2i or GLP1-RA?

Study Design: A multi-center retrospective cross-sectional study.

Methods: The study included T2DM patients aged 18 years or above between January 2020 and January 2021. Patients were then classified into four groups depending on the eligibility and the reception of SGLT-2i or GLP1-RA. The medications were used appropriately if patients were eligible and received or illegible and did not receive them based on the American Diabetes Association (ADA) recommendations. The primary outcome was the prevalence of ASCVD, while the secondary outcome was the appropriate use of GLP1-RA or SGLT-2i. Statistical analyses included descriptive statistics and logistic regression.

Results: A total of 304 patients were included in our analysis. Most of them were female (60.5%), with a mean age of 49.7 years old. The prevalence of ASCVD in all included patients was 10.1%. Of the included patients, 25.7% were eligible for GLP1-RA or SGLT-2i but not received it. A past medical history of hypertension and high risk 10-year risk score for ASCVD were significantly associated with higher odds of not prescribing GLP1-RA or SGLT-2i while they were eligible for it using univariate regression (OR 3.36, OR 8.39, respectively). However, using multivariate analysis, none of the patient's characteristics were significantly related to underprescribing GLP1-RA or SGLT-2i.

Conclusion: The prevalence of ASCVD in T2DM patients remains high in SA. Yet, there is underutilization in prescribing SGLT-2i or GLP1-RA.

21 | Direct Oral Anticoagulants vs Warfarin for the Treatment of Left Ventricular Thrombus

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Introduction: The use of direct oral anticoagulants (DOACs) for the treatment of left ventricular (LV) thrombus has gained significant

interest. DOACs offer a more simplified approach to anticoagulation when compared to vitamin K antagonists (VKAs) due to less monitoring, fewer food-drug and drug-drug interactions, and lower risk for major bleeding. Additionally, the established efficacy of DOACs in both venous thromboembolism (VTE) and non-valvular atrial fibrillation, make them an attractive alternative in treating LV thrombus.

Research Question or Hypothesis: Are DOACs efficacious and safe compared to warfarin in the treatment of LV thrombus?

Study Design: Retrospective chart review

Methods: Patients who received treatment within 30 days of initial LV thrombus diagnosis were identified using electronic health records. Patients were excluded if they had a mechanical heart valve, active VTE at diagnosis, history of intracranial bleeding, or no follow-up visits after diagnosis. The primary outcome included a combined endpoint of thrombus persistence, stroke, or other systemic embolism. Secondary outcomes included individual components of the primary outcome, incidence of bleeding, mortality, and other treatment-associated adverse events.

Results: Chart review included 168 patients with 36 patients included for the primary analysis. Fifteen (41.7%) patients received warfarin and 21 (58.3%) received a DOAC. The primary outcome occurred in 15 patients, five (33%) patients treated with warfarin and 10 (47.6%) patients treated with DOAC (P=0.391).

Conclusion: This study shows that there was a numerical increase in the primary outcome in patients receiving DOAC compared to warfarin in the treatment of LV thrombus, yet the difference was not statistically significant. The small sample size limits the generalizability of these results.

22 | Opportunity for Optimization of Triglyceride Therapy Post-Acute Myocardial Infarction

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Introduction: Cardiovascular disease (CVD) is one of the leading causes of death in developed countries. Elevated triglyceride levels serve as a marker for increased risk of ischemic events, with an 8-21% lower risk for every 1 mmol/L triglyceride reduction. Statin therapy alone does not reduce this risk, thus creating a need for additional lipid modification. Icosapent Ethyl, a stable eicosapentaenoic acid (EPA) ethyl ester, demonstrated lower triglyceride levels on stable statin doses and demonstrated protection against cardiovascular events (REDUCE-IT trial).

Research Question or Hypothesis: To identify number of patients in a large UK tertiary referral centre which treats acute myocardial infarction (AMI) who could benefit from further lipid optimization.

Study Design: A retrospective analysis of data sets collected from the AMI service from November 2020 through July 2021 where eligible patients with completed data sets to evaluate patients suitable according to REDUCE-IT inclusion criteria.

Methods: Cholesterol levels were assessed at baseline and up to 12 weeks following high-intensity statin therapy. The primary endpoint evaluated number of patients with a fasting triglyceride level of 1.52 to 5.63 mmol/L and low-density lipoprotein (LDL) cholesterol level of 1.06 to 2.6 mmol/L who would be potentially eligible to receive triglyceride therapy.

Results: 128 patients had full data sets available and were screened with a median follow up of 3 months. 21 patients (16%) were deemed eligible for further triglyceride therapy. At 12 weeks, patients on average saw a 43% reduction in LDL, but only an 8% reduction in triglycerides.

Conclusion: Our cohort of patients demonstrate that a significant proportion of patients recently admitted with AMI could benefit from optimization of triglyceride therapy reducing the composite risk of cardiovascular death, nonfatal myocardial infarction, and nonfatal stroke.

23 | Evaluating the effectiveness of Tisdale risk scoring tool in predicting cardiac events.

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Introduction: Torsades de pointes (TdP) is a life-threatening arrhythmia associated with prolonged QTc. Identifying risk factors for prolonged QTc may lead to decreased patient risk. Tisdale's risk score was developed to identify patients' baseline risk for QTc prolongation. The purpose of this study was to evaluate the effectiveness of criteria in this tool over time at predicting cardiac events.

Research Question or Hypothesis: Does Tisdale's risk scoring tool predict cardiac events?

Study Design: Single-center, retrospective, observational cohort study.

Methods: Adult patients admitted to the CCU over a two-year period with ≥1 cardiovascular diagnosis and 12-lead EKG were included. Patients with durable left ventricular assist devices or baseline QTc >500 were excluded. Among the ten predictors in Tisdale's risk score, six were measured repeatedly. The primary endpoint was evaluating effectiveness of QTc risk score components in predicting cardiac events throughout hospital admission, measured with first five EKGs. Cardiac events included QTc prolongation >500 or ≥60 from baseline, ventricular tachycardias, and cardiac arrest. Descriptive statistics and mixed regression models were used.

Results: A total of 1112 patients were included in final analysis, from which 333 (30%) experienced a cardiac event during admission. Utilizing Tisdale's risk score only at baseline, for risk scores ≥7, yielded 37% positive and 71% negative predictive values. Mixed effects regression model accounting for repeated measures demonstrated four predictors maintaining significance over time for development of cardiac events (HFrEF, age ≥ 68, potassium ≤ 3.5 mmol/L, and receipt of ≥ 1 QTc-prolonging drug).

Conclusion: Our study demonstrated poor predictive value for current risk scoring tool at baseline for cardiac events during admission, with only four of ten predictors maintaining significance over time if reassessed with each EKG. Developing an electronic integrated tool to identify patients' dynamic risk over time may aid in provider intervention to improve outcomes.

24 | Opportunity for optimisation of anti-hyperglycemic therapy in Patients with Type 2 Diabetes Post Myocardial Infarction

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Introduction: Cardiovascular events are a leading cause of death in patients with diabetes. Sodium-glucose co-transporter 2 inhibitors (SGLT2i) have shown efficacy in reducing cardiovascular morbidity and mortality in type 2 diabetes mellitus (T2DM). The National Institute for Health Care and Excellence (NICE) of the United Kingdom recommends SGLT2i agents as first-line and add-on therapy for patients with T2DM and established cardiovascular disease, regardless of baseline glycosylated hemoglobin (HbA1c) level.

Research Question or Hypothesis: We sought to determine the prevalence of patients with T2DM admitted with an acute myocardial infarction (AMI) to asses the opportunity to optimise diabetes therapy at discharge, namely with the addition of an SGLT2i

Study Design: This retrospective study evaluated data from AMI admissions at a large tertiary cardiovascular center in London.

Methods: Baseline demographics were collected for patients admitted for an AMI between 11/01/2020 and 02/28/2021 and referred to the hospital's outpatient AMI follow-up program. Hospital care records were analyzed to categorize patients as diabetic (HbA1c ≥48 or prior diagnosis of diabetes), pre-diabetic (HbA1c 42-47), or non-diabetic. Presence of SGLT2i therapy at both admission and discharge was also recorded.

Results: There were 173 patients that met the inclusion criteria: 4 patients had type 1 diabetes mellitus, 50 had T2DM, and 24 were pre-diabetic. Of the 50 patients with T2DM, only five were admitted on an SGLT2i. Three additional patients were initiated on SGLT2i therapy during their hospital admission. None of the patients with type 1 or pre-diabetes were prescribed SGLT2i therapy.

Conclusion: The low number of T2DM patients discharged on an SGT2i after an AMI (16%) highlights an opportunity for targeted interventions to improve prescribing of anti-hyperglycemic agents in this population to further optimise medical therapies. Further work is needed to assess whether these patients are optimised at future appointments.

Clinical Administration

25 | The effect of the CURES mandate on opioid and naloxone prescribing practices at a large academic medical center

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Introduction: Government-mandated prescription drug monitoring programs (PDMPs) have demonstrated the potential to improve prescribing practices within the United States by reducing cases of drug abuse and diversion during the current opioid crisis while improving patient quality of care. On October 2, 2018, the state of California mandated all providers to utilize the Controlled Substance Utilization Review and Evaluation System (CURES), its own electronic PDMP, prior to prescribing opioids. Providers were required to review CURES and run a Patient Activity Report (PAR) prior to prescribing controlled substances for the first time and once every four months thereafter.

Research Question or Hypothesis: The study assessed changes in average daily morphine milligram equivalents (MME) within a large academic medical center before and after the CURES mandate to determine if it was successful in reducing opioid prescribing amongst patients.

Study Design: The study was an IRB-approved, retrospective cross-sectional study.

Methods: Data was collected from a large academic health center. Patients 18 years and over who were prescribed opioids over a two-year period (10/2/17-10/2/19) were included in the study. A student's T-test was used to compare pre- and post-CURES mean daily MME of the entire sample ($\alpha = 0.05$) as the primary outcome. A Chi-Square analysis was also performed to assess secondary outcomes such as change in MME within inpatient/outpatient subgroups and naloxone prescribing.

Results: MME for all patients was 20 for both pre- and post-CURES (p=0.970). Change in MME pre-and post-CURES was 0 for inpatients (n=164; $p = 0.376$) and −10 for outpatients ($n = 199$; $p = 0.171$). Naloxone prescribing was 1.5% and 4.8% pre- and post-CURES, respectively (p=0.06).

Conclusion: The study did not demonstrate efficacy in reducing opioid prescribing with the CURES mandate alone. Future research should investigate whether additional interprofessional collaboration in transition-of-care settings would reduce opioid prescribing within patient populations.

Community Pharmacy Practice

26 | Opportunistic Detection for Atrial Fibrillation in Community Pharmacies: A Pooled Analysis of Cross-Sectional Studies

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Introduction: Atrial fibrillation (AF) is the most common cardiac arrhythmia affecting an estimated 1-2% of the general population in developed countries. AF is frequently asymptomatic (33%) with many only diagnosed following a debilitating stroke. Reducing the risk with appropriate detection and management is recommended by ACC guidelines. Community pharmacists have been shown to be an accessible healthcare professional and we evaluated the feasibility of community pharmacists detecting atrial fibrillation.

Research Question or Hypothesis: To evaluate pooled analysis assessing the feasibility of opportunistic detection by community pharmacists in people aged >65 years using single-lead ECG technology.

Study Design: Cross-sectional study of community-based screening to identify unknown AF by community pharmacists. The first cohort utilized a traditional pathway of onward referral to primary care physicians, and the second cohort referred appropriate patients to an innovative one-stop AF clinic.

Methods: There were a total of 21 pharmacies recruited and trained to perform AF detection using both pulse check and AliveCor Kardia Mobile single-lead ECG. Pharmacists screened eligible patients (>65, asymptomatic, with no history of CVD with the exception of hypertension, diabetes, and those receiving cholesterol-lowering therapy) for AF. Following use of mobile ECG, potential patients were then referred to the individual's primary care physician (first cohort) or a secondary care center to confirm diagnosis with a 12 lead ECG and echocardiogram (second cohort).

Results: A total of 1,059 people were screened by community pharmacists. 878 were classified as normal (83%), 73 had possible AF (7%), and 108 were deemed unclassified (i.e., other abnormalities e.g. heart rate above 100bpm) (10%).

Conclusion: Opportunistic detection for AF by community pharmacists utilizing mobile technology is feasible, and a potential untapped resource to support the detection of undiagnosed AF, and preventing potential debilitating strokes.

Critical Care

27 | Quality of Critical Care Clinical Practice Guidelines Involving Pharmacotherapy Recommendations

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Introduction: Clinical practice guidelines (CPGs) provide recommendations to inform decision-making based on the best available evidence. However, research indicates that clinicians frequently do not apply the recommendations from CPGs. One factor contributing to the lack of utilization of CPGs relates to the quality of the evidence base supporting the recommendations. This is particularly a problem when prescribing medications in critical care since there is a paucity of high-level evidence.

Research Question or Hypothesis: What is the quality level of CPGs involving pharmacotherapy recommendations?

Study Design: Systematic guideline appraisal

Methods: A systematic electronic search was performed using PubMed, Medline, and Embase for critical care CPGs published between 2012-2022 and involving pharmacotherapy recommendations. The Appraisal of Guidelines for Research & Evaluation II (AGREE II) instrument was employed to appraise CPG quality with independent assessment by two appraisers.

Results: Twenty-one CPGs were evaluated. The number of recommendations in each guideline ranged from 2 to 250 with a total of 1604 recommendations. The number of strong recommendations in each guideline ranged from 0-31 with a total of 116 strong recommendations, or 7.23% of total recommendations. There was at least one pharmacist author in 9 (43%) of guidelines. The domains with highest quality scores were scope and purpose (0.88, 95%CI 0.85-0.92), rigor of development (0.80, 95CI 0.77-0.83), clarity of presentation (0.84, 95%CI 0.81-0.87), and editorial independence (0.86, 95%CI 0.79-0.94), while those with the lowest scores were stakeholder involvement (0.69, 95%CI 0.63-0.75) and applicability (0.49, 95%CI 0.43-0.55). Involvement of a pharmacist in CPGs was associated with significantly higher scoring for stakeholder involvement (P=0.0356).

Conclusion: The quality of critical care CPGs involving pharmacotherapy continues to improve when comparing the results of our study to previous investigations. However, there remain concerns related to applicability and stakeholder involvement. It is important to involve pharmacists in CPGs with pharmacotherapy recommendations.

28 | Opioid and Adjunctive Analgesic Medication Prescribing Trends in Surgical Sepsis Survivors

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Introduction: Advances in sepsis treatment have shifted focus to post-discharge follow-up and functional outcomes for intensive care

unit (ICU) survivors. Chronic pain is a feature of post-intensive care syndrome (PICS), and analgesic medications remain common discharge medications. Specifics regarding the prescribing practices of opioid and adjunctive pain medications in the surgical sepsis population remain unknown.

Research Question or Hypothesis: To identify trends in analgesic medication use in sepsis survivors treated in a surgical ICU, comparing patients with and without an opioid prescription at discharge.

Study Design: Retrospective cohort analysis

Methods: Prior to admission and discharge opioid drug and adjunctive pain medications were collected. Readmissions were evaluated up to a year post discharge, and patients with a discharge disposition of hospice or death were excluded. Comparisons were performed via chi-squared tests for categorical variables and t-tests and Wilcoxon rank-sum tests for continuous variables according to normality.

Results: A majority of patients (260/316, 82%) received an opioid prescription at discharge. Patients receiving opioids at discharge were more likely to be prescribed an opioid prior to admission (48% vs. 29%, p=0.007), were older (mean 57 vs. 65 years old, p<0.001), and had a lower Charlson comorbidity index (median 3 vs. 4, p=0.001). Acetaminophen was more likely to be prescribed at discharge with an opioid prescription (42% vs. 18%, p<0.001), while tramadol was more frequently prescribed in the non-opioid group, although not statistically significant. Finally, at one-year post-encounter, opioid prescription at discharge was associated with a higher incidence of at least one hospital readmission (55% vs. 39%, p=0.037).

Conclusion: Opioid medications are frequently prescribed at discharge in sepsis survivors treated in a surgical ICU. Further statistical analysis of risk factors for readmission and persistent opioid use after discharge may provide more detail on the impact of discharge pain medications on patient-related outcomes.

29 | Use of Hydromorphone Continuous Infusions Compared to Fentanyl Continuous Infusions in Critically Ill Patients

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Introduction: IV opioids are standard of care for analgosedation in mechanically ventilated (MV) patients. Long term use of high dose, short acting IV opioids is associated with iatrogenic complications and increased duration of mechanical ventilation. Fentanyl is traditionally the IV opioid of choice for continuous infusions; however, drug shortages have posed a challenge to maintain adequate supply of this medication. Limited studies exist to compare outcomes of patients receiving continuous infusions of fentanyl versus hydromorphone.

Research Question or Hypothesis: Patients receiving continuous infusion hydromorphone will have no significant differences in outcomes compared to patients receiving continuous infusion fentanyl.

Study Design: single center, retrospective chart review

Methods: Mechanically ventilated adult patients admitted to an ICU between 1/1/2020 – 12/31/2021 and received scheduled oral oxycodone or methadone to wean from IV hydromorphone or IV fentanyl were included. The primary outcome was total dosage requirements of IV opioid at time of initiation of oral opioid for weaning from IV opioid. Secondary outcomes included duration of MV, PRN opioid requirement, hospital length of stay (LOS), ICU LOS, and utilization of scheduled sedatives or PRN sedatives. Outcomes were measured with chi-square and Mann-Whitney U-tests.

Results: 93 patients met inclusion criteria for this study (21 in the IV hydromorphone group and 72 in the IV fentanyl group). Total dosage requirement (milligram morphine equivalents) of IV opioids was equivalent in both groups (1421 MME vs. 1722 MME). No difference was detected in duration of MV (413 hours vs. 376 hours), hospital LOS (891 hours vs. 1037 hours), ICU LOS (739 hours vs. 702 hours), or utilization of PRN opioid (38% vs. 58.3%), PRN sedatives (47.6% vs. 56.9%), or scheduled sedatives (95.2% vs. 84.7%).

Conclusion: Patients admitted to the ICU who received MV had similar outcomes when using continuous infusion hydromorphone versus fentanyl. Hydromorphone appears to be an effective substitute for IV fentanyl when IV fentanyl is unavailable.

30 | Relationship of Medication Regimen Complexity to Medication Errors in Critically Ill Patients

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Introduction: Intensive care unit (ICU) patients have a higher risk for medication errors. Medication errors, in the form of severe adverse drug events, can double the risk of mortality and increase healthcare costs. The medication regimen complexity-intensive care unit (MRC-ICU) is a validated scoring tool previously associated with outcomes, mortality, and length of stay. Evaluations focusing on the relationship between the MRC-ICU score and medication safety have not been completed.

Research Question or Hypothesis: We hypothesized higher MRC-ICU scores would be associated with higher rates of medication errors.

Study Design: A single-center, observational study was conducted in ICU patients from August – October 2021.

Methods: Medication errors were prospectively assessed over eight-weeks. Patient demographics, outcomes, and MRC-ICU score within 24 hours of ICU admission were retrospectively collected from the electronic medical records (EMR). The primary outcome was to determine the relationship between MRC-ICU and medication errors within 24 hours of ICU admission using Pearson correlation. To minimize bias and ensure validity, three pharmacists independently placed medication errors into harm categories with discrepancies being decided by vote. Harm categories included no harm, minor, moderate, serious, or severe harm. Statistical analyses were completed using IBM SPSS Statistics for Windows, Version 27.0. Statistical significance was assessed using an alpha level of 0.05.

Results: A total of 150 patients were included. Two pharmacists recorded 633 errors during the eight-weeks. No significant relationship was observed in the primary outcome between MRC-ICU and medication errors (r2=0.13, p=0.11). Although not statistically significant, errors with higher harm scores occurred more frequently with MRC-ICU scores >10 (15 vs. 7, p=0.33).

Conclusion: Medication errors appear to occur independently of medication regimen complexity. Although not statistically significant, higher MRC-ICU scores relate with higher harm scores. Exploring this trend may help pharmacists identify patients at risk for medication errors.

31 | Impact of midodrine initiation on vasopressor weaning in recovery phase of septic shock

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Introduction: Vasoactive agents and intravenous fluids are recommended for initial hypotension management in septic shock. Midodrine, an alpha-1 agonist, has been utilized as an adjunctive agent to facilitate vasopressor weaning during recovery phase of septic shock. When compared to placebo in patients with shock requiring one vasopressor, midodrine was found to be of no benefit in decreasing time to vasopressor discontinuation. However, limited robust evidence is available to elucidate safety, efficacy, and optimal dosing of midodrine for this indication.

Research Question or Hypothesis: Does midodrine impact time to vasopressor discontinuation in patients during recovery phase of septic shock?

Study Design: This retrospective cohort review included patients ≥18 years in recovery phase of septic shock receiving a single intravenous vasopressor between 07/01/2017 and 12/31/2019.

Methods: The primary outcome was the impact of midodrine on time to vasopressor discontinuation, defined as a vasopressor-free period of 24 hours. Secondary outcomes included time to ICU discharge, hospital length of stay, in-hospital and 30-day mortality, and adverse drug effects. Subgroup analyses of patients receiving adjunctive glucocorticoids, thiamine, or vitamin C or high (≥30mg/day) versus low-dose midodrine regimens (<30mg/day) were analyzed. Statistical significance was defined as p<0.05 using independent student t-tests and chi-square tests.

Results: Of 394 patients included in this review, 44 patients received midodrine. Patients who received midodrine experienced longer duration of vasopressor utilization compared to those who did not receive midodrine (8.3 vs 41.6 h, p< 0.001). Use of adjunctive therapies did not impact time to vasopressor discontinuation. There were no differences in secondary endpoints. Patients who received midodrine experienced more bradycardia (14.9% vs 29.5%, p=0.01).

Conclusion: Midodrine initiation did not reduce time to vasopressor discontinuation in recovery phase of septic shock and was associated with increased rates of bradycardia. These results support contemporary evidence of inadequate efficacy and potential safety risks when utilizing midodrine as a vasopressor sparing agent in septic shock.

32 | The impact of a nurse-driven heparin nomogram in cardiothoracic surgery patients

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Introduction: Historically at our institution, a heparin infusion after cardiothoracic (CT) surgery was monitored and titrated solely by providers. A nurse-driven Cardiac Surgery Heparin Nomogram (CSHN) was implemented at EMCP for post-operative CT surgery patients on June 14, 2021.

Research Question or Hypothesis: The new nurse-driven CSHN is as safe and effective as the previous provider-driven standard of care in CT surgery at our institution.

Study Design: Retrospective, single center, quasi-experimental in two separate time cohorts, June 2018-December 2019 and June 2021-December 2021, before and after the implementation of the CSHN.

Methods: Patients ≥18 years old who underwent CT surgery with a postoperative heparin infusion and ≥1 therapeutic aPTT were included. Patients not utilizing the CSHN after June 14, 2021, were excluded. Endpoints included time to first therapeutic aPTT, percentage of time in goal range, time from first out-of-range aPTT to dose adjustment, and incidence of thromboses. Safety outcomes included any incidence of major bleeding, interventional procedures due to bleeding, and death.

Results: Twenty-four (pre-nomogram) and 13 patients (post-nomogram) were included. The post-nomogram group was therapeutic faster than the pre-nomogram group (12.3 ± 8.3 vs. 22.0 ± 14.4; p=0.04). The time to heparin dose adjustment (hrs) following the first out of range aPTT was 6.6 ± 13.5 (pre-nomogram) and 5.6 ± 6.1

(post-nomogram) (p=0.81). The percentage of time in therapeutic range was 38.8% (pre-nomogram) and 51.2% (post-nomogram) (p=0.08). There were 66.7% and 61.5% patients who met any bleeding outcome (p=1.00) with 33.3% and 30.8% who required an interventional procedure due to major bleeding (p=1.00), in the pre-nomogram group and post-nomogram group, respectively. There were no thromboses or deaths.

Conclusion: The CSHN resulted in faster times to first therapeutic aPTT. The nomogram proved to be efficacious and safety outcomes were comparable to prior standards of care at EMCP.

33 | Assessing an Insulin Infusion Protocol and Calculator on Hyperglycemic Outcomes in the ICU During the COVID-19 Pandemic

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Introduction: Hyperglycemia is associated with worse outcomes in the intensive care unit (ICU). Data suggests COVID-19 patients have poorly controlled glucose levels and an increased need for a calculator-based insulin infusion protocol. Studies examining the use of insulin calculators achieved consistent target blood glucose values with minimal episodes of hypoglycemia.

Research Question or Hypothesis: Did implementation of an insulin infusion calculator and protocol reduce time to target blood glucose range and reduce the number of hypoglycemic events in the ICU during the COVID-19 pandemic?

Study Design: An IRB-exempt retrospective cohort study examining patients treated with an insulin infusion before and after the implementation of an insulin infusion protocol and calculator.

Methods: Reports of insulin infusion orders were pulled from the computerized patient record system. Data were collected from January 1, 2021 to August 31, 2021 (pre-intervention group) and November 1, 2021 to March 18, 2022 (post-intervention group). If patients were not located in the ICU or initiated on an insulin infusion, they were excluded from the study. The primary outcomes were time to target blood glucose range and number of hypoglycemic events.

Results: There were 51 patient encounters analyzed, with 24 patients in the pre-intervention group and 16.7% with a current COVID-19 infection at time of admission. There were 27 patients in the post-intervention group and 18.5% with a current COVID-19 infection. The average time to target blood glucose was 12.9 hours in the pre-group and 4.1 hours in the post-group. In the post-group, 12 patients experienced 46 hypoglycemic events with 10 events (21.7%) being severe hypoglycemia (< 40mg/dL). In the post-group, 9 patients experienced 24 hypoglycemic events, with 3 events (12.5%) being severe.

Conclusion: Implementation of an insulin infusion protocol and calculator led to a lower incidence of hypoglycemic events and reduced time to target blood glucose range in the ICU.

34 | Effect of Hypoalbuminemia on Response to Loop Diuretics and Albumin in Patients with Acute Respiratory Distress Syndrome

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Introduction: Conservative fluid management is a cornerstone of therapy for Acute Respiratory Distress Syndrome (ARDS). Existing studies of loop diuretics have had difficulty achieving goal urine output (UOP) and evaluations of adjunctive albumin have been limited by heterogeneous cohorts.

Research Question or Hypothesis: Hypoalbuminemic patients with ARDS are more likely to exhibit a positive response to loop diuretics with adjunctive albumin than patients with normal serum albumin.

Study Design: Single-center, retrospective observational study

Methods: Adult patients were included if admitted to an intensive care unit (ICU) from January 2016 to September 2021 and received loop diuretic and albumin within one hour of each other. Exclusion criteria included liver failure, dialysis, pregnancy, trauma or positive test for SARS-COV-2. Patients were divided into two groups (low and normal) by baseline serum albumin, where low albumin was defined as ≤ 3.5g/dL. The primary outcome was the percentage of patients with a positive response to combination therapy, defined as UOP ≥ 600mL within six hours of the last agent being administered. Secondary outcomes included UOP at six hours and change in body weight, oxygenation, and serum albumin at 24 hours. Chi-squared and Mann-Whitney U tests were used for nominal and continuous variables, respectively with alpha <0.05 used to determine significance.

Results: 102 patients were in the low-albumin group and 73 in the normal-albumin group. 61 (56%) were positive responders in the low-albumin group, compared to 43 (64%) in the normal-albumin group (p=0.313). Patients in low-albumin group had a greater change in serum albumin (p<0.001) at 24 hours. No other secondary outcomes were statistically significant.

Conclusion: Patients with low albumin were no more likely to have a positive response to adjunctive albumin therapy with loop diuretics than patients with normal albumin. Heterogeneity of administration exist and should be further explored.

35 | Impact of periprocedural antibiotics on the incidence of infective endocarditis in transcatheter aortic valve replacement (TAVR)

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Introduction: TAVR infective endocarditis (IE) is a rare complication that is associated with significant mortality. Current guidelines recommend cefazolin or levofloxacin (if beta-lactam allergy) monotherapy as pre-procedural prophylactic antibiotics; vancomycin may be added if patients are colonized with *methicillin-resistant staphylococcus aureus* (MRSA). In July 2018, WakeMed Health & Hospitals changed TAVR pre-procedural antimicrobial therapy to include vancomycin for all patients given the prevalence of enterococcus species among cases of TAVR-IE.

Research Question or Hypothesis: Does the addition of vancomycin to pre-procedural antibiotics reduce the incidence of TAVR infective endocarditis?

Study Design: This is an institutional review board exempt single-center retrospective chart review

Methods: Adult patients undergoing TAVR between February 2015 to June 2018 received cefazolin or levofloxacin with or without the addition of vancomycin depending on their MRSA screen. Patients undergoing TAVR from July 2018 to July 2021 received cefazolin or levofloxacin with the addition of vancomycin. Patients were excluded if they did not receive protocolized pre-procedural antibiotics or if they did not survive beyond post-op day seven. The primary outcome was the incidence of IE and secondary outcomes included causative microorganism, time elapsed from implantation to IE, need for surgical intervention and mortality.

Results: A total of 406 patients were included for analysis, 201 prior to antimicrobial changes and 205 post-antimicrobial changes. The incidence of TAVR-IE was similar between groups (1.99% vs 2.90%, p=0.54). *Enterococcus faecalis* was the most common causative microorganism (50% vs 50%). Additionally, time elapsed from implantation to IE (413 days vs 240 days), need for surgical intervention (0% vs 0.50%), mortality in-hospital (0.49% vs 0%) and one year mortality (5.5% vs 4.5%) were similar between groups.

Conclusion: The incidence of IE was similar regardless of the addition of vancomycin to pre-procedural antibiotics in patients undergoing TAVR. Future studies are needed to evaluate these results.

36 | Assessment of the duration of inhaled epoprostenol therapy for the treatment of ARDS due to COVID-19 and associated mortality

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Introduction: Epoprostenol has been used off-label as an inhaled pulmonary vasodilator for hypoxemia due to ARDS since the early 2000s. During the COVID-19 pandemic, the high rates of refractory hypoxemia and lack of medication options led to increased interest and expanded use. Professional societies currently recommend against the routine use of inhaled vasodilators in COVID-19 respiratory failure based on weak evidence that it does not improve mortality. Further research regarding utilization and optimization of epoprostenol therapy, including duration of therapy is needed.

Research Question or Hypothesis: To evaluate the use and duration of inhaled epoprostenol in patients with severe COVID-19 who developed ARDS

Study Design: Single-center, retrospective chart review

Methods: Adult patients admitted to UCHealth Poudre Valley Hospital ICU between January 2020 and December 2021 with a diagnosis of COVID-19, requiring mechanical ventilation, and ≥ 1 dose of inhaled epoprostenol were reviewed. Outcomes included in-hospital mortality and duration of epoprostenol therapy. Data was assessed with descriptive statistics.

Results: Data was collected for 25 patients. Most patients were male (88%) with an average age of 56 years, ranging between 36-72 years. Nineteen (75%) patients who received inhaled epoprostenol experienced in-hospital mortality. The average overall duration of epoprostenol therapy was 6.88 days, ranging between 1-33 days. The average duration of epoprostenol use was lower among survivors at 3.33 days compared to 8 days among those who died. There were no survivors among the patients who received epoprostenol for > 7 days.

Conclusion: Mortality was expectedly high among severe COVID-19 patients who received epoprostenol. In some cases, epoprostenol was used for over 30 days. Notably, there were no survivors among patients who received epoprostenol for > 7 days. Further studies and cost effectiveness analysis are needed to help identify optimal duration of therapy and define criteria for appropriate initiation and discontinuation.

Drug Information

37 | Compliance with CONSORT Statement Extension for Non-Inferiority Trials in Infectious Diseases

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Introduction: The CONSORT (Consolidated Standards of Reporting Trials) Statement provides a set of standards for reporting clinical trials. Utilization of these standards on a consistent basis can lead to improved interpretation of methods and results of randomized clinical trials. The CONSORT Statement extension for non-inferiority trials includes additional standards specific for this study type.

Research Question or Hypothesis: How compliant are non-inferiority trials in infectious diseases with the CONSORT extension for non-inferiority trials?

Study Design: Cross-sectional evaluation study

Methods: A PubMed search for non-inferiority infectious disease trials published between the period of January 2016 and December

2020 was conducted. Results were filtered to include articles published in the top 30 infectious disease journals using the Scimago Journal Rank; RCTs addressing antibiotics, antifungals, and/or HIV/antiviral were included. Trials were assessed according to twelve categories of the CONSORT extension for non-inferiority trials. Two individual reviewers performed article evaluation after establishing inter-rater reliability (intraclass correlation coefficient 0.907). Data were analyzed using descriptive statistics with the Kruskal-Wallis test used to compare subgroups (e.g., by publication year).

Results: The initial PubMed search identified 131 results, which was narrowed down to 86 studies for evaluation. The median score for the CONSORT criteria compliance was 4 out of 12 (IQR: 3 to 4, Range: 1 to 10). The item on stating the analysis type (e.g., per protocol, intention-to-treat) had the highest compliance, satisfied by 81 of 86 papers (94.2%), while the lowest compliance involved providing the rationale for using a non-inferiority design, with 2 of 86 papers (2.3%) satisfying it. There was no difference in scores across the five-year study period (p=0.096).

Conclusion: The majority of non-inferiority trials are not highly compliant with the CONSORT extension, without improvement over the 2016-2020 period.

38 | Network pharmacology for predicting effective ingredients of Jieyu Decoction for treatment of postpartum depression

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Introduction: Antidepressants have disadvantages such as slow onset of action, incomplete symptom relief, and many adverse reactions, especially in treatment of postpartum depression. Jieyu Decoction(JYD) is a traditional Chinese medicine prescription for treatment of postpartum depression around three hundred years, however its effective components and mechanism is unclear.

Research Question or Hypothesis: What is the active ingredients of JYD in the treatment of depression? What is the mechanism?

Study Design: Network pharmacology and molecular docking

Methods: The active ingredients of JYD were screened through the TCM System Pharmacodynamic Analysis Platform, drug targets were predicted by the SwissTargetPrediction database, disease targets were downloaded from GeneCards and Disgenet databases, and the intersection targets were analyzed for GO function enrichment and KEGG pathway enrichment. Protein-protein interaction data was downloaded from String database. Cytoscape software was used for composition and target network analysis and visualization, and AutoDock and PyMOL software were used for molecular docking.

Results: There are 81 active ingredients of JYD with 257 predicted targets, among them 99 of predicted targets were related to depression. Core targets were obtained by the MCC algorithm in the cytohubba plugin in Cytoscape. They are IL6, MAPK3, IL10, MAPK1, TP53, IFNG, TNF, IL4, IL2, TGFB1. The Core active ingredients in the component-potential target-disease network graph are kaempferol, beta-sitosterol, naringenin, luteolin, Stigmasterol. The potential pathway of JYD in the treatment of depression is PI3K-Akt, IL-17, estrogen and ERK1/2 signaling pathway by Go and KEGG enrichment analysis. The binding energies of β-sitosterol and stigmasterol to IL6, TNF, IL10, MAPK3, TP53 and IFNG were all less than -7.0 kcal·mol^{-1}, indicating a good docking effect. Naringenin, stigmasterol and kaempferol have good docking effects with MAPK1 .

Conclusion: The study reflects the characteristics and protential mechanisms of Jieyu Decoction in treatment of postpartum depression, which includes five active ingredients targeting ERK and IL-6 pathways by regulating synaptic transmission and reducing neuroinflammation.

39 | Description of Statistical and Clinical Significance in Abstracts of Pharmacy Studies

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Introduction: Previous studies have found low rates of reporting of p-values (15-45%), 95% confidence intervals (CIs, 2-5%) in abstracts of biomedical literature; however, reporting has become more consistent over time. Statistically significant results are more likely to be reported. Though studies have investigated this topic in the general biomedical literature, there is a paucity of information in the pharmacy literature.

Research Question or Hypothesis: How are p-values and 95% CIs reported in the pharmacy literature, and has this changed over time?

Study Design: Cross-sectional evaluation study

Methods: The study was conducted using eight pharmacy journals, selected based on impact factor and publication by national pharmacy organizations: American Journal of Health-System Pharmacy, American Journal of Pharmaceutical Education, Annals of Pharmacotherapy, Journal of the American Pharmacists Association, Journal of Managed Care & Specialty Pharmacy, PharmacoEconomics, Pharmacotherapy, and Research in Social and Administration Pharmacy. PubMed was used to search each journal for clinical studies, observational studies, and evaluation studies published from 2000-2019. Articles with fewer than 100 subjects were excluded. Data were extracted by a single investigator and analyzed with descriptive statistics.

Results: A total of 403 abstracts were analyzed. The most common publication types (not exclusive) were randomized controlled trials (51.2%), non-government research (38.3%), observational studies (26.6%), clinical trials (26.4%), and comparative studies (25.1%). The most common medication classes were anticoagulants (5.7%), antibacterials (5.0%), and hypoglycemic agents (5.0%). Overall, 165 abstracts (40.9%) presented exact p-values and 149 of these

(90.3%) were statistically significant for the primary endpoint. Seventy abstracts (17.4%) presented 95% CIs, and 53 of these (75.7%) were statistically significant. Studies published from 2000-2004 were less likely to provide specific p-values and 95% CIs compared to 2015-2019 (35.3% vs. 42.6%, 8.8% vs. 20.9%, respectively).

Conclusion: P-value and 95% CI reporting was more prevalent in the pharmacy literature compared to studies in other disciplines, and somewhat increased over the study period.

Education/Training

40 | Use of standardized patients in a third-year pharmacy student capstone course to identify medication therapy problems in an objective structured clinical exam

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Introduction: Standardized patients (SPs) are actors role-playing patients in objective structure clinical exams (OSCEs). Potential benefits of using SPs may include standardized learning experiences and fidelity real-world emulations. Use of SPs on academic performance remains unreported.

Research Question or Hypothesis: To compare students' identification of medication-therapy problems (MTP) in medication history OSCEs utilizing SPs versus those utilizing student peer actors.

Study Design: Single center, retrospective cohort

Methods: Subjects included two cohorts of third-year student pharmacists enrolled in a required capstone course in spring 2019 and 2021 semesters. One cohort had peers acting as patients, and another interacted with SPs. Students completed 2 OSCEs and were assessed by faculty using a performance-based rubric. OSCE cases varied yearly but were similarly designed and complex. The primary outcome was students' identification of MTPs, defined per Pharmacy Quality Alliance Frameworks. Secondary outcomes included performance on the rubric and MTP management. Data were analyzed via Pearson's chi-square and Wilcoxon two-sample tests using SPSS Statistics software.

Results: One-hundred forty-four subjects were enrolled: 87 in the peer and 57 in the SP cohorts. Baseline characteristics between cohorts were similar across age, overall GPA, and composite PCAT score ($p>0.05$), though differences were noted in some PCAT content areas and longitudinal pharmacy practice course grades ($p<0.05$). Fewer students in the SP cohort identified MTPs versus the peer actor cohort on both OSCEs (52.6% vs. 89.7% and 64.9% vs. 88.2%, $p<0.05$), and OSCE grades were significantly lower in the SP cohort (76.0% vs. 81.5% and 76.5% vs. 89.0%, $p<0.05$). MTP management was significantly different between the cohorts across both OSCEs ($p<0.05$)

Conclusion: Use of SPs in medication history OSCEs were associated with significant decreases in students' identification of MTPs and lower OSCE grades. Continued research is warranted to assess factors associated with differences in performance and scores, and to provide recommendations optimizing potential roles of SPs and peer actors.

41 | Examining the relationship between student performance on course level exam items and success on first time attempts on the North American Pharmacist Licensure Examination (NAPLEX)

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Introduction: The NAPLEX utilizes item response theory to assign an ability score based on responses to exam questions of differing difficulty. Previous studies have associated the scores on the NAPLEX with standardized tests such as the Pharmacy Curriculum Outcomes Assessment (PCOA). This study aims to evaluate the association between a student performance on the exam items in a single course with differing difficulty and first time NAPLEX attempts.

Research Question or Hypothesis: Can performance on exam questions with differing levels of difficulty in a single course predict success on the NAPLEX?

Study Design: A retrospective case control study

Methods: Exam item (stratified by item difficulty and point biserial) performance, course assessments grades, on time graduation, and PCOA scores from the 2017 and 2018 Duquesne University pharmacy graduates were entered into a logistic regression in two blocks. Block one compared measures of performance directly related to course level data and Block 2 compared measures of performance seen in previous studies (on time graduation and PCOA scores) of students that did or did not pass the NAPLEX on the first attempt.

Results: Student performance on exam questions with differing levels of difficulty in a single course was not associated with NAPLEX performance. All other course level items had small non-significant relationships. A two variable model correlated ($r2=0.42$) PCOA total scale score and NAPLEX performance ($p<0.001$). Interestingly, there was approximately 15% of students with an A grade and 18% students with a B grade that failed their first attempt, which lowered the performance of the model.

Conclusion: Utilizing student performance on exam items of differing difficulty was not associated with passing or failing the NAPLEX. The PCOA total scaled score was associated with passing the NAPLEX

42 | An interprofessional academic detailing initiative to improve opioid safety

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Introduction: Academic detailing is a technique where healthcare professionals are educated about evidence-based information on opioids to change their practice. There has been limited studies showing the effectiveness of pharmacists and public health officials partnering on academic detailing initiatives to improve opioid-related knowledge and reduce opioid overdoses.

Research Question or Hypothesis: To determine if an academic detailing program consisting of community health workers and pharmacy students can increase healthcare professional's knowledge about methods to improve opioid safety.

Study Design: Case series.

Methods: Third-year pharmacy students received academic detailing training by the National Resource Center for Academic Detailing (NaRCAD). Afterwards, students partnered with Worcester County Health Department community health workers to do routine visits to medical offices and pharmacies to educate healthcare professionals about appropriate opioid prescribing, Prescription Drug Monitoring Programs (PDMP), and naloxone usage. Healthcare providers' attitudes of the program were measured with a 6-point Likert scale and rates of Worcester County opioid statistics were indirectly evaluated for program success.

Results: Forty-eight individualized academic detailing sessions were conducted by 7 student pharmacists and 3 community health workers. 35 primary care medical offices (72.9%) and 13 pharmacies (27.1%) participated in the initiative. Forty-four participants (91.7%) found the information presented in the academic detailing session useful. Forty-one participants (85.4%) reported that their knowledge of opioids improved and 12 participants (25%) reported that they would make modifications to their practice after the academic detailing session. The number of opioid-related overdoses in Worcester County fell from 3 to 1 people during the program.

Conclusion: This is an innovative, interprofessional program consisting of pharmacy students and community health workers working together to improve opioid safety. Pharmacy students trained in academic detailing have the skills to influence healthcare professional's decisions on opioid misuse. Individualized academic detailing sessions are an impactful method to change opioid usage patterns while bringing educational resources to the community.

43 | Effects of Mentorship on Clinical Practice Faculty Well-Being

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Introduction: Among clinical practice faculty, having a mentor is associated with a lower risk of burnout. However, whether this depends on mentorship quality or comes at the expense of mentors' well-being remains uncertain. These relationships are important to explore as mentorship is often framed in universally positive terms.

Research Question or Hypothesis: How do clinical practice faculty perceptions of mentorship quality relate to mentor and mentee well-being (e.g., burnout)?

Study Design: Cross-sectional, observational study

Methods: Clinical practice faculty at our institution were invited to complete an online survey. Mentees evaluated their mentor using the validated Mentorship Evaluation Tool (MET); mentors completed a self-evaluation form of the MET and measures of emotional labor. Both groups responded to measures of job satisfaction and burnout (exhaustion and disengagement). Mentor-mentee data were then matched and analyzed in pairs. The primary outcome of interest was the relationship between mentee burnout and mentor evaluation scores. Bivariate correlations were used to assess all relationships and statistical significance was defined as $p<0.05$. Data were analyzed using R version 4.1.2.

Results: A total of 10 mentor-mentee pairs completed the survey. Mentee job satisfaction was positively related to mentor MET score ($r=.76$, $p=.011$) whereas both exhaustion and disengagement were inversely related to mentor MET score ($r=-.64$ and $r=-.80$, respectively; $p<.05$ for both). In terms of mentors' emotional labor, compassion satisfaction was associated with lower mentee disengagement ($r=-.80$, $p=.017$) whereas the deep-acting required for mentorship came at mentors' expense (exhaustion $r=.97$, $p<.001$). Discrepancies in mentor-mentee MET scores were not associated with any variables of interest.

Conclusion: Burnout was lower among mentees who evaluated their mentors highly, but this may have come at the expense of mentors' well-being. Although our study was small due to mentor-mentee pairings, it highlights an issue worth further exploration.

44 | Introducing Interprofessional Roles/Responsibilities and Ethical Decision Making Through Guided Questions and a COVID-19 Case Discussion

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Introduction: Interprofessional education (IPE) is an imperative to prepare pharmacy students for contemporary practice. There has been a significant move by health professions educators to engage students of various professions with one another. Of the four IPE competency domains, there is sparse literature in values/ethics domain.

Research Question or Hypothesis: Does guided questions/discussion around COVID-19 case followed by debrief enhance pharmacy and medical students' confidence in knowledge about interprofessional roles/responsibilities and ethical decision making ability?

Study Design: Retrospective pre-post survey assessing students' confidence in knowledge about roles/responsibilities and proficiency in making ethical decisions.

Methods: Interprofessional teams of first year pharmacy and medical students participated in a COVID-19 vaccine case discussion. In small groups, learners developed a vaccine distribution priority list. Groups presented their recommendations during faculty facilitated large group debrief. Students also engaged in small group discussion in answering guided questions about each profession's roles/responsibilities. Large group debrief provided clarification of roles/responsibilities. Quantitative data was assessed on a Likert scale: Not confident at all(1) to very confident(5). A Fisher's Exact Test assessed the proportional differences. Qualitative comments were collated and thematic analysis was performed using the constant comparison method.

Results: 303 students (156 pharmacy, 147 medicine) participated. Self-rating of confidence in roles/responsibilities knowledge improved: "not confident at all/not confident" decreased from 90 to 18 ($p<0.001$) and "confident/very confident" increased from 83 to 191 ($p<0.001$). Similarly, confidence in ethical decision making ability improved: "not confident at all/not confident" decreased from 55 to 9 ($p<0.001$) and "confident/very confident " increased from 119 to 204 ($p<0.001$). Three themes of learning emerged from 266 qualitative comments: knowledge about roles/responsibilities, insights into communication and teamwork, and managing ethical dilemmas.

Conclusion: This learning engagement had a positive impact on students' self-perception of confidence in knowledge of roles/responsibilities and ethical decision making ability. Future studies directly assessing learning in these areas could further validate these findings.

45 | Impact of a Pre-Pharmacy Skills Lab Immersion Activity on the Professional Identity Formation of Pharmacy and Pre-Pharmacy Students

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Introduction: Extracurricular activities with pre-pharmacy and pharmacy students have the potential to support professional identity formation in individuals who are at different points in their professional experience and training.

Research Question or Hypothesis: How do pharmacy and pre-pharmacy students describe the perceived impact of an extracurricular skills lab activity on professional identity formation?

Study Design: Cross-sectional survey utilizing open-ended questions.

Methods: The activity was four hours long and consisted of 22 different stations facilitated by pharmacy students, each covering a different area of pharmacy practice or pharmacist responsibilities (e.g. IV preparation, compounding, prescription order entry, etc.). A total of 43 pre-pharmacy students and 43 pharmacy students participated in the activity. A post-activity survey was sent to all participants and asked about the activity's impact on their professional identity and what they felt was the most valuable part of the activity. A qualitative content analysis approach was used in which two investigators coded responses, developed categories of similar codes, and identified overarching themes based on relationships between categories. A third investigator read through all responses and provided confirmation for the identified themes.

Results: Fifteen pre-pharmacy students (34.8% response rate) and 19 pharmacy students (44.2% response rate) completed the survey. Pre-pharmacy student responses revealed two themes: 1) hands-on activities were insightful for understanding roles in pharmacy practice; and 2) making connections with pharmacy students helps to prepare for what's ahead. Pharmacy student responses revealed two themes: 1) reaffirmed their passion for pharmacy; and 2) importance of engaging the next generation of pharmacy students.

Conclusion: An extracurricular activity providing interaction between pre-pharmacy and pharmacy students was beneficial for supporting various aspects of professional identity formation. These types of activities impact both the current and next generation of pharmacy students, and could potentially be enhanced in the future by also engaging active practitioners.

46 | Comparison of a flipped classroom delivered on campus and online

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Introduction: In 2020, the COVID-19 pandemic required the UA RKKCOP Self-Care Therapeutics course, taught traditionally as an on-campus flipped classroom design, to be offered as an online course.

Research Question or Hypothesis: Student performance on exams will be similar regardless of students attending a flipped classroom on campus versus online, via web-conferencing.

Study Design: Retrospective comparison between an on-campus and online flipped classroom Self Care Therapeutics course.

Methods: Exam performance was compared for the 2019 in-person attending cohort and the 2020 online attending cohort. Course design was similar between the two cohorts, with each completing assigned pre-reading, an associated quiz, in-class small group discussions and in-class large group faculty-led debrief. For small group discussions, the on-campus cohort selected their own group members while the online cohort was randomly placed into different groups for each class. Three examinations were administered consisting of 33 multiple choice questions. Descriptive statistics and a two tailed Mann-Whitney U test was used to compare student performance between the on-campus and online attendance cohorts. A significance level of 0.05 was used.

Results: There were 243 students included in the analysis (58% female, 42% male). Minimal differences between the exam averages

were observed for all 3 exams with statistically significant differences observed in performance for exam 1 only (exam 1 = 0.04±0.11, p=0.02; exam 2 = 0.03±0.09, p=0.11; exam 3 = 0±0.09, p=0.95). The correlation in scores between different exams appeared the same for both years. There was a moderate positive correlation between scores on exams 1, 2, and 3.

Conclusion: Based on examination results, content in a flipped classroom design may have been as effectively delivered online as it was in person. Further research using data from multiple courses or from the same cohort, randomized, is needed to improve the external validity of these findings.

47 | Pharmacy Students' Professionalism and Communication Skills as Predictors of North American Pharmacist Licensure Examination Success

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Introduction: During advanced pharmacy practice experiences (APPEs), pharmacy students are often evaluated on soft skills, including professionalism and communication, that are vital to the success of pharmacists in real-world practice. However, there is a void of research that establishes an association between these skills and success on the North American Pharmacist Licensure Examination (NAPLEX). Currently, research focuses on quantitative metrics, including grade point averages, Pharmacy College Admission Test scores, and Pharmacy Curriculum Outcomes Assessment scores.

Research Question or Hypothesis: Do assessments of professionalism and communication among pharmacy students correlate with NAPLEX performance?

Study Design: Retrospective, observational study

Methods: Data was captured from the experiential education learning management system for the graduating classes of 2017-2019 for pharmacy students across 2 campuses at Wingate University. Graduates with an available NAPLEX score were eligible for inclusion. Grading rubrics were compared across required and elective APPEs. Relevant rubric components were divided into categories of professionalism or communication. Scores were standardized using a z-score and averaged over APPEs. Spearman's correlation coefficients were used to identify correlations between each item and individual student NAPLEX scores.

Results: During the study period, 282 graduates were eligible for inclusion (n=248 Wingate campus and n=34 Hendersonville campus). Overall, both professionalism and communication demonstrated statistically significant correlations with graduate NAPLEX performance, with correlation coefficients of 0.218 (p<0.001) and 0.235 (p<0.001), respectively. No difference was found between graduating classes or individual campuses.

Conclusion: NAPLEX success rates are frequently used as a marker of graduate success. Current data is limited to correlations of NAPLEX success rates with standardized testing and academic metrics. This study found that professionalism and communication skills also correlated with NAPLEX success, indicating the need for continued focus on development and strengthening of these soft skills within the pharmacy school curriculum.

48 | Perceptions of PGY2 and combined PGY1/2 residency program directors on letters of recommendation

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Introduction: Pharmacy residency opportunities have gained significant interest over the past decade. Historically, letters of recommendation (LORs) have been a key portion of the resident's application, and have provided insight into the candidate that can not be achieved from the application itself. While the importance of the LOR has been established there is a need for candidates and reference writers to better discern the weight that LORs carry in the application process.

Research Question or Hypothesis: What are residency program director preferences surrounding letters of recommendations for residency applications?

Study Design: This study was a prospective, cross-sectional survey.

Methods: This study gauged the perceptions of PGY2 Residency Program Directors (RPDs) on LOR's. Following IRB approval, the survey was designed in the Qualtrics® survey platform and distributed toh RPD's across the United States. Results were transferred to the IBM SPSS® Statistics 26 platform where data were analyzed using Chi-Squared, Mann Whitney U, Spearman Correlation, and Kruskal Wallis tests.

Results: A total of 1,126 directors were emailed the link to complete the survey. The survey response total reached 190 of PGY1/2 and PGY2 (16.87% response rate). The top three characteristics that RPD's valued the most included clinical problem solving skills, ability to organize and manage time, and willingness to accept constructive criticism. The survey also evaluated which LOR writers were preferred in residency rankings. The results showed that PGY2 RPD's prefer LORs from employers and fellows more than APPE preceptors, professors, faculty members who served as preceptors, school of pharmacy deans, and non-pharmacy professionals.

Conclusion: We found that RPDs preferred PGY2 candidates with clinical problem solving skills, strong organization and time management skills, and willingness to accept constructive criticism. These findings may provide guidance for reference writers (and candidates seeking references) to best highlight a candidate's skills and characteristics.

49 | An Evaluation of Intercultural Learning Assessment Tools for International Advanced Pharmacy Practice Experience Pre-Departure Training

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Introduction: A gap exists in the literature addressing intercultural skill development and assessment during international Advanced Pharmacy Practice Experiences (APPEs). Pre-departure training is a critical component, allowing student pharmacists to evaluate their mindset and intercultural skills.

Research Question or Hypothesis: The purpose was to evaluate intercultural assessments to identify their utility as part of the preparation process for international APPEs.

Study Design: A retrospective, descriptive evaluation of student pharmacist assessments.

Methods: A critical review of published literature, focused on intercultural learning tools and their use prior to international programs, was completed. The Intercultural Development Inventory®(IDI) and Cultural Intelligence® (CQ) were chosen for utilization as Purdue University has utilized these tools for study abroad assessment. During this evaluation the Intercultural Effectiveness Scale®(IES) was identified and added. Between 2019 and 2022, 150 student pharmacists taking a pre-departure course completed an intercultural assessment. Assessment results were evaluated to look at similarities in results, gaps in reporting, and the utility of these assessments in pre-departure training.

Results: A literature search identified very limited use of these assessments in student pharmacists or international APPEs. Each tool quantifies intercultural knowledge of student pharmacists. The average IDI developmental orientation was 90.5 (n=112), placing most students in polarization or minimization. The average CQs (n=112) were drive: 80.5; knowledge: 50.8; strategy: 70.6; and action: 64.0. Students fell in the middle of worldwide norms across all four assessed capabilities. The IES scores (n=38) varied across domains with an average of 4.74. The highest scored domain was continuous learning (5.22). All tools provided a customized plan for intercultural development. The IDI provides reports directly to facilitators while the CQ and IES results are communicated directly to the student.

Conclusion: These tools assess intercultural abilities but the differences in reporting of results and scoring limit the ability to directly compare the tools.

50 | Paired or pooled analyses in continuing medical education, which one is better?

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Introduction: In data analyses, pairing participant responses is often thought to yield the purest results. However, ensuring all participants answer all questions can be challenging. Pooling all responses together may diminish the robustness of a statistical analysis, but the practical significance is still debatable.

Research Question or Hypothesis: Is there a difference in question performance between paired vs pooled data in the immediate post-content and 90 day follow-up time periods?

Study Design: Retrospective analysis

Methods: Data from a live continuing education series for allied health professionals was analyzed. Eight different educational sessions were held and participants could engage in as many or as few as desired. For each topic, identical questions were asked prior to the educational content (pre), immediately following the content (post), and on a 90 day follow-up survey (follow-up). A paired analysis was done for matched responses on pre vs post and pre vs follow-up questions. A pooled analysis was done for the aggregate responses on pre vs post and pre vs follow-up questions. Chi-squared was used to compare differences between pooled analysis groups.

Results: Responses from 56 questions were included in the analysis. The pre vs post content questions yielded 323-956 matched pairs and the pre vs follow-up questions yielded 41-236 matched pairs. The pre vs post pooled analysis yielded 1260-2285 participants and the pre vs follow up pooled analysis yielded 777-1431 participants. In both the paired and pooled pre vs post analysis, all questions yielded a statistically significant improvement in correct responses. In the paired pre vs follow up analysis, 59% (n=33) questions demonstrated a statistically significant improvement in correct responses, compared to 62% (n=35) in the pooled pre vs follow up analysis.

Conclusion: Paired and pooled data yielded similar results at the immediate post-content and 90 day follow-up time periods.

51 | Cracking the Code: A Clinical Escape Room to Enhance Interprofessional Collaboration

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Introduction: Interprofessional collaboration is crucial in healthcare. Students benefit from opportunities to work with other healthcare professions as this fosters an environment where collaboration and teamwork are at the forefront. Participation in an interprofessional escape room activity is an effective way to augment these skills and highlight their importance in a clinical setting.

Research Question or Hypothesis: The purpose of this study is to assess the impact of an innovative escape room activity on interprofessional collaborative competency in pharmacy and family nurse practitioner (FNP) students.

Study Design: Retrospective analysis of pre-post Interprofessional Collaborative Competency Attainment Survey (ICCAS) results

Methods: A clinical escape room was designed for third-year pharmacy and FNP students. Diverse teams of five to six students were tasked with solving a geriatric patient case within an hour in order to "escape." The ICCAS was utilized to gather data from nursing and pharmacy students to evaluate the impact of the escape room activity on the ICCAS domains: communication, collaboration, roles and responsibilities, collaborative patient-centered care approach, conflict management, and team functioning. This is a twenty-one question survey that evaluates students' perceptions of their interprofessional skills.

Results: A total of 13 FNP and 38 third-year pharmacy students participated in the escape room activity, with 48 of those students (94%) having completed the pre- and post- survey. A statistically significant difference was found regarding students' perception of their interprofessional skills before and after the simulation. ($p<0.001$)

Conclusion: This data suggests that the use of an interprofessional escape room is an effective manner to help students learn skills related to communicating and resolving conflicts with other healthcare professionals.

Emergency Medicine

52 | Evaluation of 3% Hypertonic Saline Administration for Traumatic Brain Injury

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Introduction: Brain herniation may cause neurologic injury and death. Indicators of herniation include early signs of increased intracranial pressure (ICP) (tachycardia and/or hypertension), Cushing's triad, and physical symptoms of increased ICP (headache, altered mental status, posturing, unequal pupils, fixed or dilated pupils, and/or seizure). If these signs are present, treatment with 3% hypertonic saline (HTS) is warranted. This medication use evaluation (MUE) was conducted to ensure proper use of HTS therapy in trauma patients at our institution.

Research Question or Hypothesis: Did trauma patients appropriately receive 3% HTS based on early signs of increased ICP, Cushing's triad, and/or physical symptoms of increased ICP?

Study Design: This is a retrospective, observational, single center MUE.

Methods: Adult trauma patients initiated on 3% HTS at a Level 1 trauma center from 5/1/2021 to 6/30/2021 were included. The primary objective was to evaluate whether trauma patients who received 3% HTS exhibited early signs of increased ICP, Cushing's triad, or physical symptoms of increased ICP. The secondary objective was to evaluate the rate of positive CT scans for hemorrhage or impending herniation in patients who received HTS. Hypernatremia was also assessed as a safety outcome. Data was examined using quantitative analysis.

Results: Fifty-three patients received 3% HTS but only 37 met the inclusion criteria. All 37 (100%) exhibited one or more early signs of increased ICP, Cushing's triad, or physical symptoms of increased ICP. Out of 37 patients, 26 (70.3%) had positive CT scans for hemorrhage or impending herniation. Hypernatremia occurred in 19 (51.4%) out of 37 patients with 4 (10.8%) requiring intervention with dextrose 5% in water.

Conclusion: Adult trauma patients at our institution received 3% HTS appropriately based on early signs of increased ICP, Cushing's triad, and/or physical symptoms of increased ICP with more than half having confirmed hemorrhage or impending herniation on radiographic imaging.

53 | Retrospective assessment of sugammadex to facilitate neurologic assessment in severely brain-injured patients

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Introduction: Widely used in anesthetic management, sugammadex is increasingly employed in reversal of neuromuscular blocking agents (NMBAs) outside of procedural settings, where little evaluative data currently exists.

Research Question or Hypothesis: What is the utility and safety of using sugammadex to facilitate neurologic assessments in NMBA-exposed patients with traumatic brain injury (TBI) or non-traumatic intracranial hemorrhage in emergency department or critical care settings?

Study Design: Retrospective, single-arm analysis at a Level 1 trauma center

Methods: All brain-injured patients receiving sugammadex to facilitate neurologic evaluation in non-procedural settings during one year were assessed for inclusion. The primary outcome was the qualitative impact of sugammadex administration upon neurosurgeon decision-making. Secondary quantitative outcomes included change to Glasgow Coma Scale (GCS) and hemodynamic parameters compared before and after sugammadex administration. Sugammadex dosing was also assessed across various weight scalars to explore dose-response trends and generate preliminary guidance for use in this setting.

Results: Our study criteria yielded twelve sugammadex administrations across eleven patients, most having sustained TBI. All sugammadex administrations were adjudicated beneficial to neurosurgeon decision-making and 50% were associated with a change to prognosis and plan. Sugammadex was associated with an increase in GCS of 1-8 points among the 67% of patients who responded. Mean

arterial pressure (MAP) decreased significantly after sugammadex administration [median 94 vs. 104 mmHg (p=0.0215), median change of -8 mmHg (95%CI -25-3 mmHg)]. No apparent dose-response trends were observed for changes to GCS, MAP, or heart rate.

Conclusion: Use of sugammadex to facilitate neurologic assessment after NMBA exposure in brain-injured patients was frequently associated with clinically meaningful changes to neurologic exam and treatment plan. The risks of hemodynamic compromise and care complexity should be collaboratively weighed before pursuing this modality. An empiric sugammadex dose of 200 mg appears reasonable, but further evaluation of NMBA reversal in the neuro-critically ill outside of procedural settings is warranted.

54 | Variable vs. Fixed-Dose Four-Factor Prothrombin Complex Concentrate for Factor Xa Inhibitor Reversal

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Introduction: Four-factor prothrombin complex concentrate (4F-PCC) is recommended for the reversal of factor-Xa (FXa) inhibitor associated major bleeding when Andexanet alfa is not available. Prior studies evaluating fixed-dose regimens of 4F-PCC predominately include patients with intracranial and trauma associated major bleeding. This study was designed to determine the efficacy and safety of variable versus fixed-dose 4F-PCC in the setting of non-intracranial, non-traumatic FXa-associated major bleeding.

Research Question or Hypothesis: Compared to variable-dose 4F-PCC, fixed-dose 4F-PCC provides similar hemostatic efficacy, safety, will decrease time to administration, and provide cost-savings for non-intracranial, non-traumatic FXa inhibitor associated major bleeding.

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

Methods: Patients with non-traumatic, non-intracranial FXa inhibitor associated major bleeding who were reversed with either a variable-dose (50 units/kg) or a fixed-dose (2000 units) of 4F-PCC were included. Patients on anticoagulation other than FXa inhibitors, those without major bleeding, or intracranial or traumatic bleeding were excluded. The primary outcome was hemostatic effectiveness at 48 hours. Secondary outcomes included the incidence of thrombosis or death at 30 days, time to 4F-PCC administration, and cost of 4F-PCC treatment.

Results: Fifty-seven patients were included with 38 patients receiving fixed-dose 4F-PCC and 19 patients receiving variable-dose 4F-PCC. Apixaban was the most common FXa inhibitor reversed and gastrointestinal bleeding was the most common type in both groups. Hemostatic effectiveness was achieved in 22 of 38 patients (57.9%) in the fixed-dose group and in 7 of 19 patients (36.8%) in the variable-dose group ($p = 0.2$). There was no significant difference in thrombosis or death at 30 days or time to administration. Treatment costs were lower in the fixed-dose 4F-PCC group.

Conclusion: Among patients with non-intracranial, non-traumatic FXa inhibitor associated major bleeding, the use of fixed-dose 4F-PCC yielded similar hemostatic effectiveness compared to variable-dose 4F-PCC, and was associated with lower drug cost.

55 | Evaluation of Clinician Adherence to *M. genitalium* Testing Guidance in Emergency Departments at an Academic Medical Center

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Introduction: Limited understanding of *Mycoplasma genitalium* and insufficient guidance on diagnosis and treatment challenge clinical management of this emerging sexually transmitted infection (STI). Prior to the Center for Disease and Control and Prevention including *M. genitalium* in the 2021 STI guidelines, the MetroHealth System implemented *M. genitalium* testing in 2020. Meanwhile, medical providers were provided with a testing and treatment guidance document to facilitate appropriate utilization of this new test.

Research Question or Hypothesis: Are *M. genitalium* laboratory orders in the emergency department (EDs) at an academic medical center in accordance with the institutional testing guidance?

Study Design: This is an institutional review board exempted, single-center, retrospective cohort study.

Methods: All patients tested for *M. genitalium* between July 1st 2020 and July 1st 2021 in the EDs were screened for inclusion. Ten patients were randomly selected each month for evaluation. The primary objective was to assess clinicians' adherence to MetroHealth *M. genitalium* diagnostic testing guidance.

Results: The primary outcome of percentage of appropriate *M. genitalium* testing was 14.2% (17/120, 95% CI 8-20.4): 9 had pelvic inflammatory disease (PID), 5 had urethritis, 2 had cervicitis, and 1 was requested by the patient. Of 103 inappropriate testing orders, 88.3% (91) patients presented with genitourinary symptoms without a diagnosis of urethritis, cervicitis, endometritis or PID; 95.1% (98) did not have previous exposure to *M. genitalium*; 2.5%; [3] presented with non-STI related symptoms; 6.7%; [8] were asymptomatic. *M. genitalium* infection rate was 21.7% (26/120). Sub-analysis of race, co-infection and syndromic presentations between positive/negative *M. genitalium* test results and appropriate/inappropriate testing yielded no statistical difference. 14/26 (53.8%) received appropriate treatment for *M. genitalium*.

Conclusion: We identified low testing guidance adherence after implementation of *M. genitalium* testing with a guidance document. These results support the need for further education and quality improvement initiatives to improve appropriate testing and treatment.

Endocrinology

56 | Factors associated with an increased risk of vitamin b12 deficiency in type 2 diabetes patients on metformin

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Introduction: Metformin is an antidiabetic agent used to treat type 2 diabetes. The risk of vitamin b12 deficiency has been associated with prolonged use of metformin. Many other factors have also been associated with vitamin b12 deficiency. Studies on the possible additive effect of multiple risk factors for developing a vitamin b12 deficiency are lacking.

Research Question or Hypothesis: We hypothesized that the presence of one or more known risk factors associated with vitamin b12 deficiency would correlate to deficient vitamin b12 levels in these patients.

Study Design: This single center, retrospective cohort study was approved by the Institutional Review Board.

Methods: For inclusion, patients needed to be at least 18 years old, diagnosed with type 2 diabetes, taking metformin for at least 2 years, and actively taking metformin during the study period of October 2020 to September 2021. The primary outcome was the rate of occurrence of serum b12 levels <300 pg/mL associated with the presence of vitamin b12 risk factors. Demographics were compared using descriptive statistics, and clinical data using Wald Chi-squared and Pearson Correlation Coefficient tests.

Results: A total of 387 patients met inclusion criteria for this study. As observed, 25 patients had at least one b12 result below 300 pg/mL. Among the assessed risk factors, none were associated with a higher incidence of b12 deficiency. Patients with higher weights were found to have an increased risk of vitamin b12 deficiency ($p=0.0438$).

Conclusion: Patients at higher weights may have an increased risk of vitamin b12 deficiency. Only 21% of patients had their vitamin b12 level checked during the study period, warranting a closer look at current site protocols for checking this lab. Further studies with larger study populations are needed to better evaluate the association of these risk factors with vitamin b12 deficiency.

Health Services Research

57 | Using card sorting to explore deprescribing preferences among older adults who take multiple nonprescription products on a daily basis

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Introduction: Deprescribing often focuses on prescription medications. However, use of over-the-counter (OTC) medications on a chronic basis (e.g., proton pump inhibitors), at high doses (e.g., famotidine with renal dysfunction), or in combination with other medications (e.g., diphenhydramine plus anticholinergic medications), places older adults at increased risk for harm from their medications. Furthermore, dietary supplements have varying degrees of effectiveness and safety.

Research Question or Hypothesis: We sought to explore the extent to which people ≥65 years who reported taking ≥10 nonprescription products on a daily basis were interested in deprescribing.

Study Design: Semi-structured interviews

Methods: We recruited adults ≥65 years who reported taking ≥10 nonprescription products using our institutional research recruitment website. Participant spoke with a research assistant via telephone to create a list of all of their prescription and OTC medications and dietary supplements. Subsequently, the principal investigator met with each participant via video and conducted a semi-structured interview with an embedded card sorting activity. Participants were asked to imagine their primary care provider raised the idea of deprescribing. Participants were asked to sort each medication into one of the following categories: prefer to continue, stop or lower (deprescribe), or unsure. We used descriptive statistics to summarize our findings. The study was deemed exempt by the Institutional Review Board.

Results: Among the 15 participants, 7 (47%) identified as female, 13 (87%) white, and 12 (80%) reported good or very good health. Participants reported taking an average of 19 medications (range 14-26). Approximately three-fourths of the medications that were currently being taken were OTC products or dietary supplements (n=207/283, 73%). Participants were interested in deprescribing 5.8% (n=12/207) of the nonprescription products.

Conclusion: Older adults were resistant to deprescribing nonprescription products. Additional research is needed to explore how to facilitate effective deprescribing conversations with older adults about nonprescription products.

58 | Expedited Partner Therapy approval timeframes analyzed by chlamydia and gonorrhea statistics among states

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Introduction: Expedited partner therapy (EPT) functions differently among states. EPT's effectiveness may be indirectly proportional to the number of reported sexually transmitted infections (STIs). The purpose of this research was to assess recently reported cases and rates of chlamydia and gonorrhea relative to durations of EPT approvals throughout the United States. Pharmacists play instrumental roles in EPT facilitation. Therefore, pharmacists and other healthcare professionals are likely interested in how long EPT has been available compared to chlamydia and gonorrhea statistics.

Research Question or Hypothesis: Are timeframes of EPT approvals predictive of decreases in recently reported chlamydia and gonorrhea cases and rates at the state level?

Study Design: This study featured a retrospective design that evaluated data from the Centers for Disease Control and Prevention (CDC).

Methods: Utilizing CDC data, this approach analyzed 2019 chlamydia and gonorrhea cases and rates (per 100,000) in relation to state EPT approvals. The independent variable was EPT approval timeframe, in months, and the dependent variables were chlamydia and gonorrhea cases and rates. Linear regressions assessed predictions of chlamydia and gonorrhea cases and rates by EPT approval timeframes, with statistical significance set a $p < 0.05$.

Results: The amount of time EPT has been in place significantly predicted decreases in chlamydia and gonorrhea cases, Beta coefficient = -237.67, p = 0.019, 95% CI (-434.863, -40.478) and Beta coefficient = -79.415, p = 0.022, 95% CI (-147.064, -11.765), respectively, but not decreases in chlamydia and gonorrhea rates, p= 0.807, and p = 0.894, respectively.

Conclusion: Different scenarios confound EPT effectiveness aside from chlamydia and gonorrhea data. Varying EPT implementations across states are also factors. These results indicate EPT duration may be predictive of decreases in chlamydia and gonorrhea cases, but not rates.

Hematology/Anticoagulation

59 | Direct Oral Anticoagulants Versus Warfarin for the Treatment of Left Ventricular Thrombus in Patients with Reduced Ejection Fraction Heart Failure

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Introduction: The safety and efficacy of direct oral anticoagulants (DOACs) for left ventricular thrombus (LVT) in patients with heart failure with reduced ejection fraction (HFrEF) is inconclusive. This patient population carries a higher risk of LVT and may benefit from a simplified anticoagulation regimen. This study's goal was to determine the efficacy and safety of DOACs compared to warfarin for LVT among HFrEF patients.

Research Question or Hypothesis: Are DOACs safe and effective compared to warfarin for LVT in patients with HFrEF?

Study Design: Single-center, retrospective cohort study.

Methods: This was an IRB-approved study of adults with HFrEF admitted to an academic medical center between January 1, 2013 and December 31, 2019 prescribed a DOAC or warfarin for LVT. The primary endpoint was stroke or systemic embolism (SSE), and secondary endpoints included ISTH-defined major bleeding, bleeding-related hospitalization, thrombus resolution, and mortality, all assessed within 6 months post-discharge.

Results: Of the 81 patients included, 27.2% (n=22) received a DOAC and 72.8% (n=59) received warfarin. SSE occurred in 9.1% (n=2) of DOAC patients and 6.8% (n=4) of warfarin patients (p=0.724). There was no statistical difference in major bleeding between DOAC and warfarin groups (n=3, 13.6% vs n=2, 3.4%, p=0.088), bleeding-related hospitalization (n=1, 4.5% vs n=2, 3.4%, p=0.806) or mortality (n=4, 18.2% vs n=5, 8.5%, p=0.216). Of the 50 patients receiving follow-up imaging, 56.3% (n=9) DOAC patients and 67.6% (n=23) warfarin patients experienced thrombus resolution.

Conclusion: No difference in rates of SSE, major bleeding, bleeding-related hospitalizations, or mortality was observed between patients with HFrEF receiving DOACs or warfarin for treatment of LVT. While DOACs may be an acceptable alternative to warfarin, larger scale studies are warranted to future delineate the role of DOACs in this patient population.

60 | Direct Oral Anticoagulants Versus Warfarin for the Treatment of Inferior Vena Cava Thrombus

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Introduction: No specific guidelines exist regarding treatment of inferior vena cava (IVC) thrombus. Historically, treatment included parenteral therapy with transition to warfarin. While direct oral

anticoagulants (DOACs) are an attractive alternative to warfarin, there is a paucity of data supporting their use for this indication. This study sought to determine the efficacy and safety of DOACs compared to warfarin for the treatment of IVC thrombus.

Research Question or Hypothesis: Do DOACs have the same efficacy and safety profile compared to warfarin for treatment of IVC thrombus?

Study Design: Single-center, retrospective cohort study

Methods: This was an Institutional Review Board approved study of adult patients admitted to an academic medical center between January 1, 2013 and May 31, 2021 with a diagnosis of IVC thrombus and newly prescribed DOAC or warfarin therapy. The primary efficacy outcome was radiographically confirmed thrombus resolution, and the primary safety outcome was major bleeding, both assessed within 6 months of hospital discharge. Secondary outcomes included pulmonary embolism, mortality, and hospital admission for a bleeding-related event.

Results: Thirty-three patients were included, with 23 (69.7%) receiving DOACs and 10 (30.3%) receiving warfarin. Ten (30.3%) patients had repeat imaging available, with 6 patients in the DOAC group and 4 patients in the warfarin group. Thrombus resolution was observed in 2 (33.3%) patients treated with a DOAC compared to no patients treated with warfarin (p=0.374). No difference in major bleeding was observed between patients receiving DOACs or warfarin (8.7% vs 10%, p=0.905).

Conclusion: No statistical difference was observed between patients receiving DOACs or warfarin for the treatment of IVC thrombus in rates of thrombus resolution or major bleeding. Further studies or a larger scale meta-analysis are warranted to further delineate optimal oral anticoagulation in the treatment of IVC thrombus.

61 | Truncated Initial Therapy in Patients Receiving Apixaban for New Onset Venous Thromboembolism Following Parenteral Anticoagulation

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Introduction: Apixaban dosing initially for venous thromboembolism (VTE) is 10 mg twice daily for seven days followed by 5 mg twice daily based on the AMPLIFY trial, which excluded patients who received greater than 36 to 48 hours of parenteral anticoagulation (AC).

Research Question or Hypothesis: Is there any difference in VTE recurrence or major bleeding in patients receiving the full or truncated duration of apixaban 10 mg twice daily after at least 48 hours of parenteral AC?

Study Design: Retrospective, single-center study.

Methods: This study evaluated adult patients with a new VTE admitted between January 1, 2018 to July 31, 2021 who received the full seven days of an apixaban load versus a truncated duration after at least 48 hours of parenteral AC. The primary outcomes were recurrent VTE and major bleeding within six months of the event. Secondary outcomes included identification of predictors for VTE recurrence or major bleeding and a subgroup analysis of the primary outcomes in patients receiving different durations of apixaban loading doses.

Results: Of the 398 analyzed patients, 133 were included. Patients in the truncated group were significantly older, weighed less, had lower creatinine clearance, and received EKOS less often. Between patients who received the full versus truncated duration, there was no significant difference in incidence of recurrent VTE (2 [3.5%] vs. 3 [3.9%], respectively, p = 1.00) or major bleeding (5 [8.8%] vs. 10 [13.2%], respectively, p = 0.58). No patient-specific factors increased incidence of VTE recurrence or bleeding. There were no significant differences in VTE recurrence or major bleeding between patients receiving different durations of apixaban loading doses.

Conclusion: This small retrospective study did not identify a difference in incidence of VTE recurrence or major bleeding between adults with newly diagnosed VTE who received a full or truncated duration of apixaban loading doses after at least 48 hours of parenteral therapeutic AC.

62 | Enoxaparin 40 mg daily versus q12 for venous thromboembolism prophylaxis in morbidly obese medical patients

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Introduction: Venous thromboembolism (VTE) is a major cause of in-hospital morbidity/mortality and obesity increases the incidence of VTE 6.2-fold. There is currently no data to support a specific dosing regimen in medical patients with a BMI over 40 kg/m^2.

Research Question or Hypothesis: Does an increased dose of enoxaparin decrease rates of thrombosis in morbidly obese medical patients?

Study Design: This was a single center, retrospective chart review conducted at Einstein Medical Center Philadelphia from July 2019 to March 2021. The sample size provides 80% power detecting a 90% reduction in risk, based on previous studies.

Methods: Patients were included if they were ≥ 18 years old, on a non-surgical service, had a BMI ≥ 40 kg/m^2, and received enoxaparin 40 mg daily or q12. The primary endpoints were hospital-associated VTE (HA-VTE) rates and major and minor bleeding rates between the dosing regimens. Secondary endpoints included readmission for bleeding or VTE within three months.

Results: There were 250 patients enrolled in the daily vs 125 in the q12 group. In this study, the incidence of HA-VTE was one in each group [1 (0.4%) vs 1 (0.8%) p=1.00]. There were no minor bleeding events in the daily group but there were 2 (1.6%) patients who experienced minor bleeding in the q12 group [0 (0%) vs 2 (1.6%), p=0.11]. There were no major bleeding events or readmissions within three months for VTE or bleeding in either group.

Conclusion: In this study, there were no significant differences in rates of thrombosis or major/minor bleeding between daily or q12 enoxaparin dosing in morbidly obese patients. However, this study was limited by a low baseline risk of VTE overall and a higher BMI in the q12 group. Further studies should be done in patients with a BMI over 40 kg/m^2 and a high thromboembolic risk.

Infectious Diseases

63 | Assessment of fluoroquinolone cross-reactivity in a real-world setting

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Introduction: Fluoroquinolone allergies are reported in 2% of hospitalized patients with the incidence increasing. Data remains unclear regarding cross-reactivity of IgE-mediated reactions within the fluoroquinolone class and data is conflicting. In an attempt to add to the literature, we aim to evaluate rates of cross-reactivity among patients with a reported fluoroquinolone hypersensitivity reaction.
Research Question or Hypothesis: What is the likelihood of fluoroquinolone cross-reactivity in a real world setting?
Study Design: This was a retrospective medical chart review within a 2,600-bed health system.
Methods: Patients were included if they were admitted to our health-system between 2013 and 2021 and had a documented fluoroquinolone allergy within the electronic health record (EHR) and at least one subsequent documented inpatient administration of an alternative fluoroquinolone.
Results: Of the 94 patients evaluated, 29 patients met inclusion criteria. Patients were excluded if the initial antibiotic allergy was deemed by the authors as a side effect or intolerance, or was unlisted. Thirty-eight percent of patients had an initial antibiotic allergy to ciprofloxacin, 34% to levofloxacin, and 28% to moxifloxacin. Eight patients were challenged with an ophthalmic formulation (moxifloxacin), while 21 were challenged with systemic therapy. The median time to fluoroquinolone challenge was 6 years (1 day – 11 years). Cross-reactivity occurred in 10% of cases. Of the patients that reacted to the fluoroquinolone challenge, two patients reacted to ciprofloxacin and one patient reacted to moxifloxacin. Reactions were from systemic therapy only.
Conclusion: This study suggests low risk of allergic cross-reactivity between fluoroquinolones, especially when ophthalmic moxifloxacin is challenged. Generalizability of this report is limited by sample size. However, all cases meeting inclusion criteria were reviewed over an 8-year period within a health-system, suggesting upcoming studies performed in a real-world setting with larger sample sizes may be challenging.

64 | The Impact of Antibiotics Stewardship Program on Antibiotics Use, the Cost of Antibiotics, and Antimicrobial Susceptibility Pattern : An Experience from a Developing Country

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Introduction: Antimicrobial misuse is a worldwide issue, and antimicrobial resistance is among the most challenging aspects. About 30% to 50% of antibiotics prescribed in hospitals are unnecessary or inappropriate. Antibiotic stewardship programs (ASPs) include strategies and interventions that enable rational antiinfective use.
Research Question or Hypothesis: What is the impact of ASP of these three restricted antibiotics (meropenem, colistin, and tigecycline) on days of therapy/1000 patient days, cost as US Dollar/1000 patient days, antibiotic susceptibility pattern, and overall mortality?
Study Design: A retrospective, quasi-experimental study at An Najah National University Hospital, a tertiary care hospital in Palestine, over a period of 20 months before and 17 months after implementing the ASP which was introduced on September 2019.
Methods: Data were analyzed using version 21 of IBM-SPSS. Normality testing was via Kolmogorov-Smirnov test. The student t test was used for normally distributed data, while the Mann-Whitney test was used for nonnormally distributed data. The Chi-square test was used to determine the relationship between antimicrobial susceptibility and the year, p values <0.05 considered significant for all tests
Results: A total of 2,367 patients who received at least one of the targeted antibiotics were divided into two groups: 1,710 patients pre-ASP and 657 patients post ASP. The most significant reduction in DOT per 1,000 patient days was observed with tigecycline, with a percentage of change of - 62.08%. Furthermore, the mean cost of the three antibiotics decreased significantly by 55.5 % in the post-ASP phase, susceptibility to meropenem and piperacillin/tazobactam with respect to Pseudomonas aeruginosa was statistically significant in the post-ASP phase. However, the change in mortality rate was not statistically significant ($p = 0.057$)
Conclusion: ASP had a positive effect in reducing antibiotics use and cost, with no negative effect on mortality. However, a long-term evaluation of the impact of the ASP is needed to determine its lasting influences

65 | The Impact of Antimicrobial Stewardship Pharmacist-led Culture Reviews in the Ambulatory Setting of a Comprehensive Cancer Center

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Introduction: Several antimicrobial stewardship (AS) interventions, such as the review of microbiological cultures, have demonstrated improved patient outcomes in the inpatient and outpatient settings. Though studies have described the impact of AS pharmacist-led culture review, none of those evaluated the impact of such service in institutions that primarily serve immunocompromised cancer patients.

Research Question or Hypothesis: Microbiology culture review led by the AS pharmacist in the ambulatory setting will have a positive impact on optimizing antimicrobial therapy in cancer patients.

Study Design: A retrospective study at King Hussein Cancer Center in Jordan.

Methods: We included all positive microbiological cultures that were reviewed in real time by the AS pharmacist for adult cancer patients treated in the ambulatory setting, between August 2020 and February 2021. At the time of the review, cultures were assessed for appropriateness of treatment and any recommended modifications were communicated with the primary physician. We recorded the number of antimicrobial modifications made, type of modifications, and physicians' acceptance rate. Modifications included changing from non-susceptible to susceptible antimicrobials, initiation, discontinuation or de-escalation of antimicrobials.

Results: A total of 661 cultures from 504 patients were included. The mean age of patients was 58 years ±16 (SD); most had solid tumors (95%), and 34% were on chemotherapy at the time of the culture collection. Among the reviewed cultures, 175 (26%) required antimicrobial therapy modification, with an acceptance rate of 86%. The modifications consisted of changing from non-susceptible to susceptible antimicrobials (n=95, 55%), initiation (n=61, 35%), discontinuation (n=10, 6%) and de-escalation (n=7, 4%) of antimicrobial therapy.

Conclusion: AS pharmacist-led culture reviews had a significant impact on optimizing antimicrobial therapy in cancer patients in the ambulatory setting. Future studies should evaluate the impact of such service on clinical outcomes.

66 | Probiotic Effectiveness for the Treatment of Antibiotic-Associated Diarrhea in Patients Receiving High-Risk Antimicrobials vs Low-Risk Antimicrobials

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Introduction: Antibiotic-associated diarrhea (AAD) is amongst the most common adverse-effects reported with broad-spectrum antibiotics. The use of probiotics in the prevention and treatment of AAD remains controversial amongst the healthcare community. In a large study conducted by Hempel and colleagues with 11,811 patients, probiotic administration was effective in the treatment of AAD.

Research Question or Hypothesis: Assess the effectiveness of probiotics for the treatment of AAD in patients receiving high-risk and low-risk antimicrobials

Study Design: Single center, retrospective, observational review

Methods: Patients receiving *Lactobacillus acidophilus* (*L. acidophilus*) were identified via clinical pharmacist workflow tool and patient charts were manually assessed for inclusion. Patients were included if they were inpatient, ≥ 18 years old, on antimicrobial therapy, experiencing AAD, and receiving probiotics. Patients were excluded if they received probiotics prior to admission, admitting diagnosis was diarrhea or *Clostridioides difficile*. Effectiveness of probiotics was defined by improvement in number of stools in a 24-hour period; ≥6 bowel movements, 3-5 bowel movements, and ≤ 2 bowel movements.

Results: 2,649 patients were assessed for inclusion. 149 met inclusion criteria and were randomized to high-risk antimicrobial group (N=121) or low-risk antimicrobial group (N=28). Mean age was 67.6 ± 15.3 and 33.5% were male. Probiotic treatment was effective in treatment for AAD in 98% (119/121) of patients in the high-risk antimicrobial group and 100% (28/28) in the low-risk antimicrobial group. There was no statistical difference between groups in the primary outcome, high risk group, 119 (118.58) [0.00] vs low risk group, 28 (28.42) [0.01], P=.53. There was also no statistical difference in thirty-day readmission rate (13.2% vs 25%; P= .120) or development of *Clostridioides difficile*.

Conclusion: *L. acidophilus* probiotic use in the treatment of AAD exhibited no significant difference between high-risk antimicrobial groups versus low-risk antimicrobial group. *L. acidophilus* remains a safe and effective therapy for the treatment of AA

67 | Antimicrobial Utilization Trends during the COVID-19 Pandemic Throughout the US

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Introduction: The purpose of this study is to evaluate the trends of use of various antimicrobials prior to and during the coronavirus disease 2019 (COVID-19) pandemic, which is caused by a coronavirus and is unaffected by antimicrobials. Despite the inactivity of antimicrobials against COVID-19, they are still employed due the possibility of underlying or "just in case" scenarios of bacterial infection.

Research Question or Hypothesis: We hypothesis that the utilization rates of common intravenous antimicrobials correlate to the number of hospitalized COVID-19 patients.

Study Design: Retrospective evaluation.

Methods: This study utilized de-identified data and was exempt from requiring IRB approval. The antimicrobial utilization was collected through the National Center for Advancing Translational Sciences (NCATS) National COVID Cohort Collaborative (N3C) from 01/01/2019 to 12/31/2021. Antimicrobials of interest included carbapenems, 3rd/4th generation cephalosporins, fluoroquinolones, and piperacillin-tazobactam. Antimicrobial utilization rate was measured using the metric days of therapy (DOT) and patient days.

Results: Ten antibiotics were evaluated in this study and accounted for 7,891,986 DOT over three years. Monthly antibiotic utilization (mean±SD per 10,000 patient days [PD]) in 2019 (28.3±13.9) was significantly higher than 2020 (10.8±1.5) and 2021 (12.1±5), p<0.001. All the antibiotics evaluated had significant decreases in utilization with the exception of ceftriaxone (CRO) and piperacillin-tazobactam (TZP). Monthly CRO utilization (mean±SD per 10,000 patient days) in 2019 (3.11±0.32) and 2020 (3.18±0.23) were similar, but higher than 2021 (2.88±0.29), p=0.16. TZP had a similar DOT/10,000PD trend where utilization in 2019 (2.1±0.39) and 2020 (1.8±0.09) were constant and higher than 2021 (1.61±0.08), p<0.001. There is a negative correlation between COVID-19 cases and antibiotics evaluated, r = -0.655, p<0.001.

Conclusion: The antimicrobial utilization decreased during the years 2020-2021 with the exception of CRO and TZP. We plan to develop a model to determine the influence of COVID-19 on antibiotic prescribing and evaluate antimicrobial use based on US regions.

68 | Evaluation of pharmacokinetic dosing of vancomycin using a self-developed AUC monitoring tool and calculator

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Introduction: Recently, the IDSA recommended a change in vancomycin therapeutic drug monitoring from trough-based to AUC/MIC based, targeting levels of 400-600 mg*hr/L, to improve efficacy and minimize toxicity. Our institution has not yet implemented this recommendation. The purpose of this study was to evaluate vancomycin pharmacokinetic dosing using a self-developed AUC monitoring tool and calculator.

Research Question or Hypothesis: Implementation of a vancomycin AUC monitoring tool and calculator at a 545 bed, acute care, public NYC hospital will demonstrate that most vancomycin orders do not attain a therapeutic AUC/MIC.

Study Design: Retrospective review of vancomycin orders, quantitative research

Methods: De-identified vancomycin order reports were generated through the electronic medical record over a nine-month period from June 2021 through February 2022. Expected AUC/MIC ratios were calculated using first order pharmacokinetics in the AUC monitoring tool. Orders were evaluated for appropriateness based on achievement of an expected AUC/MIC of 400-600 mg*hr/L. Data was stratified by obesity status and rates of acute kidney injury (AKI) were evaluated. Orders for one-time doses, pediatric, or dialysis patients were excluded. Categorical data was analyzed using the Chi square test.

Results: A total of 305 vancomycin orders were evaluated. Overall, 27.9% achieved a therapeutic AUC/MIC, 34.8% were subtherapeutic, and 37.4% were suprathepeutic. In non-obese patients, 30.4% were therapeutic, 23.9% were subtherapeutic, and 45.7% were supratherapeutic. In obese patients, 20% therapeutic, 68% were subtherapeutic, and 12% were supratherapeutic. Significantly more obese patients had subtherapeutic values and significantly more non-obese patients had supratherapeutic values. No difference in the achievement of therapeutic values was seen between the groups. Rates of AKI were less than 5% in both groups.

Conclusion: Use of a vancomycin AUC monitoring tool and calculator identified most vancomycin orders did not achieve the AUC/MIC ratio recommended by the guideline update. Prospective implementation of this calculator would help to improve vancomycin use at our institution.

69 | Cefiderocol versus BAT (best available therapy) in the treatment of multidrug-resistant Acinetobacter Baumannii infections: early evidences from a retrospective observational study

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Introduction: Multidrug-resistant (MDR) bacterial infections, particularly those resistant to carbapenems, represent a major global health issue. Among these, Acinetobacter Baumannii is one of the leading cause of healthcare-related infections. The treatment of MDR A. baumannii involves a first-line therapy with tigecycline to which polymyxins (colistin) could be associated. Other antibiotics may be added to tailor the best available therapy (BAT). Cefiderocol represents a new therapeutic option for MDR germs. Data on its real-world effectiveness on A.baumannii, however, are limited.

Research Question or Hypothesis: In patients with MDR A.Baumannii infections, does Cefiderocol provide benefits in terms of reduced mortality compared with BAT?

Study Design: Retrospective cohort-study

Methods: Data were collected for consecutive adult patients with a microbiological confirmed infection for MDR A.baumannii treated with an antibiotic regimen including cefiderocol and/or colistin at our hospital in 2021. Individuals on cefiderocol were assigned to the intervention group and compared with the BAT group. The primary outcome was the overall mortality rate during hospital stay. Categorical variables were analyzed using Chi-square or Fisher's exact tests while continuous variables with Student's t-test or Mann-Whitney U test. P-values were considered significant if <0.05.

Results: 19 and 49 patients were included in the cefiderocol and BAT group, respectively. Baseline characteristics were overlapping, except for median age, older in controls (71 years, IQR:63-81 vs 60, 53-72, p<0.001). 8 patients (42.1%) in the interventions and 25 (51.0%) in the controls died during their hospital stay, showing no statistical

difference (p=0.50). Although days of therapy are significantly greater in controls (20 days, IQR:12-35 vs 10, 7-14, p<0.001), cefiderocol patients remain more days hospitalized (65 days, IQR:35-77.5 vs 33, 18-60; p<0.001).

Conclusion: Our analysis shows no statistically significant difference in the effectiveness of cefiderocol in patients with A.baumannii infections compared with BAT. Further analyses are needed in order to control for possible confounding variables and including a larger sample of patients.

70 | Evaluation of unnecessary antimicrobial use in kidney transplant patients with asymptomatic bacteriuria

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Introduction: Urinary tract infection is a common complication in kidney transplant recipients (KTR), notably within the first months after KT. KTR are often treated for asymptomatic bacteriuria based on clinical judgment and limited data showing clear clinical benefit. Treatment of asymptomatic bacteriuria in KTR could potentially increase antimicrobial resistance and unnecessary antibiotic exposure.

Research Question or Hypothesis: What is the incidence of KTR receiving antimicrobial therapy for asymptomatic bacteriuria at Einstein Medical Center Philadelphia (EMCP)?

Study Design: Retrospective chart review from January 1, 2017 to May 1, 2021. Patients were separated into two groups, those who received antimicrobial treatment versus those who received no treatment.

Methods: Inpatients with kidney transplantation at EMCP admitted with bacteriuria were included. Inpatients were excluded if they were less than 18 years of age, pregnant, within one month of transplant, within seven days of a urologic procedure, or symptomatic. Inferential statistics were used to summarize outcomes by Fisher's exact test and Student's t-test.

Results: 59 patients with 270 urine cultures were evaluated. 27 (45.8%) received antimicrobial treatment in the setting of asymptomatic bacteriuria. The total duration of antimicrobial therapy was 4.25 ± 3.44 days. Patients with polymicrobial urine cultures were more likely to have received antimicrobial therapy (61.5% vs 33.3%; p=0.0384). There were more readmissions with a resistant organism in patients that were treated with antibiotics (34.6% vs 6.1%; p=0.0077). There were no differences in readmissions for pyelonephritis (7.7% vs 9.1%; p=1.000) or cases of *C. difficile* infections (0% vs 0%).

Conclusion: This analysis showed that 45.8% of KTR were treated for asymptomatic bacteriuria at EMCP. Treatment of asymptomatic bacteriuria was associated with an increased risk of readmission with a resistant organism. Effective antibiotic stewardship practices may help reduce resistance rates while maintaining patient safety.

71 | Bacterial Uropathogens in Cancer Patients with Urinary Tract Infections in the Ambulatory Setting

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Introduction: Understanding the causative pathogens of infections is essential for appropriate therapy. Though UTIs are among the most common community infections in patients with cancer, few studies have described the causative uropathogens and the resistance patterns in this patient population.

Research Question or Hypothesis: What are the most common pathogens and their resistance in cancer patients diagnosed with UTIs in the ambulatory setting?

Study Design: A retrospective study at King Hussein Cancer Center in Jordan.

Methods: The study included adult cancer patients who were diagnosed with UTIs in the ambulatory setting between August-2020 and March-2021. A UTI was defined as a positive culture along with antibiotics initiated empirically or as definitive therapy. Fungal cultures and any cultures taken upon or during hospitalization were excluded. For patients with multiple positive cultures, only the first was included. We recorded the patients' characteristics and type of pathogens. Multi-drug-resistant (MDR) pathogens were defined as having acquired or intrinsic non-susceptibility to at least one agent in three or more antimicrobial categories.

Results: A total of 367 patients were included, among whom 40% were males, with a mean age of 60 years ±15 (SD) and the majority had solid tumors (90%). Gram-negative bacteria represented 90% of the UTIs, with the most common being Escherichia coli (65%), Klebsiella pneumonia (19%) and Pseudomonas aeruginosa (6%). Gram-positive bacteria represented 10% of the UTIs, with the most common being Enterococcus Faecalis (43%) and Coagulase-Negative Staphyloccoccus (25%). Among the reviewed cultures, 54% had an MDR pathogen, of which the majority (68%) were extended-spectrum-beta-lactamase-producing pathogens.

Conclusion: The majority of UTIs in ambulatory adult cancer patients were caused by gram-negative bacteria, with a high prevalence of MDR pathogens. Further research should focus on identifying predictors of MDR pathogens to ensure appropriate antimicrobial therapy.

72 | Comparative Analysis of Cycle Threshold Scores in SARS-CoV-2 Variants

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Introduction: This comparative analysis of SARS-CoV-2 variants aims to identify trends to inform future treatment and quarantine strategies. The goal is to provide insight to further involve pharmacists in the interpretation of cycle threshold (CT) scores for the purpose of patient education and guidance of treatment recommendations.

Research Question or Hypothesis: Patients with lower CT scores will require more drug therapy and longer quarantine.

Study Design: A single-center, retrospective, observational cohort study of patients testing positive for SARS-CoV-2 from July 2021 to January 2022

Methods: Patients testing positive with SARS-CoV-2 were analyzed by viral load (CT score), vaccination status, and variant.

Results: A total of 485 patient samples were analyzed, with 62% (N=293) of patients having received at least one COVID-19 vaccination at the time of study. Delta represented 34% (N=164), Omicron represented 49% (N=238), and the UK variant represented 1% (N=5) of positive cases, with the remaining 15% (N=76) unknown. Mean CT score of the Delta variant was lower (17) than with Omicron (20) ($p<0.0001$). Delta also had more severe cases than Omicron, as defined by a CT of less than 15 (38% vs. 21%, $p<0.001$). In those with repeat testing, patients who cleared the virus by second test had higher baseline CT scores (30) compared to those who did not clear the virus (24, $p=0.031$). Drug therapy was initiated more often with Delta variant infection than with Omicron (31% vs. 16%, $p=0.0005$).

Conclusion: Patients experienced more severe illness with the Delta strain of SARS-CoV-2 as evidenced by lower mean CT scores, higher incidence of severe CT scores, and higher percentage of patients requiring drug therapy than with other variants. Lower CT scores may require longer time to clear virus.

73 | Comparative evaluation of baricitinib and tocilizumab in patients with COVID-19

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Introduction: The Food and Drug Administration authorized baricitinib and tocilizumab for emergency use for the treatment of suspected or confirmed COVID-19 in high-risk hospitalized patients. To balance the scarcity of drug with broad emergency use authorization criteria, our facility imposed more stringent criteria. While both drugs have been shown to reduce 28-day mortality in COVID-19, it is unclear if one drug has a place in therapy different from the other.

Research Question or Hypothesis: Is there a significant difference in 28-day mortality between patients treated with baricitinib compared to tocilizumab?

Study Design: Single-center, retrospective cohort

Methods: The electronic medical record was queried for all consecutive patients who received either baricitinib or tocilizumab in a 6-month period. The primary outcome was 28-day mortality in COVID-19 patients who received either drug. Patients had to receive concomitant corticosteroids and supplemental oxygenation not more than 24 hours before therapy initiation. Secondary outcomes included in-hospital mortality, incidence of secondary bacterial infections (SBI), and other relevant comparisons. Fisher's Exact Test was used to compare categorical data; independent samples t-test and Wilcoxon Rank Sum were used to compare normally and non-normally distributed continuous data, respectively.

Results: Fifty patients were included: 8 (16%) received baricitinib and 42 (84%) received tocilizumab. Baseline characteristics were similar between groups including APACHE-II score (21.02±16.54). 28-day mortality was higher for tocilizumab (50% vs. 12.5%, $p=0.064$) but did not reach significance. In-hospital mortality was significantly higher for tocilizumab (57.1% vs. 12.5%, $p=0.049$). There was no significant difference in the incidence of SBI or vasopressor requirements between the groups.

Conclusion: Although tocilizumab resulted in significantly higher in-hospital mortality, these patients could have been unable to take oral agents, like baricitinib, and have had further progression of COVID-19. Until larger studies are conducted, the choice of one agent over another will likely be based on situation-specific factors.

74 | Effect of Prescriber Dashboards and Feedback on Antibiotic Prescribing in Multiple Speciality Clinics

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Introduction: Among the CDC's Core Elements of Outpatient Antibiotic Stewardship is tracking antibiotic prescribing and reporting back to providers. Feedback and audit systems allow for targeted identification of prescribing issues. Prior studies have been conducted mostly in primary care or pediatric clinics.

Research Question or Hypothesis: Do antibiotic prescribing dashboards and feedback decrease antibiotic prescribing rates and alter antibiotic class prescribing across multiple specialty clinics?

Study Design: Quasi-experimental study in multiple outpatient clinics and survey.

Methods: Seven clinics with high levels of antibiotic prescribing were identified for intervention. Seven low prescribing clinics and one off-site clinic were monitored for comparison. Antibiotic prescribing data

was used for the creation of quarterly dashboards and feedback reports. Baseline reports were sent in October 2020 and then each subsequent quarter. January through September 2020 was considered baseline and October 2020 to June 2021 was intervention. Quarter 1 (Q1) of 2020 and 2021 were compared to correct for seasonality and COVID19. Prescribers who received dashboards received a survey to reflect upon the intervention. Antibiotic prescriptions per 1000 visits (Rx/1000) were evaluated compared to baseline for total and antibiotic classes using chi-square goodness of fit in SPSS.

Results: Antibiotic prescribing decreased in the entire intervention group (93.76 to 73.35 Rx/1000), but this was not significant (p=.104). Control also did not change significantly from baseline (p=0.114). Similar results were seen comparing Q1-2020 and Q1-2021. No antibiotic class varied significantly in the intervention group. When considering individual clinic performance, 2 of 7 intervention clinics decreased prescribing, significantly. When comparing Q1-2020 and Q1-2021, 5 of 7 clinics decreased significantly. Based on the survey, prescribers (n=24) felt they prescribed less (67%), prescribed better durations (71%), and chose better empiric antibiotics (57%).

Conclusion: While overall prescribing did not decrease significantly, total or by class, select clinics did when accounting for seasonality. However, providers felt that they were making better prescribing decisions.

75 | The Potential for Drug-Drug Interactions with the use of Rifampin in Patients with Prosthetic Related Orthopedic Infections

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Introduction: The 2012 Infection Diseases Society of America (IDSA) guidelines for the management of prosthetic joint infections favors the use of rifampin in patients with rifampin susceptible staphylococcal prosthetic joint infections. Despite this guideline recommendation, the use of rifampin may be avoided due to drug-drug interactions.

Research Question or Hypothesis: A formal study was conducted to determine the prevalence of drug interactions, particularly therapy altering interactions, involving rifampin in patients being treated for prosthetic-related infections.

Study Design: In a retrospective study, we looked at the prevalence of potential drug interactions involving rifampin in patients diagnosed with prosthetic-related infections.

Methods: The patient population included 166 patients from a single academic medical center who had been diagnosed with a prosthetic-related infection from November 2017 to November 2021. Patients were assessed for drug-drug interactions with rifampin and current home medications as determined by the discharge medication list. Severity of drug-drug interactions was determined using Lexicomp interaction analysis. Each interaction was labeled A, B, C, D, or X, listed in order of increasing severity. Primary outcomes include the number of potential drug interactions with rifampin and number of interactions labeled as category X.

Results: A total of 899 interactions were recorded with a median of 5 interactions per patient (category B or higher). 99.4% of patients had at least one home medication with an interaction of category C or higher and 75.9% of patients had at least one interaction category D or higher. 37.4% of patients had an interaction labeled as category X, meaning the combination of medications should be avoided.

Conclusion: An overwhelming percentage of patients with prosthetic infections had home medications with therapy altering interactions with rifampin. These interactions should prompt health care providers to thoroughly assess patient's medication regimens prior to prescribing rifampin to determine the risks and benefits from such therapy.

76 | Dalbavancin utility as step-down or salvage antimicrobial therapy among people who inject drugs

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Introduction: A well-known clinical dilemma complicating the management of infections in people who inject drugs (PWID) is the restriction of outpatient parenteral antimicrobial therapy due to concerns of illicit drug use via the intravenous catheter, heightened overdose risk, and inadequate follow-up. Consequently, PWID often remain inpatient for the duration of their parenteral antimicrobial course; this is unequivocally associated with longer lengths of stay and increased rates of patient-directed discharge (PDD) compared to the general population. Dalbavancin serves two unique roles in this patient population, step-down therapy to decrease length of stay once clinically stable and salvage therapy in the setting of PDD.

Research Question or Hypothesis: Quantify on and off-label dalbavancin utility as step-down and salvage antimicrobial therapy among PWID.

Study Design: Single-center retrospective review.

Methods: Inpatients administered ≥14 days of parenteral antibiotics from November 2018 through October 2021 were screened for inclusion. Patients with clinical contraindications to dalbavancin were excluded. PWID with ≥7 days of parenteral therapy completed and ≥7 days of therapy remaining at the time of achieving 48 hours of clinical stability (non- critical unit, afebrile, resolved leukocytosis, source control or negative blood cultures) were included in either the step-down cohort (completed parenteral antimicrobial course inpatient) or salvage therapy cohort (PDD prior to completing course). Number of inpatient days prevented with dalbavancin and readmissions due to index infection were assessed in each cohort, respectively.

Results: Nineteen patients were considered dalbavancin eligible in this 3-year retrospective review. In the step-down cohort (n=11) a one-time dalbavancin dose prevented a minimum of 77 inpatient days total. Multiple doses of dalbavancin prevented a maximum of 237 inpatient days total. In the salvage cohort, 50% (n=4/8) were

readmitted due to the index infection resulting in 28 potentially avoidable inpatient days.

Conclusion: Dalbavancin may address treatment disparities experienced by PWID and reduce unnecessary inpatient days and hospital readmissions attributable to inadequate antimicrobial courses.

Managed Care

77 | Characterization of pharmacy interventions and fidelity assessment in a Comprehensive Medication Management for ambulatory care patients with chronic non-communicable diseases

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Introduction: Medication errors, adverse drug reactions and complex pharmacotherapy strategies are challenging in chronic non-communicable diseases (NCDs) patients. Our Comprehensive Medication Management (CMM) program was developed to optimize medication use in a patient-centered, team-based care setting and follow-ups to strengthen the overall use of medications. Interventions performed by clinical pharmacists within a (CMM) program may improve patients' safety and adherence.

Research Question or Hypothesis: Interventions made by a clinical pharmacist within the CMM program improve patients´ safety and adherence to pharmacotherapy.

Study Design: Retrospective, descriptive, observational study of 302 patients enrolled in the CMM program with DRPs at Clínica Biblica Hospital from 2018 to 2021.

Methods: We analyzed the pharmacotherapeutic interventions by the clinical pharmacist towards other healthcare professionals, patients support network and patients. The selected variables were the following: acceptance rate of the interventions, risk of medication, medication-related needs, potential severity, impact of the interventions. Furthermore, the adherence rate was determined by applying validated questionnaires to the patients and keeping track of medication dispatch dates. The Relative frequency (%) and 95% CI for the categorical variables were calculated.

Results: We identified 595 DRP in 302 patients. An intervention was made for each DRP, with an overall acceptance rate of 93%. 49.1% of the DRP corresponded to the use of high-risk medications (IC95%: 45.0-53.0). Regarding the medication-related needs, 10.6% (IC95%: 8.36-13.3) were related to indication, 38.7% (IC95%: 34.8-42.6) to mediation effectiveness, 29.2% (IC95%: 25.7-33.0) to medication safety and 21.5% (IC95%:18.3-24.9) to medication adherence. 37.5% of the DRPs were classified as grade 3 or higher. The mean adherence rate increased from 74% to 88%.

Conclusion: The implementation of a CMM program can increase the level of medication adherence. In addition, the interventions carried out by a pharmacist can prevent and solve PRM, including cases of clinical relevance, such as the misuse of high-risk medications or the appearance of serious adverse effects.

78 | Analysis of Opioid Prescription Practices After Intervention by a Pharmacy Benefit Manager to Prescribers of Commercial Health Plan Members

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Introduction: High-dose opioid prescriptions are associated with increased risk of opioid use disorder and overdose. Frequently, high daily doses of opioids are the result of multiple prescriptions written by different providers. With access to members' complete prescription claims histories, pharmacy benefit managers are in a unique position to be able to identify and intervene on members receiving high doses of opioids.

Research Question or Hypothesis: How do targeted mailings to providers of members with claims for ≥ 90 morphine milligram equivalents (MME) per day impact these members' future opioid prescriptions and average daily MME?

Study Design: Retrospective analysis of prescription claims data from commercial health plan members.

Methods: Members were included in the study if they had opioid claims averaging ≥ 90 MME per day from July 1, 2019, through October 31, 2019. In November 2019, letters containing information about the patient's opioid claims history and the risks associated with high doses of opioids were sent to prescribers of intervention group members. Outcomes were collected from July 1, 2020, through October 31, 2020. The primary outcome was mean decrease in daily MME; secondary outcomes included change in number of opioid prescribers.

Results: Sixty-five members qualified for the study, 33 in the intervention group and 32 in the control group. The average decrease in daily MME in the intervention group (33.3) compared to the control group (13.4) was not statistically significant (p=0.30). The average number of opioid prescribers was similar at baseline (intervention: 1.39, control: 1.63) and statistically different post-intervention (intervention: 1.18, control: 1.59; p=0.04).

Conclusion: Mailings to prescribers of members with high daily MME values were not found to be associated with a significant decrease in average daily MME but did result in a decrease in average number of opioid prescribers. Longer-term studies may be necessary to determine the full impact of mailed interventions.

Medication Safety

79 | Patient-centered decision algorithms to improve selection of over-the-counter medications

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Introduction: There are ≥300,000 over-the-counter (OTC) medications on the market making it challenging for consumers to select safe and effective products to manage their symptoms.

Research Question or Hypothesis: What are consumer's perceptions about use of an electronic decision support tool to help them make informed decisions about OTC medications?

Study Design: Structured interviews

Methods: We recruited community members who were ≥18 years via our institutional research website. Participants completed a 30-45 minute video interview in which they discussed their perceptions of using an electronic OTC decision support tool. We shared a prototype related to treating a fever in an adult patient and sought feedback related to the patient- and condition-related questions included in the algorithm (6-point Likert scale, 1=not at all important to 6=extremely important). We asked participants to rate their likelihood of using the tool to treat a new symptom (10-point Likert scale, 1=not at all to 10=extremely likely). We conducted a thematic analysis (qualitative data) and used Stata SE 16.0 to conducted a descriptive analysis (quantitative data).

Results: Among 20 participants, 11 (55%) were female, 10 (50%) were white, and the mean age was 47.9 years (range 18-81 years). The questions reported as being extremely important (score of 6) by most participants were allergies (n=17, 85%), increased risk of bleeding (n=15, 75%), temperature (n=12, 60%), and duration of symptoms (n=12, 60%). Three-fourths of participants (n=15) selected a score of 7 or higher when asked about their likelihood of using this the tool for a new symptom. Concerns that were raised included accuracy and completeness of the algorithm, data storage, and accessibility.

Conclusion: Consumers were interested in using an electronic tool to determine if their symptoms can be self-treated, and if so, which medications are appropriate. We intend to further our research by expanding the prototype to include multiple symptoms.

80 | Evaluation of the Incidence of Hypoglycemia in Non-critically Ill Adult Patients Administered Premixed Insulin 70/30 and Rapid-acting Insulin Via Sliding Scale in the Inpatient Setting

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Introduction: American Diabetes Association (ADA) recommends the utilization of a basal insulin regimen or basal-bolus insulin regimen in noncritically ill hospitalized patients. ADA does not recommend the use of premixed insulins in the inpatient setting due to increased risk of hypoglycemia. There appears to be a lack of evidence regarding the incidence of hypoglycemia in patients being administered a combination of premixed insulin and sliding scale insulin in the inpatient setting. The purpose of this study is to evaluate the incidence of hypoglycemia in non-critically ill patients administered premixed insulin 70/30 and rapid-acting insulin via sliding scale.

Research Question or Hypothesis: We hypothesize that premixed insulin will be associated with hypoglycemic events requiring hypoglycemic rescue medications.

Study Design: This is a retrospective electronic medical record review.

Methods: The incidence of hypoglycemic events was evaluated in adult patients (≥18 years old) with a prior diagnosis of Diabetes Mellitus (Type I and II) who were admitted to any Geisinger hospital between 08/01/2020 and 07/31/2021 and administered premixed insulin 70/30 plus insulin via sliding scale. Patients admitted to any intensive care unit were excluded. Descriptive statistics were used to evaluate outcomes.

Results: A total of 58 patients administered premixed insulin plus insulin sliding scale were evaluated. Of these patients, 84.5% had a history of diabetes mellitus diagnosed >1 year prior to admission, 93% of diagnoses being Type II Diabetes Mellitus. Mean A1C was 8.8%. Of the evaluated patients, 5 (8.6%) experienced a hypoglycemic event. Of these hypoglycemic events, 4 occurred after premixed insulin and rapid-acting insulin were administered within 20 minutes of each other. Hypoglycemic events were treated with glucose chewable tablets and 50% dextrose injection. Severe hypoglycemia (blood glucose <40mg/dL) did occur in 1 patient.

Conclusion: The use of premixed insulin was associated with hypoglycemic events requiring hypoglycemic recuse medications.

81 | Institutional Variation of Phenytoin Preparation, Administration, and Monitoring Practices

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Introduction: Intravenous (IV) phenytoin (PHT) is administered to patients with seizures. IV PHT carries a black box warning for cardiovascular adverse events when infused rapidly. Manufacturers of PHT IV products recommend IV infusion rates of ≤50 mg/min and continuous cardiac monitoring. Additionally, they recommend that IV PHT dilutions should be >5 mg/mL, which can be difficult for slow IV administrations.

Research Question or Hypothesis: We hypothesize that IV PHT administration, monitoring, and preparation practices vary between institutions and differ from the manufacturers' recommendations.

Study Design: A cross-sectional survey was electronically distributed in July 2020 to approximately 3800 members from five American College of Clinical Pharmacy (ACCP) and Practice Research Networks' (PRN) listservs. The survey inquired about the participants' institutional characteristics and IV PHT administration, monitoring, and preparation practices.

Methods: The data were analyzed using descriptive statistics and compared in terms of institutional size, type, and region using the chi-squared test.

Results: The survey consisted of 134 participants. Most of the survey participants [64.66% (86/133)] used IV PHT at their institution, while 34.59% (46/133) stated that they only use fosphenytoin (fosPHT). Only 51.35% (38/74) and 8.06% (5/62) of respondents reported the use of cardiac monitoring for loading and maintenance doses of IV PHT, respectively. For IV PHT doses <250 mg, 46.77% (29/62) did not adhere to the manufacturers' dilution limit, and we found a statistically significant difference in compliance of this dilution limit between larger institutions (>400 beds) and mid-size hospitals (251 to 400 beds) [57.14% (20/35) vs 15.38% (2/13); p=0.04]. Intravenous push administration was common among the participants' institutions that use IV PHT [40.32% (25/62)].

Conclusion: This survey demonstrated a variety of IV PHT administration, monitoring, and preparation practices, including non-adherence to the product labeling. Further studies are needed to determine the clinical impact of these results.

82 | Expert consensus on the nephrotoxic potential of 195 medications in the non-intensive care setting: a modified-Delphi method

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Introduction: Nephrotoxin exposure is a significant predictor of acute kidney injury (AKI) development in both the inpatient and outpatient settings with ~30% of AKI cases attributable to drugs. Unfortunately, neither a standardized list of nephrotoxic medications to surveille or their perceived nephrotoxic potential (NxP) exist for non-critically ill patients. Importantly, standardized lists should be specific to clinical settings because of varying drug use for different patient populations.

Research Question or Hypothesis: What is the clinicians' perceived NxP of drugs reported in the literature as being associated with AKI?

Study Design: Three-round, interdisciplinary, web-based modified-Delphi survey

Methods: Potentially nephrotoxic medications were identified through a comprehensive literature search. Twenty-nine participants with nephrology and pharmacist expertise were identified through the Caring for OutPatiEnts after AKI (COPE-AKI) investigator group and professional affiliations. The primary outcome was NxP consensus. Participants rated each drug on a scale of 0-3 (not nephrotoxic to definite nephrotoxicity). Group consensus was met if ≥75% of responses were one single rating or a combination of two consecutive ratings. If ≥50% responses indicated "unknown" or not used in the non-intensive care setting, the medication was removed. Medications not meeting consensus for a given round were included in the subsequent round(s).

Results: 191 medications were identified in the literature, with four medications added after the first round from participants' recommendations (n=195). NxP index rating consensus after three survey rounds for routine drug use was: 14 (7.2%) no NxP in almost all situations (rating 0); 62 (31.8%) unlikely/possibly nephrotoxic (rating 0.5); 21 (10.8%) possibly nephrotoxic (rating 1); 49 (25.1%) possibly/probably nephrotoxic (rating 1.5); 2 (1.0%) probably nephrotoxic (rating 2); 8 (4.1%) probably/definite nephrotoxic (rating 2.5); 0 (0.0%) definitely nephrotoxic (rating 3); and 39 (20.0%) medications were removed.

Conclusion: NxP index rating provides perceived clinical consensus on nephrotoxic medications in the non-intensive care setting, allowing future studies to develop and validate a nephrotoxic burden index.

Neurology

83 | Adherence to Established Blood Pressure Goals in Patients Presenting with Acute Intracerebral Hemorrhage

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Introduction: Conflicting evidence exists surrounding blood pressure (BP) control in patients with acute intracerebral hemorrhage (ICH). The ACC/ASA guideline recommends against lowering BP to < 140 mmHg within 6 hours due to the increased risk of acute kidney injury. The current practice at our health-system recommends titrating to a BP goal of < 160 mmHg, however, management may vary due to the lack of a nadir range.

Research Question or Hypothesis: The lack of guidance to a specific SBP goal range predisposes patients to hypotension leading to brain ischemia and renal adverse events (AE).

Study Design: Multicenter, single-health system, retrospective cohort study

Methods: Adult patients admitted to the neuro ICU or neuro step-down unit with acute ICH from June 2019-June 2021 were included.

The primary objective was to characterize the percent time (PT) within goal SBP (140-160 mmHg) in the first 48-hours. The lowest SBP within the hour was collected. Secondary endpoints included the PT above and below the established BP range, episodes of severe hypotension, and incidence of new brain ischemia or renal AE within 7 days.

Results: Of 723 patients screened, 83 patients were included. The majority of included patients were males (60%) aged 62 years who presented with an IPH (53%) secondary to hypertension (30%). During the initial 48-hours, the PT spent within SBP 140-160 mmHg was 34% and < 140 mmHg was 55%. Hypotension requiring treatment discontinuation or initiation of vasopressor therapy was associated with renal AE (OR, 3.74; 95% CI, 1.16-11.98; P=0.0213). Brain ischemia and renal AE were associated with a relative SBP reduction of > 20% (OR, 23.4; 95% CI, 1.99-311.89.17; P<0.01 and OR, 9.43; 95% CI, 2.69-36.93; P<0.01, respectively).

Conclusion: Most patients were maintained with a SBP of < 140 mmHg over the initial 48-hour period. Relative SBP reduction > 20% was significantly associated with both brain ischemia and renal AEs.

84 | Assessing the Value of Financial Assistance for Equitable Access to Specialty Medications in Adults with Multiple Sclerosis Using a Health System Specialty Pharmacy.

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Introduction: The high cost of Multiple Sclerosis (MS) specialty medications can limit access to therapy causing delays in treatment initiation or poor adherence which may lead to disease progression, increased risk for hospitalization, and increased healthcare costs. Integrated health system specialty pharmacies' (HSSP) have comprehensive medication management services that secure copay assistance funding through drug manufacturer copay cards, independent grant foundations, NYS EPIC, and internal social work to help alleviate the financial burden associated with these medications.

Research Question or Hypothesis: Integrated HSSPs can allow for greater access to MS medications through their role in obtaining financial assistance from various programs for patients in need.

Study Design: Single-center retrospective chart review

Methods: Prescription claim data was reviewed for 528 University of Rochester (UR) MS Center patients receiving specialty medications between July 20, 2020 and July 20, 2021. Descriptive statistics were used to assess and summarize all outcome data.

Results: More than half of UR MS Center patients (60.2%) received funding to help cover their copay(s) from at least one financial assistance program. On average, patients saved $7.98 per day after pharmacy intervention. The average copay per day post financial assistance was $3.19 (SD 10.4). The median copay per day was $0 (IQR 0). Over the 12 months observed, patients saved a total of $790,211.49. Independent grant foundations provided the most financial support to patients with a total of $350,459.14, followed by manufacturer copay assistance providing $257,559.11. The NYS EPIC program and internally funded social work program provided $92,460.71 and $89,732.53, respectively.

Conclusion: Patients using this HSSP were able to save thousands of dollars in their out-of-pocket costs by obtaining financial assistance. This study shows that an integrated HSSP is able to assist patients with obtaining financial assistance, which can improve access to these medications.

Oncology

85 | Validation of the ^{CSR}FENCE Score for Prediction of Febrile Neutropenia During Chemotherapy Cycles 2-6 in Patients with Cancer

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Introduction: The Cycle Specific Risk of FEbrile Neutropenia after ChEmotherapy (^{CSR}FENCE) score was developed to estimate the risk of febrile neutropenia (FN) during chemotherapy cycles 2-6 in patients with solid tumors and diffuse large B-cell lymphoma (DLBCL). However, the score has not been validated externally.

Research Question or Hypothesis: We hypothesized that the ^{CSR}FENCE score is a valid tool to predict the risk of FN.

Study Design: Retrospective cohort study.

Methods: We included adult patients with solid tumors and DLBCL who received chemotherapy cycles 2-6 between January and November 2019. Patients' medical records were reviewed after each cycle to identify FN events, defined as neutrophil count $<0.5x10^9$/L with fever $\geq 38.2^0$C. The ^{CSR}FENCE score was determined by adding the coefficients for risk factors, as described by the original study, and then classified as low, intermediate, high, and very high risk for developing FN. Discriminatory ability of the score was assessed by Area under the Curve (AUC) based on Receiver Operating Characteristics (ROC) curve. Performance of the score was assessed by comparison of incidence rate ratios within each ^{CSR}FENCE risk group.

Results: We included 2870 chemotherapy cycles, of which 42(1.5%) were associated with FN. Of the FN events, 3(7.1%), 14(33.3 %), 5(11.9 %), and 20(47.6%) were classified in low, intermediate, high, and very high risk groups, respectively. The AUC-ROC curve was 0.73 (95% CI 0.64– 0.81). Compared with the low risk group (n=666), the incidence rate ratio of developing FN was 1.01 (95% CI 0.15–43.37), 0.69 (95% CI 0.08–32.46) and 1.17 (95% CI 0.17–49.49) in the intermediate (n=1431), high (n=498) and very high (n=275) risk groups, respectively.

Conclusion: The ^{CSR}FENCE score demonstrated moderate discriminatory ability for predicting FN. Further validation in multicenter studies is necessary to determine its generalizability.

86 | Immune checkpoint inhibitor-induced acquired thrombotic thrombocytopenic purpura: a pharmacovigilance study

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Introduction: Immune checkpoint inhibitors (ICIs) are commonly used agents for a wide variety of cancer types and are associated with immune-related adverse events (irAEs), most commonly colitis, dermatitis, and thyroiditis. Rare autoimmune hematologic toxicities have been reported but are less well-described in the literature. Acquired thrombotic thrombocytopenic purpura (TTP) is a life-threatening autoimmune hematologic condition that has been reported with ICIs but has been limited to case reports.

Research Question or Hypothesis: Is there a positive association between ICI use and occurrence of TTP?

Study Design: Retrospective study utilizing the FDA Adverse Event Reporting System (FAERS) pharmacovigilance database

Methods: We queried the FAERS for cases of TTP reported with ICI exposure from initial FDA approval for each agent to December 31, 2021. The drugs evaluated included atezolizumab, avelumab, cemiplimab, durvalumab, nivolumab, and pembrolizumab. The primary endpoint, reporting odds ratio (ROR) for ICI-related TTP, was evaluated using a disproportionality signal analysis. ROR is a validated reporting method in pharmacovigilance that measures the magnitude of reporting between cases and non-cases in pharmacovigilance databases. Only ICIs with >5 reports were included to minimize false positives.

Results: There were 35 reports of TTP with ICIs: atezolizumab (n=7), durvalumab (n=2), nivolumab (n=18), and pembrolizumab (n=8). The most commonly reported malignancies in which ICI was used and a case of TTP was reported included non-small-cell lung cancer (n=8, 23%) and renal cell carcinoma (n=5, 14%). The ROR was statistically significantly increased for atezolizumab (ROR 6.22, 95% CI 2.96-13.09), nivolumab (ROR 3.16, 95% CI 1.99-5.03), and pembrolizumab (ROR 2.56, 95% CI 1.28-5.12). Ten cases (29%) were considered life-threatening and 8 cases (23%) were reported to have resulted in patient death.

Conclusion: There is a significant reporting signal of TTP with several ICIs in the FAERS database. Clinicians should be aware of this potentially serious adverse event.

87 | Real-world utilization of rituximab and rituximab biosimilars for oncology versus non-oncology indications

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Introduction: Limited data exist on adoption of rituximab biosimilars versus the originator product by indication. Available data from real-world studies comparing rituximab biosimilar use to the originator predominantly focused on oncology indications. This is the first study to assess utilization of all three US rituximab biosimilars and their originator.

Research Question or Hypothesis: Is there a difference in utilization of rituximab biosimilar versus originator products for oncology versus non-oncology indications?

Study Design: Comparative analysis.

Methods: De-identified real-world data of rituximab, rituximab-abbs, rituximab-pvvr, and rituximab-arrx dispensations between December 31, 2018 and February 1, 2022, were extracted using Comparative Rapid Cycle Analytics P&T™ (Agilum Healthcare Intelligence, Inc., a Craneware company). The primary outcome was rituximab originator versus biosimilar utilization for oncology versus non-oncology indications. Results were stratified by on-label and off-label use, and treatment setting. ANOVA and chi-square tests were used to identify factors significantly associated with rituximab originator and biosimilar usage.

Results: 28,025 encounters were captured for rituximab and its biosimilars across 193 facilities (rituximab, n=23,395; biosimilars, n=4,630 [rituximab-abbs, n=2,550, rituximab-pvvr, n=2,081, rituximab-arrx, n=0]). Rituximab had higher dispensations for oncology (78.4%) and non-oncology indications (88.3%), than its biosimilars (oncology=21.6%, non-oncology=11.7%, p<0.01). Oncology and non-oncology use of rituximab and biosimilars was higher in urban and outpatient settings than in rural and inpatient settings (p<0.01 for both). Most oncology dispensations were on-label (94.5%), while non-oncology dispensations were off-label (73.6%, p<0.01). Higher proportion of biosimilar use was attributed to on-label indications (67.7%, off-label=32.2%) compared to originator rituximab (on-label=58%, off-label=42%, p<0.01). Non-academic settings showed higher biosimilar adoption than academic settings (70.3% vs. 48.8%, p<0.01). Three-year annual trends from 2019-2021 revealed decreased originator rituximab utilization (99.99% to 40.1%) and increased biosimilar use (0.01% to 59.9%).

Conclusion: Real-world evidence suggests an increase in rituximab biosimilar adoption over time although there is lower adoption for non-oncology indications.

88 | Letermovir Prescribing at a London Hospital

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Introduction: Letermovir is licensed as prophylaxis of cytomegalovirus (CMV) reactivation in adult CMV-seropositive recipients of an allogeneic hematopoietic stem cell transplant (HSCT). Initiation must be between day 0 and day 28 (D0-28) and stopped at D100 unless there is a clinically indicated and documented reason. There is no clear guidance on what population should receive extended prophylaxis, although studies indicate patients with graft versus host disease (GVHD) on high dose immunosuppression would qualify.

Research Question or Hypothesis: This drug utilization audit is to determine if letermovir is being used in line with local guidance, more specifically on course duration.

Study Design: This study was a retrospective analysis at a large oncology specialist center.

Methods: Patients were identified by running a letermovir dispensing report from July 2019-March 2022. Patient history was obtained from electronic health records (EHR). Patients who had completed their letermovir course were selected to be included in this subset of patients. Patient records were used to determine course duration and indication.

Results: Data was collected on 42 transplants (39 patients). In 20 (48%) transplants, the letermovir course extended beyond D100. For those extending beyond D100, 10 (50%) had GVHD documented as the reason and 10 (50%) had failed to document the reason for the extended course.

Conclusion: Forty-eight percent of patients received an extended course of letermovir, with half of those not having a documented reason for the extension. Building stop dates into the EHR, incorporating letermovir use monitoring into the pharmacy oral chemotherapy clinic workflow, and/or requiring post-transplant letermovir prescriptions to be written for only the amount to reach D100, are possible interventions to increase documentation of extended prophylaxis and prevent extension, if not required.

Other

89 | The Impact of Implementing a National Clinical Review Process for Non-formulary Medication Requests in Saudi Arabia

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Introduction: Since medications often constitute a large percentage of healthcare budgets, ensuring rational medication use is essential. For publicly funded healthcare programs, modern government formularies represent an effective tool to this end. Therefore, in December 2017, the Saudi Ministry of Health (MOH) introduced a national clinical review process for the non-formulary medication (NFM) requested within the MOH institutions to standardize the reviewing process by the governance of the Pharmacy and Therapeutics Committee.

Research Question or Hypothesis: Describe the effectiveness of implementing a national clinical review process for NFM on the approval rate, decision turnaround time, and potential cost savings.

Study Design: Retrospective, cross-sectional and observational study.

Methods: This study was undertaken over 36 months. All NFM requests were received through an electronic system, linking all the ministry's regions and departments with a single coding system. Quantitative descriptive statistics: frequency, percentage, median, and interquartile range were used to present the result of this study. In addition, Microsoft Office Excel 2016 software was used to analyze the data.

Results: The approval rate among the total of 2388 NFM requests analyzed was 1,733 (74%). The median submission and decision turnaround times were 7 (IQR: 4-17) and 6 (IQR: 4-9) working days, respectively. Further, the median decision turnaround time of 5 (IQR: 4-9) for approved responses was shorter than the median for disapproved requests which was 7 (IQR: 4-10) working days. Of the 615 disapproved requests, 514 (83.6%) were disapproved for a single reason. Moreover, disapproval of those 615 requests equated to potential cost savings that exceeded 14.8 million United States Dollars.

Conclusion: This study showed that well-managed formularies could combine effectiveness, best practices, and evolving medical knowledge in a way that benefits the patient, the health care provider, and society. The cost savings were noticeable, and turnaround times showed encouraging achievement compared to the previous system, but there is scope for further improvement.

Pain Management/Analgesia

90 | Ketorolac Use in Cardiovascular Surgery

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Introduction: The purpose of this study is to compare opioid utilization among patients who did and did not receive ketorolac for postoperative pain management in non-emergency cardiovascular surgery.

Research Question or Hypothesis: Non-emergency cardiovascular surgery patients receiving ketorolac will experience reduced opioid utilization postoperatively compared to patients not receiving ketorolac.

Study Design: This single-center, retrospective, IRB approved cohort study included adults who underwent non-emergent cardiovascular surgery and received the cardiovascular surgery ERAS protocol at Indiana University Methodist Hospital between January 1, 2020 and September 15, 2020.

Methods: The primary outcome is opioid utilization in morphine milligram equivalents for 72 hours postoperatively. Secondary outcomes included gastrointestinal bleed, acute kidney injury, hospital length of stay, and clinically significant bleeding. Age, sex, weight, serum creatinine, hemoglobin, platelet count, surgery type, comorbidities, morphine milligram equivalents, and ketorolac dosing was collected. Patients 18 years and older who underwent non-emergent cardiovascular surgery requiring sternotomy, received the ERAS protocol, and had a serum creatinine within 48 hours of admission were included. Patients who were pregnant, incarcerated, or underwent emergency surgery were excluded.

Results: Morphine milligram equivalents were greater in patients that received ketorolac compared to those that did not receive ketorolac (72.0 versus 47.0; $p = 0.179$). Prescription and illicit opioid use were more common in the ketorolac group (41.5% vs. 10.6%; $p<0.001$). There was no statistically significant difference in secondary outcomes.

Conclusion: Ketorolac did not reduce morphine milligram equivalents within 72 hours of non-emergent cardiovascular surgery.

Pediatrics

91 | Vancomycin in a neonatal intensive care unit: a retrospective drug utilization evaluation

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Introduction: Although the utilization of vancomycin has become a standard in antimicrobial therapies, guidelines lack a universally recognized dosing standard in the neonatal population. This lack of standardization can lead to extended duration of therapy, inconsistencies in de-escalation, suboptimal dosing, and adverse events.

Research Question or Hypothesis: Is the current institutional vancomycin protocol and usage in the NICU at MetroHealth Medical Center (MHMC) providing therapeutically optimal care while mitigating collateral consequences?

Study Design: A retrospective electronic health records review of neonates admitted to MHMC in the NICU who received vancomycin between January 2020 and May 2021 was conducted. The primary endpoints included proportion of therapeutic initial troughs, time to trough, and number of troughs drawn during the course. The secondary endpoints included appropriateness of therapy, incidence of acute kidney injury, and combination with nephrotoxic agents. All data was evaluated and reported in terms of courses of therapy.

Methods: A descriptive analysis of the data was done to evaluate both primary and secondary endpoints.

Results: Sixty-two courses from forty-eight neonates were included; 33 (53.2%) were male, with an average day of life at vancomycin initiation of 17.9 days, ranging from 1 to 59 days of life. Based on the current protocol, 56 (90.3%) courses were dosed appropriately. Of initial vancomycin serum levels, 20 (32.2%) courses were therapeutic, 38 (61.3%) subtherapeutic, and four (6.4%) supratherapeutic. All initial suboptimal troughs received a therapy adjustment. On average, a therapeutic trough was achieved in four doses with 42 (67.7%) courses achieving at least one therapeutic trough during the duration. Acute kidney injury (AKI) occurred in 10 (16.1%) patients and. nephrotoxic agents were prescribed 90% of the time in AKI patients.

Conclusion: Vancomycin dosing in the NICU using MHMC's protocol is most commonly leading to subtherapeutic troughs. Based on the results, our institution has changed our current protocol to incorporate updated dosing schedules and trough monitoring.

92 | Use of dornase alfa in pediatric patients without cystic fibrosis

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Introduction: In December 2020, our institution implemented restrictions on use of dornase alfa in patients without cystic fibrosis. Patients with thick secretions, bronchiolitis, or pneumonia may trial dornase alfa after nebulized acetylcysteine and/or hypertonic saline. The purpose of this study was to evaluate change in dornase alfa use after implementing order restrictions and assess clinical outcomes.

Research Question or Hypothesis: Institutional dornase alfa use would decline after order restriction implementation

Study Design: Qualitative, descriptive retrospective chart review

Methods: Patients included in this investigational review board approved study were less than 18 years of age without a history of cystic fibrosis who received dornase alfa from 12/1/2019-12/31/2021. Descriptive statistics were used to summarize results and t-tests and ANOVA tests were used to analyze continuous variables. Significance was set at alpha less than 0.05. The primary endpoint was adherence to order restrictions. Secondary endpoints included respiratory function changes after dornase alfa therapy.

Results: Seventy-seven patients received 101 orders of dornase alfa. There were 56 orders in the year prior to restrictions and 45 after, of which 16 (36%) met ordering criteria. There was no change in median doses received (6 vs 5, p=0.49) or median duration of use (p=0.59). The mean oxygenation index before and after restrictions was 18.93 and 16.15 (p=0.252) and mean FiO2% was 58.0 and 51.9 (p=0.113), respectively. De-escalation of respiratory support occurred in three

patients in the pre-restrictions group and one in the post-restrictions group. Of 85 orders with chest imaging, 17 (20%) showed improvement one week after dornase alfa, 49 (58%) showed no change and 19 (22%) showed worsening.

Conclusion: After implementation of restrictions on dornase alfa, the number of orders decreased but many did not adhere to ordering restrictions. Dornase alpha use did not significantly impact respiratory function in pediatric patients without cystic fibrosis.

Peri-Operative Care

93 | Octreotide Dosing in the Medical Management of Chyle Leak Following Otolaryngologic, Thoracic, and Trauma Surgery: A 9-Year Evaluation

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Introduction: Chyle leak is a rare complication following otolaryngologic, thoracic, and trauma surgery wherein the thoracic duct is transected. Case reports describe octreotide for the medical management of chyle leak, but limited data exist to determine the ideal dose.

Research Question or Hypothesis: Octreotide dose will be lower in patients who fail medical management of chyle leak.

Study Design: This retrospective, single center, cohort study evaluated adult patients admitted to the otolaryngology, cardiothoracic, and trauma surgery teams over a 9-year period.

Methods: Patients diagnosed with a chyle leak who received octreotide were eligible for inclusion. Groups were defined as successful medical management or failure requiring definitive surgery. The primary endpoint was daily octreotide dose between groups. Categorical data was analyzed using Chi-square of Fisher's exact test. Continuous data was analyzed using Student's t-test or Wilcoxon Rank Sum. A multivariate logistic regression was performed to determine independent risk factors for conservative management failure. Octreotide dose was identified *a priori* and variables with a p-value <0.2 on univariate analysis were considered for inclusion in the model.

Results: Forty-seven patients with chyle leak were included. Thirty-two (68.1%) patients had successful medical management while 15 (31.9%) patients failed and required surgical intervention. There was no difference in median daily octreotide dose (250 [IQR, 170-288] mcg vs. 253 [IQR, 200-282] mcg, p=0.9). Octreotide weight-based dose, treatment duration, and route of administration were similar between groups. Daily drain output and complete bowel rest were significantly higher in the failure group. Daily drain output was identified as an independent risk factor for failure.

Conclusion: Octreotide dose was similar in patients with and without successful medical management of chyle leak. Future studies are needed to determine optimal octreotide dosing and elucidate the relationship between octreotide, drain output, and surgical intervention need.

Pharmacoeconomics/Outcomes

94 | Cost Effectiveness Study of Hyperkalemia Management in Heart Failure Patients

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Introduction: Patiromer (PAT) is a sodium-free, non-absorbed potassium (K^+) binder approved for the treatment of hyperkalemia (HK). The impact of PAT on healthcare resource utilization (HRU) and inpatient healthcare costs among heart failure (HF) patients is unknown.

Research Question or Hypothesis: Does PAT affect HRU and inpatient costs vs. no K^+ binder (NoKb) among HF patients with HK with Medicare Advantage insurance.

Study Design: Cohort study with propensity score and coarsened matching (1:1).

Methods: Two HK cohorts, PAT and NoKb, were identified using the Optum De-identified Clinformatics® Data Mart Database (1/1/2016–12/31/2019). Inclusion criteria included pre-index serum-K^+≥5.0mEq/L and HK (ICD-9/10 code); ≥6-months insurance enrollment and HF (ICD-9/10 code). Follow-up was from index date to first censoring event (insurance disenrollment, death, study end, sodium polystyrene sulfonate/sodium zirconium cyclosilicate initiation, PAT discontinuation [PAT only], PAT initiation [NoKb only]). Outcomes were analyzed at 6 months post-index. HRU outcomes included: inpatient admission or emergency department (ED) visit, mean length of stay (LOS), and inpatient costs overall and ≥$14,900 (Medicare Advantage patients' benchmark).

Results: There were 860 patients (430 matched pairs) in the PAT and NoKb cohorts: median age 75 vs. 76 years; female 46% vs. 43%, low-income subsidy 43% vs. 40%, chronic kidney disease 96% vs. 96%, diabetes 78% vs. 74%, respectively. Analysis of 61 matched pairs at

6-months follow-up reported PAT (vs. NoKb) was associated with a 68% reduction (P=0.002) in relative odds of inpatient admission or ED visit and a 60% relative reduction (P=0.02) in mean LOS. PAT was also associated with 65% lower relative inpatient spending rate (P=0.009) and an 83% reduced likelihood of inpatient costs ≥$14,900 ($P$=0.009).

Conclusion: Medicare Advantage patients treated with patiromer reported significantly lower inpatient admissions, ED visits, LOS and inpatient spending rate compared to NoKB. Given the small sample, further research is warranted to confirm these findings.

95 | Multi-Center Analysis of Safety and Feasibility of Administration Intravenous Levetiracetam and Lacosamide via Rapid Undiluted Infusion.

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Introduction: Levetiracetam and lacosamide are commonly used antiseizure medications that are recommended by manufacture to be administered over 30-60 minutes infusions. Literature supports the infusion of these medications as rapid IV push (IVP) leading to the timely administration and easy access.

Research Question or Hypothesis: Is administration of levetiracetam or lacosamide via rapid undiluted IVP safety and cost effective.

Study Design: This retrospective multicenter analysis was conducted in two community hospitals and evaluated patients who received IV lacosamide or levetiracetam via IVP.

Methods: The primary outcome was safety of IVP administration. A cost analysis was also performed to evaluate the annual cost saving opportunity associated with adoption of a new protocol.

Results: A total of 120 patients (58 in levetiracetam and 62 lacosamide group) were included in the study. 91.4% of all lacosamide doses were 100-200 mg. While 74.9% of subjects in levetiracetam group received 500-mg dose and 24.4% of patients were administered 1000 mg of levetiracetam. The incidence of adverse reactions (ADR) per patient was 10.3% and 6.5% in levetiracetam and lacosamide groups, respectively. Six patients experienced ADRs related to levetiracetam IVP administration with two incidences of hypotension and four cases of bradycardia. Four patients experienced ADRs related to lacosamide IVP administration with three incidences of hypotension and one cases of bradycardia. The cost savings analysis showed a potential annual cost saving opportunity of $219,202.60.

Conclusion: IVP administration of levetiracetam and lacosamide is safe and results in significant cost saving opportunities.

Pharmacoepidemiology

97 | Impact of COVID on Antibiotic Prescribing Patterns in a Medicaid Population

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Introduction: In 2020, the COVID pandemic altered care patterns throughout health care. Routine office and ER visits declined and antibiotic prescribing changed as a consequence.

Research Question or Hypothesis: How did the COVID pandemic affect outpatient antibiotic prescribing in an Arkansas Medicaid population?

Study Design: Descriptive statistics were used to determine the impact of the COVID pandemic on outpatient antibiotic prescribing in Arkansas Medicaid patients.

Methods: Antibiotic pharmacy claims were extracted from the Arkansas Medicaid prescription claims database for calendar years 2018 through 2021. The monthly total number of antibiotic claims from January 2018 through December 2021 were calculated. Monthly data from 2018 and 2019 were averaged to create a baseline. The average percent change in the number of outpatient antibiotic claims from February 2018-2019 to April 2018-2019 was compared to the percent change from February 2020 to April 2020. Additional percent change was calculated as the difference between the 2018-2019 average percent change and the 2020 observed percent change among all ages and prespecified age-groups.

Results: The seasonal (February-April) drop in antibiotic prescriptions pre-pandemic was -18%, from 52,000 to 42,750 per month. In February-April 2020, claims fell an *additional* 42% (-60% in 2020, from 49,020 to 19,640). Age-related decreases showed claims for patients <5 years dropped an *additional* 54% from baseline; 5-17 years, 48%; and ≥18 years, 20%. Antibiotic prescriptions in April 2021 (~34,000) rebounded to approach the pre-pandemic baseline of 42,750.

Conclusion: Outpatient antibiotics prescription claims declined sharply from baseline, especially in children, in 2020 during the COVID pandemic. Potential reasons may be attributed to clinic avoidance, more viral than bacterial illnesses, or less illness due to masking and distancing; however, the degree attributed to each has not been determined. A return to baseline was observed in 2021. Continued efforts in antibiotic stewardship are warranted.

Pharmacokinetics/Pharmacodynamics/Drug Metabolism/Drug Delivery

98 | A Pharmacokinetic Modeling Approach to Evaluate the Current Dosing Recommendations for Molnupiravir, a Novel Oral SARS-CoV-2 Antiviral, in the Egyptian Population

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Introduction: Molnupiravir, a prodrug of the antiviral N-hydroxycytidine (NHC), is one of the limited treatment options that has recently gained emergency use authorization for treating mild-to-moderate SARS-CoV-2 cases. While NHC is shown to follow linear pharmacokinetics with similar exposures in healthy and SARS-CoV-2 subjects, its pharmacokinetics has not been characterized in the Egyptian population.

Research Question or Hypothesis: We aimed to develop a population pharmacokinetic model for NHC and evaluate through simulations the current molnupiravir dosage of 800 mg twice daily for five days in the Egyptian population.

Study Design: An open label, single arm pharmacokinetic study.

Methods: Twelve healthy volunteers received 800 mg molnupiravir oral dose. Model development using non-linear mixed effect modeling and internal validation using bootstrapping and visual predictive check were conducted in MonolixSuite. Simulation-based maximum concentration (C_{max}) "the safety metric" and area under the curve ($AUC_{0\text{-}12h}$) "the efficacy metric" were computed for 1000 virtual subjects. Geometric mean ratios (GMR) and 90% confidence intervals (CI) compared to previously reported values were calculated.

Results: A total of 132 NHC plasma concentrations were analyzed. Six transit compartments for absorption and one-compartment with weight on apparent clearance (CL/F) and volume of distribution (V_d/F) for disposition best described NHC's pharmacokinetics. The pharmackokinetic parameters were estimated with good precision and the population estimates for mean transit time, first-order absorption rate constant, CL/F and V_d/F were 0.49 hours, 2.32 $hour^{-1}$, 75.12 L/hour·70 kg and 118 L/70 kg, respectively. Geometric means of simulation-based C_{max} and $AUC_{0\text{-}12}$ were 3827 ng/mL (GMR = 1.05; 90% CI= 0.96-1.15) and 9320 ng.hr/mL (GMR = 1.04; 90% CI= 0.97-1.11), respectively.

Conclusion: Population pharmacokinetic model was developed for NHC. Simulations showed that current molnupiravir dosage can achieve the therapeutic targets and dose adjustment may not be required for the Egyptian population. The developed model could be used in the future to refine molnupiravir's dosage once further therapeutic targets are identified.

99 | Busulfan population pharmacokinetics improves exposure prediction in adult allogeneic hematopoietic cell transplant

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Introduction: Busulfan is an alkylating chemotherapeutic administered to patients as part of conditioning regimens prior to allogeneic hematopoietic cell transplant (allo-HCT). A test-dose strategy has been shown to reduce interindividual PK variability and improve clinical outcomes. However, significant variability in busulfan exposure (i.e., area under the concentration-time curve [AUC]) is observed in clinical practice.

Research Question or Hypothesis: How can a population pharmacokinetic (popPK) model improve busulfan AUC predictions compared to standard PK calculations used clinically?

Study Design: Single-institution retrospective clinical pharmacology study

Methods: The study included adults that received intravenous myeloablative busulfan conditioning prior to allo-HCT between 05/2011-08/2021 at UNC Medical Center. Patient clinical and demographic characteristics were extracted from the institutional electronic medical record, while PK data were collected from busulfan drug monitoring records. A popPK model was developed to identify sources of interindividual PK variability using nonlinear mixed effects modeling. Evaluation of final popPK model performance included comparisons of the popPK model and noncompartmental analyses (NCA) AUC predictions with observed AUCs after myeloablative dosing.

Results: Among the 175 allo-HCT recipients included in the study, the median age was 51 years, and the majority were diagnosed with leukemia (n=133, 76%). 2,701 PK samples were used for model development. Both test and myeloablative dose PK data were available for 128 patients. A one-compartment model, with a Poisson residual error structure, and covariate effects of weight on volume and clearance best described the data. Estimates for volume and clearance for an 83 kg individual were 42.1 L and 11.8 L/hr, respectively. Using test-dose PK data, the popPK model estimated 81 of 128 (63%) myeloablative dose AUCs within ±10% relative error, compared with 57 (44%) of patients within this range using NCA.

Conclusion: These data suggest use of a popPK model could improve busulfan AUC predictions compared to NCA.

Psychiatry

100 | The Video Gamer 500: Prevalence of Performance-Enhancing Drug Use and Internet Gaming Disorder among Adult Video Gamers

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Introduction: Performance-enhancing drug (PED) use has been reported among various populations. Although there are anecdotal reports of prescription stimulant use among video gamers, little is known regarding overall PED use in this population.
Research Question or Hypothesis: The objectives of this study were to determine the prevalence of PED use and Internet Gaming Disorder (IGD) among adult gamers as well as determine if predictive factors may place an individual at higher risk for IGD.
Study Design: Internet-based survey
Methods: Between May and June 2019, adult gamers were recruited from 16 video game-based Internet discussion boards or social forums to the complete The Video Gamer 500. The 14-item survey assessed demographics, video gaming behaviors/patterns, PED use, and IGD. The validated Internet Gaming Disorder Scale-Short Form (IGDS9-SF) questionnaire was used to screen for IGD.
Results: A total of 526 respondents (84.2% male) completed the survey with a mean age of 23.9 years and 17.8 years of gaming experience. Roughly two out of five gamers (42.6%) used a PED, averaging 1.2 PEDs in their routine. The most commonly reported PEDs were caffeine drinks (33.8%) and energy drinks (19.2%). Prescription drugs (e.g. a prescription stimulant, modafinil/armodafinil, atomoxetine, a beta blocker, or an acetylcholinesterase inhibitor) were used by 6.1% of video gamers to enhance performance; 4.9% used a prescription stimulant. IGD criteria was met by 2.3% of video gamers with significant predictive factors including a diagnosis of attention-deficit/hyperactivity disorder (ADHD) (OR 3.6, 95% CI 1.0-12.5) and using a prescription PED (OR 5.5, 95% CI 1.3-23.1).
Conclusion: PEDs are commonly used by video gamers. Predictors of meeting criteria for IGD include having an ADHD diagnosis and using a prescription PED. This information may aid clinicians and researchers to identify at-risk patients and develop appropriate intervention strategies among video gamers.

101 | Prevalence and Predictors of Antidepressant Use in Patients with Depression and Comorbid Chronic Heart Conditions- a cross-sectional study

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Introduction: Patients diagnosed with chronic heart conditions have an increased risk for depression. These patients are often instructed to follow stringent lifestyle restrictions, often experience increased health system utilization, and have decreased quality of life. Patients with uncontrolled depression may be at higher risk for exacerbation of their chronic heart conditions, leading to increased hospitalization, readmission, and mortality, though studies have shown that treating depression improves outcomes in these patients.
Research Question or Hypothesis: What is the percentage of patients with chronic heart conditions and concomitant depression being treated with antidepressants?
Study Design: National cross-sectional analysis of the National Ambulatory Medical Care Survey from 2013-2016, 2018.
Methods: All office visits for patients aged >18 with depression and either congestive heart failure OR coronary artery disease were included in the analysis. Office visits involving patients with history of stroke, congenital heart disease, autism, Alzheimer's, bipolar disorder, schizoaffective disorder, or pregnancy were excluded. The primary endpoint was the percentage of patients with heart disease and depression being treated with antidepressant medications. To identify predictors of use, a multivariate logistic regression model was created to identify variables significantly associated with antidepressant treatment in this subset of patients.
Results: In total, 884 unweighted visits were eligible for inclusion, representing more than 30 million weighted visits. Antidepressants were prescribed in 37.3% of patients with heart disease and depression (95% CI 34.3-42.7%). Significant predictors of antidepressant treatment included patients with an anxiety diagnosis and those with 4 or more chronic conditions.
Conclusion: A significant proportion of the chronic heart condition population with diagnosed depression remains untreated, despite the risks to patient outcomes. This represents an opportunity for comprehensive medication management and improvement of prescribing patterns to optimize depression treatment in patients with chronic heart disease.

102 | Risk for Suicidal Ideation with Atomoxetine And Bupropion In Attention-Deficit/Hyperactivity Disorder: A Cohort Study

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Introduction: Atomoxetine and bupropion are used for attention-deficit/ hyperactivity disorder (ADHD) and both carry a black box warning for suicidal ideation (SI). Little is known about the effect this combination has on SI in patients with ADHD.
Research Question or Hypothesis: What is the incidence of SI in patients with ADHD? Does the combination of atomoxetine and bupropion increase risk for SI compared to atomoxetine in patients with ADHD?
Study Design: Retrospective cohort study and time-to-event analysis
Methods: A retrospective cohort study was conducted using the TriNetX electronic health records network. The primary cohort included patients (6-24 years old) with ADHD from Jan. 1, 2016-Dec. 31, 2020. Additional cohorts were created from the primary cohort,

varying based on treatment exposure. For the primary analysis, patients with ADHD prescribed atomoxetine and bupropion (Cohort ATX+BUP) were compared to a matched control prescribed atomoxetine (Cohort ATX). The index event was the first instance in which both diagnosis and medication criteria were met.

Data Analysis: The incidence of SI was calculated for all cohorts. Cohorts ATX+BUP and ATX were balanced using a matched 1:1 propensity score algorithm. Covariates included: age, sex, race, medications (CN600, CN700), and ICD-10 codes (R45.85, Z81; Z91; T50.902; S00-T88; F30-F39; F10-F19). The incidence of SI was estimated and compared via Kaplan-Meier analysis and log-rank test, respectively. Hazard ratios and 95% confidence intervals were calculated via proportional hazard model.

Results: The incidence of SI varied, with the lowest rate in the pharmacotherapy-excluded cohort (0.0182 cases/person-year; n=206,320) and highest in the atomoxetine and bupropion cohort (0.0876 cases/person-year; n=1,740). At 60 months, SI occurred in 334/1,739 of the post-match Cohort ATX+BUP and 289/1,739 of the post-match Cohort ATX, HR 1.196 (95%CI 1.022,1.4, p=0.0257).

Conclusion: The incidence of SI was high in patients with ADHD and was highest among those receiving atomoxetine and bupropion. The addition of bupropion to atomoxetine increased risk for SI.

103 | Effect of Pharmacogenomic Testing on Clinical Outcomes of Patients with Major Depressive Disorder

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Introduction: The aim of this study was to evaluate patients with major depressive disorder (MDD) who had pharmacogenomic (PGx) testing completed and determine if testing led to medication changes and improved outcomes. At our institution, a large tertiary teaching hospital, pharmacogenomic testing is not routinely utilized but is available for providers to use at their discretion for patients poorly responsive to or intolerant of antidepressants. This study was developed to investigate the impact and future usability of PGx testing for MDD patients.

Research Question or Hypothesis: Determine if medication changes because of PGx testing led to a significant reduction in Patient Health Questionnaire-9 (PHQ-9) scores among MDD patients from baseline to endpoint.

Study Design: Retrospective review of patients with major depressive disorder who received pharmacogenomic testing between 1/1/2018 – 12/31/2020.

Methods: The study included 60 patients, 30 patients with PGx testing matched to a control group of 30 patients. The primary outcome variable, change in PHQ-9 scores, was compared using Student's t test. Cohen's D effect size estimate was used to determine difference in change from baseline between study groups. Time to medication change was determined for the PGx group and summarized via Kaplan-Meier curve. All statistical testing was two-sided with P<0.05 considered significant.

Results: Mean participant age was 50 years old with 66% female in both groups. A significant difference was found in the number of failed medications between study groups (3.1 in control group vs 5.4 in PGx, P =0.002). Mean follow-up PHQ-9 score was 12.1 in the PGx group vs 9.5 in the control group (P = 0.025). The control group had a significant decrease vs PGx group in follow-up PHQ-9 scores (-5.4 (6.21) vs -2.4 (7.89), D=0.429).

Conclusion: This study indicates that there is not a significant difference in depression outcomes with pharmacogenomic testing. Results can be used to initiate PGx testing earlier in MDD treatment.

Substance Abuse/Toxicology

104 | Comparison of outcomes between F(ab')2 and FabAV antivenoms in rattlesnake

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Introduction: Prompt and adequate treatment with antivenom is essential to ensure symptom resolution and prevent rebound systemic side effects associated with rattlesnake bites. FabAV was the only antivenom available for rattlesnake bites until 2019 when a new antivenom with significantly longer half-life, $F(ab')_2$, was made available.

Research Question or Hypothesis: Does the newer $F(ab')_2$ result in better clinical outcomes and more cost savings for rattlesnake bites treatment compared to historically used FabAV?

Study Design: This was a retrospective observational study conducted over a 36-month period on patients treated with antivenom (FabAV in 2018 and 2019 vs $F(ab')_2$ in 2020) for rattlesnake bites.

Methods: In 2020, $F(ab')_2$ was added to formulary for treatment of rattlesnake bites at this institution. Dosing needed to achieve initial control and repeat antivenom doses needed for symptom management was assessed. To compare efficacy between the two available antivenoms, total doses required per patient, average hospital length of stay and hospital readmission for each snakebite season was assessed between 2020 and the two previous years.

Results: A total of 32 rattlesnake bite patients were included in this review over a 3-year period. Conversion to $F(ab')_2$ for rattlesnake bite management was associated with decrease in hospital length of stay (2 vs 3 vs 3), ICU (0 vs 1 vs 1) and hospital readmission (0 vs 3 vs 1) in 2020 compared to 2019 and 2018 respectively. Total number of antivenom doses was also lower with $F(ab')_2$ compared to FabAV resulting an estimated annual cost savings of $27,610 per rattlesnake bite patient and an estimated annual cost savings of $250,000 based on our institutions snakebite census.

Conclusion: $F(ab')_2$ for rattlesnake bites is a safe and efficacious FDA approved alternative to FabAV that will provide a simpler dosing regimen and significant cost savings.

105 | Legislative Impact on the Use of Naloxone in the Medi-Cal Population

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Introduction: Despite a reduction in opioid prescribing, drug-related mortality continues to rise. California has passed legislation to expand access to naloxone, including a bill allowing pharmacists to furnish naloxone and a bill requiring providers to offer a prescription for naloxone under certain conditions.

Research Question or Hypothesis: Did California legislation impact paid claims for naloxone among Medi-Cal (California's Medicaid program) beneficiaries?

Study Design: Retrospective administrative claims analyses

Methods: All Medi-Cal paid pharmacy claims for naloxone were evaluated with a date of service between January 1, 2015, and September 30, 2021. Prescriber NPI was reviewed to determine if naloxone was pharmacist-furnished. The primary and secondary outcomes were the change in total paid claims for naloxone and the change in paid claims for pharmacist-furnished naloxone, respectively.

Results: Between January 1, 2015, and September 30, 2021, a total of 171,199 Medi-Cal beneficiaries had 235,790 paid claims for naloxone, with 32% (n = 75,567) occurring during the first nine months of 2021. The number of counties in California with a paid claim for naloxone in the Medi-Cal program increased from only 29 in 2015 to almost all counties (56 out of 58) by 2019. Between the 4th quarter of 2018 and the 1st quarter of 2019, total paid claims for naloxone increased by 250% and pharmacist-furnished naloxone increased by 150%. The highest percentage of pharmacist-furnished naloxone (22.8%) was observed during the 2nd quarter of 2020 early in the COVID-19 pandemic after the Stay-at-home Order was issued.

Conclusion: These findings suggest both allowing pharmacists to furnish naloxone and mandating that prescribers offer naloxone under certain conditions increased access to naloxone across California. During the pandemic, while many clinics closed and use of health care services declined precipitously, pharmacists played an especially key role in ensuring uninterrupted access to lifesaving naloxone.

106 | Impact of a Clinical Opiate Withdrawal Scale (COWS) protocol on management of opioid withdrawal

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Introduction: Opioid use disorder has become a public health epidemic in the United States. Abrupt discontinuation of opioids leads to intense cravings, acute withdrawal symptoms, risk of relapse, overdose and/or death. The Clinical Opiate Withdrawal Scale (COWS) is used to manage patients along with an adjunct as needed symptomatic medication per protocol.

Research Question or Hypothesis: Evaluate appropriate use of the COWS protocol in patients acutely withdrawing from opioids

Study Design: Retrospective study at Capital Health Regional and Hopewell Medical Centers in New Jersey

Methods: Using the electronic medical record (EMR), patients ≥18 years old started on the COWS protocol from September to December 2021 were included in the study. Primary outcome assessed the appropriateness of medication administration and timing based on documented COWS score. Secondary outcomes include percentage of patients referred to certified alcohol and drug counselor (CADC), rescue agent requirement, 90 day readmission for opioid withdrawal, protocol initiation but failure to optimize therapy and initiation of medication assisted treatment (MAT).

Results: In a sample population of 22 patients, the primary outcome was found in 77% of the population. For secondary outcomes, 73% were referred to a certified alcohol and drug counselor, 9% had a 90 day readmission for opioid withdrawal, 64% in which protocol was not optimized, 73% required rescue agents and MAT was initiated in 41% of patients (Buprenorphine – 5%, methadone – 27%, and both agents at various times – 9%).

Conclusion: Opioid use disorder and the management of acute withdrawal is associated with significant annual health care cost (approximately $10.6 billion).This retrospective study found that the use of the COWS scale in combination with medications appropriately addressed endorsed withdrawal symptoms. The study highlighted two major areas for improvement in our institution, initiating MAT and connecting patients with a certified alcohol and drug counselor and appropriate resources for long term management of opioid use disorders.

107 | Evaluation of hydroxocobalamin use for the treatment of suspected cyanide toxicity secondary to smoke inhalation

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Introduction: Hydroxocobalamin is the preferred treatment for cyanide toxicity after smoke inhalation. However, diagnosis is challenging due to lack of rapid confirmatory testing, and retrospective studies have associated hydroxocobalamin with risk of acute kidney injury (AKI), raising safety concerns.

Research Question or Hypothesis: Do pre-determined use criteria for hydroxocobalamin identify patients at risk for cyanide toxicity after smoke inhalation?

Study Design: Retrospective analysis of patients receiving hydroxocobalamin for suspected cyanide toxicity after smoke inhalation from 3/11/2011-8/31/2021.

Methods: Primary outcome was the proportion of patients meeting appropriate use criteria defined as one of the following: serum lactate ≥ 8 mmol/L, systolic blood pressure (SBP) < 90 mmHg, new-onset seizure, cardiac arrest, respiratory arrest. Secondary outcomes included incidence of AKI, pneumonia, resolution of neurologic symptoms present on admission, and in-hospital mortality. Descriptive statistics were used to describe the population and proportion meeting use criteria and secondary outcomes. Mann Whitney U and Fisher's Exact tests were used to compare those that met criteria and those that did not.

Results: Forty-six patients met inclusion criteria of which 35 (76.1%) met the primary outcome. All 35 patients met use criteria due to respiratory arrest. Additionally, 42.9% met use criteria for serum lactate, 40% for SBP, and 34.3% for cardiac arrest; no seizures occurred. Overall, AKI occurred in 28.3% of patients, pneumonia in 19.6%, and resolution of neurologic symptoms in 45.7%; differences were not different between groups. In-hospital mortality was higher in patients meeting use criteria, 48.6% vs. 9.1% (p=0.03). Other differences between those meeting criteria and those that did not were rate of intubation 100% vs. 54.5% (p=0.0003), mean serum lactate 9.4 mmol/L vs. 4.8 mmol/L (p=0.078), and mean SBP on hospital arrival 124 mmHg vs. 150 mmHg (p=0.047).

Conclusion: Appropriate use criteria identifies severely ill smoke inhalation victims and may provide useful guidance for clinicians considering hydroxocobalamin treatment.

Transplant/Immunology

108 | Evaluation of Rejection and Metabolic Outcomes in Steroid Free HCV-Infected Liver Transplant Recipients in the Era of Direct Acting Antivirals

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Introduction: Steroids have been a mainstay in liver transplantation as part of induction therapy and short-term use post-transplant. They are also known to have unfavorable metabolic effects. The use of pulse-dose steroids in Hepatitis C (HCV) positive liver transplantation has been associated with an increased risk for HCV recurrence, leading to use of steroid withdrawal protocols to minimize the risk of HCV recurrence. Due to high HCV cure rates with direct acting antivirals, it is not known if steroid withdrawal is still necessary.

Research Question or Hypothesis: Does steroid withdrawal impact rejection and metabolic outcomes in HCV positive liver transplantation?

Study Design: Retrospective chart review

Methods: Adult liver transplant patients transplanted with active HCV viremia, previously treated for HCV or received a Nucleic Acid Test (NAT) positive donor liver were included. Outcomes were analyzed based on the presence or absence of prednisone in the maintenance regimen. The primary endpoint was incidence of rejection at 12 months. Secondary endpoints include graft loss, all-cause mortality, infection, and metabolic syndrome.

Results: A total of 95 patients were included. Rejection at one year occurred in 14 patients (28.6%) in the steroid maintenance group (SMG) and 14 patients (30.4%) in the steroid withdrawal group (SWG) (p=0.8). SWG had a significantly higher incidence of infection requiring hospitalization when compared to SMG (34.8% vs 10.2%, p=0.004) and a significantly lower white blood cell and absolute neutrophil count at 1-month post-transplant. Steroids were resumed in 21 patients (45.6%) in the SWG. The incidence of metabolic syndrome was similar between groups. All patients achieved sustained virologic response irrespective of steroid use.

Conclusion: HCV-infected liver transplant recipients undergoing steroid withdrawal had a similar incidence of rejection to those maintained on steroids. However, they experienced more infections requiring hospitalization and a numerically higher mortality rate.

109 | Evaluation of the efficacy of IVIG for BK polyomavirus infection in kidney transplant recipients

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Introduction: BK polyomavirus (BKV) is associated with reduced graft survival in kidney transplant recipients (KTR). Intravenous immunoglobulin (IVIG) has been used after reduction of immunosuppression (RIS) has failed to reduce viral load. The benefits and optimal dose of IVIG are not well established.

Research Question or Hypothesis: Is IVIG effective for reducing BKV viral load?

Study Design: Single-center retrospective review included KTR from 2015-2020 with a plasma BKV PCR >1000 copies/mL, who received IVIG for BKV treatment and had evaluable PCRs at 1- and 2-months post-treatment.

Methods: Patients had monthly PCR screening for three months post-transplant, then every three months for 1-year. Institution guidelines for RIS-refractory BKV permit IVIG 1g/kg weekly for two doses. PCRs were collected at diagnosis and at 1-month and 2-months post-IVIG to identify patients with at least 1-log reduction. Secondary endpoints were clearance (PCR <1000 copies/mL), GFR 1-year post-transplant, rejection 1- and 3-years post-transplant, graft and patient survival.

Results: Twenty-four patients were included. The median time from transplant to first positive PCR was 100 days (IQR 64-148). Mean

initial PCR was 4.17 log10 copies/mL (±0.79). Two (8.7%) patients experienced a 1-log reduction within two months post-IVIG. Mean PCR at 1- and 2-months were 5.29 (±0.72) and 4.77 (±0.91) log10 copies/mL, respectively. Mean log change in PCR from time of initial diagnosis to 1- and 2 months post-IVIG were +1.12 (±1.11) and +0.4 (±1.38), respectively. Of the two patients who experienced a 1-log reduction, both occurred during month two. Only one of these patients cleared BKV. At 1- and 3-years post-transplant, 1 (4.2%) and 3 (12.5%) patients experienced acute rejection, respectively. Mean GFR at 1-year post-transplant was 34.4 (±20.3) mL/min/1.73m2. All patients reached 1-year graft survival. Patient and graft survival at 3-years was 91.7% and 72.3%, respectively.

Conclusion: IVIG was ineffective in the treatment of BKV in our patients. Larger studies with comparative arms are warranted.

Women's Health

110 | Prevalence of Teratogenic Prescription Medication Use in Women of Childbearing Age in Ambulatory Settings

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Introduction: Prior studies illustrate that 1 in every 13 ambulatory visits of women of childbearing age included a documented high-risk medication in pregnancy. Current data is lacking regarding medication use in females of reproductive age over the last two decades, particularly in women that are not on any form of contraception.

Research Question or Hypothesis: What proportion of women of childbearing age are on a potentially teratogenic prescription medication in the absence of contraception?

Study Design: This was a national, cross-sectional study of the National Hospital Ambulatory Care Survey from 2013-2016.

Methods: Inclusion criteria consisted of females of childbearing age (13-45 years old) that were on a prescription medication that is contraindicated in pregnancy or carries human risk in the first or second trimester. Women were excluded if they had any documented form of contraception. The primary endpoint was the percentage of women of childbearing age on potentially teratogenic prescription medication in the absence of contraception. A multivariate logistic regression model identified patient- and provider-level predictors of teratogenic medication use.

Results: The analysis included 24,191 women childbearing age, 17.3% of which were on a documented potentially teratogenic mediation in the absence of contraception (95% CI 16.2-18.5%). Positive predictors of teratogenic medication use were age between 34-45 (OR 1.195; 95% CI 1.011-1.413), Medicaid insurance (OR 1.341; 95% CI 1.060-1.696), psychiatry specialists (OR 1.966; 95% CI 1.430-2.701), prior stroke (OR 2.903; 95% CI 1.145-7.364), hyperlipidemia (OR 2.379; 95% CI 1.651-3.427), and hypertension (OR 2.917; 95% CI 2.114-4.024). Negative predictors included Hispanic ethnicity (OR 0.745; 95% CI 0.570-0.972), the total number of chronic conditions (OR 0.548; 95% CI 0.321-0.935), obstetrics and gynecology specialists (OR 0.619; 95% CI 0.442-0.866), and Midwest and West regions (OR 0.742; 95% CI 0.572-0.964; OR 0.654; 95% CI 0.510-0.839, respectively).

Conclusion: The use of teratogenic prescription medication use among women of childbearing age remains high in ambulatory practice settings.

111 | Parent and healthcare providers preference factors, decision-making and knowledge on medication use during lactation: a Canada-wide survey study

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Introduction: Decision-making around medication use during lactation is often a challenge for both parents and healthcare providers (HCPs) due to limited evidence-based information.

Research Question or Hypothesis: To understand preference factors, knowledge and decision-making of Canadian parents and HCPs regarding medication use during breastfeeding.

Study Design: Mixed-methods study design was employed. Scoping review of the literature and parent interviews informed the design of the surveys.

Methods: Two separate surveys were disseminated to (1) birthing parents; [2] HCPs. Participants were recruited through advertisements on social media. The surveys collected demographic information, participant's preference factors, decision-making and knowledge regarding medication use during infant feeding with human milk.

Results: There were 149 parent and 47 HCPs that completed the surveys at the one-month time point. Within three months postpartum 95% of the participants had fed directly from the breast/chest. Majority (95%) of the parents in this study used a medication postpartum. Over half (N=68/124,54.8%) of the parents found decision-making on medication use while nursing to be difficult and very few parents felt certain when making decisions (9.0%). Parents ranked the leading factor impeding decision-making to be lacking information about options, benefits, and risks of medications. HCPs role in parents' decision-making included sharing the decision with parents (65.5%) and providing support/advice for parents to make the decision on their own (58.6%). HCPs listed their training on medication use during lactation as being below average (31.0%) and extremely poor (31.0%). HCPs stated reliable resources, improved parent resources and more education on medication safety would help them better support parents' decision-making.

Conclusion: Parents' decision-making process on medication use during lactation and HCPs role in parents' decision-making was evaluated. Parents and HCPs would benefit from improved educational material and reliable sources for information on medication use during lactation. Finding from this study suggests a shared decision-making tool could be beneficial for clinical practice.

VPS CLINICAL PHARMACY FORUM

Ambulatory Care

112 | An Innovative Approach to Keep Your Practice Site Up-to-date On Clinical Queries: The MaryamWatch Model

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Service or Program: The clinical pharmacist at an endocrinology clinic developed an innovative approach entitled, MaryamWatch, for timely and comprehensive updates on medications, diabetes technology, literature, and responding to complex clinical questions. MaryamWatch starts with the question, summarizes the evidence/data, and concludes with Maryam's expert opinion. MaryamWatch is distributed to endocrinology faculty/fellows, pharmacist faculty, and institutions' ambulatory care pharmacists/residents.

Justification/Documentation: Clinical pharmacists' responsibilities expand beyond direct patient care and often include educating interprofessional teams. Medication discovery and therapeutic advancements are on-going and compete for healthcare provider time as they strive to stay abreast of innovations and best practices while also caring for patients. Clinical pharmacists are positioned to enhance patient care by identifying practice site relevant information, distilling complex data down to key points, and communicating the clinical relevance of the findings. MaryamWatch allows for effective dissemination of practice site relevant information to a large group and is received extremely well by the recipients. MaryamWatch series includes topics such as, *'Do the benefits of using ASA for primary prevention of ASCVD in patients with diabetes outweigh the risks?', and 'Intramuscular Levothyroxine and Ordering Guide'*. The aspirin MaryamWatch continues to inform patient care and led to the US News and World Report interview with the author. Intramuscular levothyroxine recommendations were used in a patient with absorption issues.

Adaptability: MaryamWatch is adaptable to any setting. The systematic reporting approach makes finding sections of interest easy. The expert opinion section incorporates expertise and clinical judgement relevant to the practice site. Student/resident pharmacists can assist with literature searches and journal clubs. The email list allows expansion beyond the immediate team.

Significance: MaryamWatch expanded the educational and patient care reach of the clinical pharmacist beyond the clinic team and to endocrinology and pharmacy departments. MaryamWatch has provided an educational platform for continued professional development, keeping up-to-date, and maintaining competence.

113 | Implementation of a Pharmacotherapy Clinic Service to Primary Care Providers

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Service or Program: The Pharmacotherapy Clinic (PTC) is a centralized ambulatory care service created to provide primary care patients management of chronic health conditions by pharmacists. Using a collaborative drug therapy agreement (CDTA), pharmacists manage type 2 diabetes, asthma, COPD, tobacco cessation, DOACs, and ASCVD in adult patients. Board certified, residency-trained pharmacists provide services 5 days weekly to patients referred by family practice, internal medicine, and senior care providers within a health system. Visits are 30- or 60-minutes in duration and considered billable. Under the CDTA, pharmacists assess, educate, implement a plan, order labs, and prescribe medications per evidence-based guidelines to improve adherence outcomes and reduce cost. The centralized location enables collaboration with ancillary services such as diabetes education and social work. Pharmacists also rotate through primary care clinics providing comprehensive medication reviews and managing conditions not covered by the PTC.

Justification/Documentation: Centralized PTC implementation expanded ambulatory pharmacy services to a suburban and rural patient population. This allows for the provision of value-based care to improve primary care quality metrics, reduce provider burden, and improve medication management. During the first three months of service, 236 patients established care with 377 visits completed. Management of type 2 diabetes accounted for 90% of encounters, with the remaining 10% split between asthma, COPD, DOAC management, and tobacco cessation.

Adaptability: The centralized PTC format was expanded from placement of clinical pharmacists within outpatient primary care clinics. Initial chronic health conditions identified for PTC management were based on primary care clinician needs and referrals to specialty providers. Engaging providers from all primary care clinics allows for strong collaboration and improved continuity of care.

Significance: The PTC model enables ambulatory care pharmacists to optimize safe, effective, and value-added care of chronic health conditions in a collaborative environment, while improving patient access to medications and reducing provider burden.

Oncology

114 | A specialty pharmacist-driven glucose monitoring supply service for patients starting alpelisib for metastatic breast cancer.

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Service or Program: All patients starting alpelisib through the institutional specialty pharmacy are gratuitously provided a starter package containing glucose monitor, testing strips, lancets, and alcohol swabs. The starter package was delivered with the first dispensing of alpelisib to the patient's home. Patients not filling with the institutional specialty pharmacy were assisted in obtaining these supplies through their local pharmacies. All providers were asked to submit prescriptions for the starter package items.

Justification/Documentation: A common and severe side effect of the oral oncolytic alpelisib is hyperglycemia. This side effect was noted in the literature and was identified as impacting patient outcomes through an internal medication use evaluation. While the package insert warns of hyperglycemia and recommends regular blood glucose monitoring, the manufacturer of alpelisib does not offer any resources to the glucose monitoring supplies.

This service ensures all patients starting alpelisib have the necessary supplies to monitor blood glucose daily at home. Preliminary data of our internal medication utilization review demonstrated that patients who received early intervention and monitored blood glucose at the start of alpelisib had better glucose management during their course of treatment, which is evident of the service success.

Adaptability: We expanded existing practice models within the specialty pharmacy to provide the framework for this service. Any patient receiving an alpelisib prescription initiated the service. If the starter package could not be sent along with the medication, the patient would be assisted in receiving these supplies from their local pharmacies. This service offers insight into the methods that can be implemented for other drugs with similar adverse effects.

Significance: This service can be adapted to any practice setting servicing patients utilizing alpelisib to improve clinical tolerance and therapeutic success of the medication. All pharmacists, notably pharmacists operating through an institutional specialty pharmacy, are well positioned to make such interventions and improve clinical outcomes.

Pediatrics

115 | Implementation of Pharmacist-Driven Palivizumab Prophylaxis Service in a Neonatal Intensive Care unit (NICU)

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Service or Program: The pharmacist-driven palivizumab prophylaxis service was created to align with the 2014 American Academy of Pediatrics (AAP) recommendations in a neonatal intensive care unit (NICU). The goals were to identify eligible neonates, improve adherence to current guidelines, streamline communication among health care providers and facilitate the transition of care upon discharge.

Justification/Documentation: Acute respiratory tract infection caused by the respiratory syncytial virus (RSV) is the leading cause of hospitalization among children under a year old. Palivizumab is currently an FDA-approved monoclonal antibody used to prevent severe RSV infection. The AAP recommends that infants in the NICU with risk factors receive the first dose of palivizumab within 48-72 hours before discharge during RSV season. Over the last several years, the percentage of eligible newborns who have received palivizumab has decreased due to a lack of reimbursement for inpatient use. Moreover, most insurance companies require prior authorizations for monthly injections, up to 5 doses, in an outpatient setting. In response to a few cases where high-risk newborns were discharged without being given palivizumab, a pharmacist-driven service to increase the prophylaxis rate was implemented.

Adaptability: Clinical and operation workflows were established to identify the eligible neonates and ensure mediation availability in an organized and cost-effective manner. The covering pharmacist screened eligible neonates, then determined the palivizumab plan with the physicians. Operationally, a twice-weekly batching schedule was streamlined to reduce waste. The clinical pharmacist also facilitated the prior authorization upon discharge.

Significance: From November 1st, 2021, to March 30th, 2022, approximately 115 neonates in the NICU were screened. About 10% of all newborns were eligible to receive palivizumab, of which 100% received their first dose. A pharmacist-driven palivizumab prophylaxis service can increase the adherence rate among infants discharged from the NICU. Systemic and national efforts to improve adherence rates and address barriers are warranted.

Psychiatry

116 | Telepharmacy at Mental Health Services: A new approach to medication therapy management during COVID-19

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Service or Program: The number of COVID-19 infections have increased dramatically since March 2020 in Qatar. Measures have been taken to minimize the risk of exposure to COVID-19 including medication home delivery by postal service and by using telemedicine at The Mental Health Service (MHS), a tertiary care hospital in Qatar. In order to continue patients' access to care during the pandemic, the Medication Therapy Management (MTM) clinic at MHS would like to utilize clinical pharmacists to offer patient counseling, medication reviews, and develop medication action plans with the patients via telepharmacy.

Justification/Documentation: Patients for whom counseling is essential to ensure positive outcomes of therapy were identified; patients on lithium or clozapine (phase 1), patient on newly prescribed psychotropics or on antipsychotic polypharmacy (phase 2), females on valproate in childbearing age (phase 3). The aim of this quality improvement (QI) project was to improve the number of patients currently receiving MTM service from baseline (90) by 20% by September 2020, 50% by December 2020 and 80% by March 2021. Outcome measure included percentage increase in patients from baseline who are receiving telepharmacy service, process measures included the percentage compliance of filling the Moresky Medication Adherence Scale-4 by the pharmacist, the percentage of referrals to other MHS services, balance measures were patient/caregivers and staff satisfaction. The improvement in outcome measure was successfully achieved in each phase; phase 1 – 28%, phase 2 – 82%, phase 3 – 127%. QI tools were used as appropriate.

Adaptability: This service was intended to be provided by clinical pharmacists to adult patients registered under MHS. Similar service can easily be adapted to another setting by clinical pharmacists using comparable strategies and measures.

Significance: The lessons learnt from this QI project will help in increasing patients' access to care, promote better utilization of resources, and allow better communication and management of patients.

VPS CASE REPORTS

ADR/Drug Interactions

188 | Euglycemic Diabetic Ketoacidosis following Ertugliflozin initiation and Norovirus Infection: A Case Report

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Introduction: The use of sodium-glucose cotransporter 2 (SGLT2) inhibitors continues to rise. Euglycemic diabetic ketoacidosis (euDKA), presents with metabolic acidosis with ketosis and a blood glucose level (< 200 mg/dL) and has been associated with SGLT2 inhibitors Ertugliflozin is the most recently approved SGLT2 inhibitors and although risk of euDKA is thought possible it has not been fully characterized.

Case: A 36-year-old female with a history of type two diabetes mellitus diagnosed 14 years prior to presentation, presented with severe dehydration, abdominal pain, nausea, vomiting, smelling of acetone, and recent Norovirus exposure. One week prior to presentation she was started on oral ertugliflozin 15mg daily and dulaglutide 2mg/0.85mL subcutaneously as directed. Initial work up revealed a blood glucose of 165 mg/dL, anion gap of 23 mEq/L, bicarbonate ($HCO3^-$) level of 4.0 mmol/L, a venous pH of 6.85, leukocytosis of 23.9 x 10^9/L, and + ketones. A diagnosis of severe euglycemic diabetic ketoacidosis secondary to ertugliflozin was made. The patient was treated with an insulin drip, fluids, and ertugliflozin was discontinued. The patient made a full recovery.

Discussion: Euglycemic ketoacidosis (euDKA) is characterized by metabolic acidosis, ketone formation, without markedly elevated blood glucose. SGLT2 inhibitors enhance urinary excretion of glucose in the proximal convoluted tubule of the kidney. This pathway increases the risk of euglycemia through sustained loss of urinary glucose. Norovirus is associated with gastroenteritis and can make diabetes management challenging. An analysis of FDA Adverse Event Reporting System (FAERS) data for SGLT2 inhibitor associated ketoacidosis revealed that patients were at a 7-fold increased risk of developing ketoacidosis with 71% of those patients having euDKA.

Conclusion: Data on euDKA for ertugliflozin is minimal. Further research is needed to develop a better understanding of its risk of euglycemic diabetic ketoacidosis.

189 | Trastuzumab-Induced Interstitial Pneumonitis Case Report

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Introduction: Trastuzumab is a recombinant immunoglobulin G1 monoclonal antibody used to treat HER-2 cancers. Trastuzumab-induced interstitial pneumonitis is a rare adverse effect reported in a few patients. Interstitial pneumonitis presents as symptoms of dyspnea, hypoxia, cough, and fever. If the patient is treated early, corticosteroids can slow or reverse the disease progression.

Case: A 41 year old woman presented with dyspnea and a dry cough three weeks after her third cycle of trastuzumab therapy for breast cancer. A diagnosis was made for trastuzumab-induced interstitial pneumonitis after COVID-19, pulmonary embolism, infection, pulmonary edema, and pneumonia were all ruled out. The patient was started on methylprednisolone while inpatient, and transitioned to prednisone for outpatient therapy.

Discussion: There are several trials and case reports that report trastuzumab-induced interstitial pneumonitis, but there has been no correlation reported between the patients' history, dosing regimen, or symptom onset. The lack of correlation and limited cases make this adverse effect very difficult to diagnose and monitor. New trials and case reports can bring an insight into contributing factors, symptoms at onset, and treatment for future patients.

Conclusion: With the increase in use of trastuzumab therapy, physicians should be aware of how to diagnose and treat the rare adverse reaction of trastuzumab-induced interstitial pneumonitis.

190 | Rituximab-Induced Pneumonitis: A Case Report

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Introduction: We present a case of a 58-year-old male with autoimmune hemolytic anemia who developed rituximab-induced pneumonitis, a rarely reported adverse event. This patient case is unique as they did not have cancer nor were they on any concomitant chemotherapy drugs that could have attributed to pneumonitis. This case is vital, as it adds to the body of evidence surrounding the identification and treatment of rituximab-induced pneumonitis.

Case: A 58-year-old male presented with a chief complaint of fever, cough, dyspnea, and lethargy. The patient had a past medical history of autoimmune hemolytic anemia, which was treated with rituximab outpatient. The patient developed pneumonitis two weeks after their last rituximab infusion. Their outpatient prednisone was initially continued at a lower dose. The prednisone dose was increased to 40 mg daily, rituximab was discontinued, and the patient's symptoms improved.

Discussion: Literature indicates that rituximab-related pulmonary toxicity tends to occur in patients above 55 years old, similar to this case. In contrast, many of these cases have a diagnosis of diffuse large B cell lymphoma or chronic lymphocytic leukemia and were on chemotherapy, which was not the case for the patient described in this report. The patient had a Naranjo Adverse Drug Reaction Probability Scale score of 6, indicating the pneumonitis was a probable adverse drug reaction to the rituximab. Limitations include the retrospective nature of our assessment along with the absence of a complete pulmonary function test while inpatient. We can hypothesize that patients who are on rituximab may be less likely to experience pneumonitis when using higher doses of concomitant corticosteroids.

Conclusion: Although rituximab-induced pneumonitis is rare, clinicians should consider this condition if a patient on rituximab has developed respiratory symptoms without an identifiable pathologic etiology. Once identified, rituximab should be immediately discontinued, and systemic corticosteroids should be administered to treat the condition.

191 | Alogliptin induced leukocytoclastic vasculitis: A Case Report

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Introduction: Alogliptin is a dipeptidyl peptidase 4 (DPP-4) enzyme inhibitor that results in prolonged active incretin levels and is indicated for treatment of type 2 diabetes mellitus. Studies suggest association of DPP-4 inhibitors with dermatologic reactions. To the best of our knowledge, we present the first case of alogliptin induced leukocytoclastic vasculitis (LCV).

Case: Seventy-one-year-old male with diabetes, hypertension, cirrhosis, and prostate cancer was started on alogliptin. About 6 weeks later, he developed a significant rash that began on his bilateral lower extremities and progressed proximally to the lower portion of his abdomen. The rash initially improved with a course of prednisone. About 5 weeks after, patient returned to clinic complaining of worsening of rash on his legs. Patient reported that he had completed two courses of prednisone (first course of five days and second course of nine days) which improved the rash temporarily. Upon physician's examination, petechial rash in lower extremities and left abdomen was found along with elevated inflammatory markers. Punch biopsy was obtained during the visit. Histopathology report showed scattered intraepithelial neutrophils and significant extravasation of erythrocytes in the dermis with inflammatory infiltrate composed of

neutrophils with nuclear dust consistent with LCV. Alogliptin use was discontinued as it was the most recently added medication for patient which led to resolution of patient's rash after two weeks.

Discussion: We present the first case of alogliptin induced LCV. Previous reports of LCV associated with sitagliptin and vildagliptin are published in the literature. Using the Naranjo Adverse Drug Reaction Probability Scale, we calculated a score of five placing it in the "probable" causality category. This case report adds to pharmacovigilance by increasing clinicians' awareness of atypical ADR patterns.

Conclusion: Alogliptin induced LCV is an unusual and uncommon adverse effect. This knowledge can help with treatment decisions and patient outcomes.

Cardiovascular

192 | Case report: improved blood pressure control after switching to an angiotensin receptor blocker from an angiotensin-converting enzyme inhibitor in an adolescent with symptomatic hypertension

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Introduction: Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) are first-line choices for pediatric hypertension. Guidelines and studies treat ACE inhibitors and ARBs as one class of drug therapy. Existing literature distinguishes these agents only regarding adverse drug events, not efficacy. In this case, blood pressure control was improved following a switch from lisinopril to losartan. This finding may give providers an alternative in managing antihypertensive pharmacotherapy when all other first-line choices have been exhausted.

Case: An 11-year-old male patient was referred to a pediatric cardiology clinic for markedly elevated blood pressure (164/104 mmHg – systolic 99th percentile, diastolic 98th percentile) already taking lisinopril 5 mg daily. Over one year, his lisinopril was titrated until his hypertension was controlled with lisinopril 40 mg daily (122/74 mmHg – 80th/79th percentile).

Two months after initiating lisinopril 40 mg daily, the patient reported headaches, which he attributed to his lisinopril therapy. He self-discontinued lisinopril and returned to clinic with uncontrolled hypertension. Losartan 100 mg daily was initiated. Two weeks later, the patient's blood pressure was well-controlled (98/78 mmHg – 7th/89th percentile) without symptoms of hypotension or headache. The dose was decreased to losartan 50 mg daily, and his hypertension was still controlled 2 months later (116/70 mmHg – 63rd/62nd percentile) with no symptoms.

Discussion: This patient's hypertension was controlled using initial-dose losartan despite needing maximum-dose lisinopril to achieve the same effect. Although an adverse drug event – and not a need for improved efficacy – was the reason for changing therapy, this finding suggests patient-to-patient variability in response between these two drug classes. This could be further studied by explicitly looking at between-class differences in blood pressure lowering.

Conclusion: ARBs may be considered as an alternative drug class to ACE inhibitors for differences in blood pressure lowering in addition to adverse drug events.

Endocrinology

194 | A Pharmacist-Led Analysis of Continuous Glucose Monitoring Data in a Patient with Type-2 Diabetes: A case report

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Introduction: The 2022 ADA guidelines recommend continuous glucose monitoring (CGM) in adults on multiple daily insulin injections. Barriers to CGM use include clinician readiness and access. The addition of a pharmacist to the interprofessional care team has shown larger A1c reductions with CGM use compared to teams lacking a pharmacist. This study aims to provide a case report for CGM use in the management of diabetes in a pharmacist-driven interprofessional care model in underserved populations.

Case: A 52-year-old male with a past medical history of uncontrolled type 2 diabetes mellitus (A1c 9.5%), hypertension, and hyperlipidemia presented to the Pharm.D. team at Crossover Ministry Clinic in July 2017. In March 2021, the patient was started on a CGM. At CGM initiation, the patient was prescribed metformin 2g daily, 85 units of insulin degludec, and novolog (10 units with breakfast and 28 units with dinner). Insulin degludec was decreased 29% and novolog was increased by 33% to address nocturnal hypoglycemia. By October 2021, the patient's A1c decreased to 7.8% and his time-in-range was 66%.

Discussion: A retrospective analysis of the effects of professional CGM on A1c outcomes showed a mean change in A1c of -0.92% at six months. Our patient's A1c decreased by 2.3%. He achieved his personalized A1c goal of ≤ 8% and his time-in-range goal of 50% within a 1-year time frame. The data obtained from this case report supports the role of pharmacist-managed diabetes services to help improve patient outcomes using CGMs.

Conclusion: As a result of pharmacist-led CGM implementation, the patient achieved improved glycemic control, time-in-range, reduced frequency of hypoglycemia, and decreased daily insulin requirements. This case report justifies the expansion of CGM use in patients meeting ADA criteria in underserved populations.

Hematology/Anticoagulation

195 | Transfusion Plasma Exchange (TPE) and The Supratheraputic Effects of Unfractionated Heparin (UFH): A Case Report and Review of Literature

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Introduction: Transfusion plasma exchange (TPE) is an extracorporeal method of filtration of high-molecular-weight substances to remove pathogenic substances circulating in the plasma. The removal and replacement of plasma through TPE impact the coagulation factors. Insufficient data are available that evaluate the effect of TPE on UFH.

Case: We report a case of a 78-year-old female with a past medical history of myasthenia gravis. She underwent a thymectomy that was complicated by phrenic nerve injury, innominate vein, superior vena cava injury, and bleeding. As a result, she was transferred to the ICU and was on mechanical ventilation (MV) secondary to respiratory failure. She developed a provoked left upper extremity DVT during her admission and started on UFH. Despite being on immunosuppressants; additional therapy with TPE was deemed necessary. Therefore, she was scheduled to receive five sessions of TPE. While on therapeutic heparin, she underwent TPE sessions, and interestingly, the aPTT increased tremendously (>170 seconds) post-TPE exchange. As a precautionary measure, heparin infusion was held for one day. Nonetheless, the patient has no evidence of bleeding events.

Discussion: Our patient experienced an abrupt supratherapeutic aPTT immediately after the TPE session in this case report. Besides the anticoagulation effect of UFH, TPE depletes coagulation factors temporarily after exchange, and coagulation factors recovery is seen within 4-24 hours. This concomitant effect of both UFH and TPE on coagulation factors may augment the anticoagulation effect leading to several complications such as major and minor bleeding, especially in high-risk patients.

Conclusion: This case report highlights the impact of TPE on coagulation factors and its association with the UFH supratherapeutic effect that may lead to a fatal consequence such as bleeding. Therefore, it may be reasonable to hold or decrease UFH dose during and post the TPE session with the frequent assessment of aPTT and close monitoring for bleeding.

Women's Health

196 | Novel administration of intravenous etoposide for placenta accreta spectrum disorders management: a case report

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Introduction: Placenta accreta spectrum (PAS) disorders refers to the pathologic adherence of placenta outside the uterus; including increta, percreta, and accreta. Chemotherapy can be used for conservative management to decrease maternal morbidity from serious bleeding complications and is primarily described in case reports utilizing methotrexate (MTX). Unfortunately, minimal literature characterizing intravenous (IV) etoposide dosing, administration, and outcomes in this clinical scenario exists.

Case: A 37 year-old female (G5P6) was diagnosed by ultrasound (US) and magnetic resonance imaging (MRI) with placenta percreta to her anterior abdominal wall and bladder. The patient was admitted for contractions and subsequently delivered by cesarean section at 32 weeks 6 days, followed by uterine artery embolization. After delivery, conservative management with IV etoposide was initiated at 100mg/m^2/day (187mg) x 5 days. Delayed hysterectomy was successfully performed 4 weeks post embolization with minimal blood loss. Beta-human chorionic gonadotropin levels declined from 141,034 to 14,620 mIU/mL over 4 weeks. The hospital course was uncomplicated other than neutropenia, with absolute neutrophil count nadir of 760 cells/μL.

Discussion: While numerous case reports discuss MTX use for PAS, more recent evidence recommends against use based on high failure rates and side effect profile. Only one previous case series described the use of IV etoposide, but unlike this case, at a fixed dosing strategy of 200mg daily (*Am J Obstet Gynecol*. 2011 May;204(5):e4-8). Administration of cytotoxic chemotherapy should utilize a minimum effective dose to prevent systemic side effects. Etoposide may represent an alternative approach over methotrexate based on high protein binding and lack of accumulation in plasma. Further studies should investigate outcomes and side effects when utilizing BSA based etoposide dosing.

Conclusion: Conservative management with etoposide dosed on BSA may provide an effective alternative approach in PAS disorders. To our knowledge, this is the first report evaluating outcomes with this BSA based dosing schema.

VPS ENCORE PRESENTATIONS

Community Pharmacy Practice

197 | How Do Health Professions Students Make Decisions About Using Over-the-Counter Medications? A Cross-Sectional Survey Study

Stephanie Schafer, Pharm.D. candidate[1], Cameron Bizal, Pharm.D. candidate[1], Katherine Kjendal, Pharm.D. candidate[1], Lauren Ruggles, Pharm.D. candidate[1], Shayna Skokan, Pharm.D. candidate[1] and Kevin T. Fuji, Pharm.D., M.A.[2]

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Endocrinology

198 | Ertugliflozin in older patients with type 2 diabetes (T2D): an analysis from VERTIS CV

Margaret Noyes Essex, Pharm.D.[1], Richard Pratley, MD[2], Christopher Cannon, MD[3], David Cherney, MD, PhD[4], Francesco Cosentino, MD, PhD[5], Darren McGuire, MD, MHSc[6], David Lawrence, PhD[7], Philip Jones, BMBS, PhD[8], Jie Liu, PhD[9], Ingrid Adamsons, MD, MPH[9] and Samuel Dagogo-Jack, MD, DSc[10]

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199 | Ertugliflozin has Favorable Effects on Kidney Outcomes in Patients with Baseline Evidence of Heart Failure in VERTIS CV

David Cherney, MD, PhD[1], Samuel Dagogo-Jack, MD, DSc[2], Francesco Cosentino, MD, PhD[3], Darren McGuire, MD, MHSc[4], Richard Pratley, MD[5], *Robert Frederich, MD, PhD*[6], Mario Maldonado, MD[7], Chih-Chin Liu, PhD[8] and Christopher Cannon, MD[9]

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200 | Ertugliflozin (ERTU) Delays Insulin Initiation and Reduces Insulin Dose Requirements in Patients with Type 2 Diabetes (T2D): An Analysis from VERTIS CV

Robert Frederich, MD, PhD[1], Samuel Dagogo-Jack, MD, DSc[2], Jie Liu, PhD[3], Christopher Cannon, MD[4], Harry Shi, PhD[5], Darren McGuire, MD, MHSc[6], David Cherney, MD, PhD[7], Francesco Cosentino, MD, PhD[8], Urszula Masiukiewicz, MD[9], Ira Gantz, MD[3] and Richard Pratley, MD[10]

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201 | Cardiorenal Outcomes with Ertugliflozin by Baseline Cardiorenal Medications: An Analysis from VERTIS CV

Robert Frederich, MD, PhD[1], David Cherney, MD, PhD[2], Francesco Cosentino, MD, PhD[3], Darren McGuire, MD, MHSc[4], Samuel Dagogo-Jack, MD, DSc[5], Richard Pratley, MD[6], Mario Maldonado, MD[7], Annpey Pong, PhD[8], Ira Gantz, MD[9], James Mancuso, PhD[10], Urszula Masiukiewicz, MD[11] and Christopher Cannon, MD[12]

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Harvard Medical School, Boston, MA Presented at the 81st Scientific Sessions of the American Diabetes Association, Virtual Meeting, June 25-29, 2021.

202 | Impact of statins treatment on peripheral neuropathy associated with type 2 diabetes mellitus

Abdulmohsen Assiri, Master degree in 2014. Saudi Board in clinical Pharmacy
Armed Forces Hospital, Southern Region (AFHSR), Abha, Saudi Arabia
Presented at The Clinical Pharmacy Congress on 27th and 28th April 2018, London, UK

203 | Hepatic Steatosis Index and Fibrosis-4 Scores in Patients with Type 2 Diabetes – Post Hoc Analyses from VERTIS CV

Jie Liu, PhD[1], Karen Corbin, PhD, RD[2], Samuel Dagogo-Jack, MD, DSc[3], Christopher Cannon, MD[4], David Cherney, MD, PhD[5], Francesco Cosentino, MD, PhD[6], Darren McGuire, MD, MHSc[7], Robert Frederich, MD, PhD[8], Jianxin Lin, PhD[1], Nilo Cater, MD[9] and Richard Pratley, MD[2]
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Infectious Diseases

204 | TikTok: A Modern Platform for Antibiotics Education?

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Presented at IDWeek 2021 for the Infectious Diseases Society of America, virtually, September 9-October 2, 2021.

VPS SYSTEMATIC REVIEWS/META-ANALYSIS

Medication Safety

214 | Ranitidine and Risk of Cancers: A Meta-Analysis of Cohort Studies

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Background: In 2020, ranitidine was withdrawn due to high levels of N-nitrosodimethylamine, a probable human carcinogen. The objective of our meta-analysis is to investigate the risk of developing cancers in ranitidine users compared to other H2-blockers users.
Methods: We searched PubMed and EMBASE to locate eligible studies from inception to March 2022. We included cohort studies reporting hazard ratio (HR) with 95% confidence intervals (CIs). Studies that were not published in English, in peer-reviewed journals or only presented in conferences were excluded. The Newcastle-Ottawa Scale for cohort studies were used to evaluate the quality of clinical studies. Publication bias was checked by the Egger's regression test.
Results: We included six cohort studies, which involved a total of 1,518,599 participants in the final analysis. In the random effect model meta-analysis of all six studies suggested that ranitidine use was not associated with the risk of cancers (HR: 1.01, 95% CIs: 0.97-1.05, I^2: 0%). In the subgroup meta-analysis, there were no statistically significant associations between ranitidine use and the risk of specific type of cancer, such as gastric cancer (HR: 1.04, 95% CIs: 0.92-1.17, I^2: 0%), colorectal cancer (HR: 1.04, 95% CIs: 0.88-1.23, I^2: 0%), hepatocellular carcinoma (HR: 1.06, 95% CIs: 0.64-1.73, I^2: 72.4%), kidney cancer (HR: 0.82, 95% CIs: 0.66-1.02, I^2: 10.1%), bladder cancer (HR: 1.14, 95% CIs: 0.99-1.31, I^2: 0%), prostate cancer (HR: 1.01, 95% CIs: 0.85-1.20, I^2: 0%), breast cancer (HR: 0.99, 95% CIs: 0.81-1.20, I^2: 11.6%), and lung cancer (HR: 0.98, 95% CIs: 0.83-1.15, I^2: 0%).
Discussion: There is no conclusive evidence that ranitidine use is associated with an increased risk of cancers. More high-quality prospective cohort studies are needed to assess this correlation.
Other: This research was supported by the "International Cooperation & Education Program (NCCRI·NCCI 52210-52211, 2022)" of National Cancer Center, Korea.

Other

215 | What are the prescribing patterns of proton pump inhibitors? A systematic review

Meera Essa, B.Pharm[1], Manal Esmail, B.Pharm[1], Amna Ahmed, B. Pharm[1], Shaikha Hussain, B.Pharm[1], Shamma Ali, B.Pharm[1] and Lamia AlHajri, Pharm.D.[2]

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Background: Proton pump inhibitors were developed in the 80s and are currently one of the most commonly prescribed medications. Their popularity have raised a concern related to inappropriate prescribing. Existing systematic reviews have not targeted the appropriateness of PPIs prescriptions, the most commonly prescribed PPI, and the most common indication. Hence, this systematic review aims to address these gaps.

Methods: PRISMA was used in reporting this review. PubMed/MEDLINE, ScienceDirect, SCOPUS, CINHAL, EMBASE, and Google Scholar were searched on January 2022 for relevant studies. Studies were considered eligible if they were observational, cross-sectional and/or retrospective, published in English and available as a full text. The quality of reporting was assessed through STROBE. Six researchers were involved in the process of searching and extracting the data. Results were then synthesized narratively, and presented in tables and descriptive graphs.

Results: Twenty-four studies conducted between 2008 and 2018 mainly in hospital settings and in different geographical locations (Europe, Asia, North America, Middle East, and Australia) were included. Findings unraveled that omeprazole was the most commonly prescribed PPI, and prevention against NSAIDs induced peptic ulcer disease was the most common indication. Furthermore, 65.2% of studies showed a significantly higher percentage of inappropriate PPIs prescriptions.

Discussion: Although omeprazole was the popular, literature did not identify any significant difference between omeprazole and other PPIs to privilege its popularity. Also, as PPIs were mostly used prophylactically, this could have been one of the major reasons for inappropriate prescribing alongside not having an indication, inappropriate interpretations of the guidelines, and more.

Conclusion: The high inappropriate prescriptions mandate the need for an intervention to ameliorate that. More specifically, there might be a need to develop a simple checklist to help physicians assess before prescribing. This could also help ensure that prophylactic PPI use is justifiable and appropriate.

Other: Authors declare no conflict of interest.

Pharmacoepidemiology

216 | Non-fulfillment of newly prescribed lipid-modifying medication: A systematic review

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Background: Lipid-modifying medications are prescribed to mitigate the risk of cardiovascular disease. This impact is lost when a patient does not obtain the newly prescribed medication. Non-fulfillment, a type of medication non-adherence, may negatively affect cardiovascular health. This research summarizes the published evidence on the prevalence, associated factors, consequences, and solutions for non-fulfillment of prescribed lipid-modifying medications in the United States (US).

Methods: A systematic literature search using PubMed, the internet, and screening citations of review articles was performed to identify articles published 2010-2021. Studies reporting results of non-fulfillment of lipid-modifying medications were included. Studies that evaluated non-adult or non-US populations, employed weaker study designs (e.g., case series), or not written in English were excluded. Risk of bias was assessed using the National Heart, Lung, and Blood Institute's quality assessment tools.

Results: The search identified 2,755 unique articles from which 16 studies were included. Estimates of the prevalence of non-fulfillment of new lipid-modifying medications ranged from 10.0 to 18.2% of patients, and 1.3-28.2% of prescriptions (n=9 studies). Two studies reported demographic and clinical characteristics associated with non-fulfillment while three studies described patient-reported reasons for non-fulfillment such as preference for lifestyle modifications, lack of perceived need, and side effect concerns. Four intervention studies reported mixed results with automated calls, live calls, and/or letters. One study reported worse clinical outcomes in patients with non-fulfillment: higher low-density lipoprotein levels and greater risk of emergency department visits.

Discussion: Prevalence was the most studied parameter with estimates varying due to differences in study populations, data sources, and the definition of a new prescription. Up to one-fifth of patients fail to obtain a newly prescribed lipid-modifying medication but there is limited information about the clinical consequences. Future research should assess outcomes and determine cost-effective approaches to address non-fulfillment.

Other: No funding source, no conflicts of interest, and study not registered.

Substance Abuse/Toxicology

217 | Factors that distinguish opioid withdrawal during induction with buprenorphine microdosing: A configurational analysis.

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Background: Novel buprenorphine dosing strategies have emerged with an aim to transition patients from opioid agonists to buprenorphine without prerequisite opioid withdrawal. We applied a configurational approach to a subset of data from our earlier systematic review to answer the following question: when patients received a buprenorphine initiation strategy aimed to eliminate prerequisite withdrawal, what factors consistently distinguished patients that experienced withdrawal during the initiation process from patients that did not?

Methods: From the 24 cases identified by our systematic review, we included cases that were treated using buprenorphine microdosing strategies (oral or transdermal), cases with opioid use disorder, and cases that fully transitioned to buprenorphine without continuing the full opioid agonist. Configurational analysis was used to identify combinations of patient and regimen level factors that uniquely distinguished cases experiencing withdrawal during induction.

Results: Fourteen cases were included in our analysis, of which 9 experienced opioid withdrawal symptoms. Three factors were involved in explaining both the presence and absence of withdrawal symptoms: history of heroin use, history of methadone use, and duration of overlap between buprenorphine and the full opioid agonist during induction. For the presence of withdrawal symptoms, the addition of a fourth factor "buprenorphine starting dose" resulted in a model with perfect consistency and coverage; for the absence of withdrawal symptoms, the addition of a fourth factor "induction duration" similarly resulted in a model with perfect consistency and 80% coverage.

Discussion: Application of configurational methods allowed synthesis of case reports identified through a systematic review. Application of configurational analysis allowed us to understand which combination of factors consistently identified cases with and without withdrawal symptoms when initiating buprenorphine microdosing strategies for opioid use disorder. These results can be used to generate hypotheses for future experimental studies to further elucidate microdosing efficacy and safety.

Other: N/A