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Assessing compliance with vasopressin formulary restriction at a community hospital

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Background/ Purpose: Vasopressin (AVP) is an intravenous vasopressor used to increase mean arterial pressure (MAP) in patients experiencing vasodilatory shock despite resuscitating with crystalloid fluids and high dose catecholamines. Due to lack of strong evidence to support use of AVP as a primary vasodilator in addition to the recent increase in price, our institution has implemented a formulary restriction on its usage. At MedStar Health, AVP is permitted for patients experiencing shock only when NE requirements exceed 20 mcg/min or phenylephrine (PE) requirements exceed 200 mcg/min. In tachycardic patients (heart rate above 110 beats per minute) the NE requirements are lowered to 10 mcg/min. Once NE requirements are below 20 mcg/min (or 10 mcg/min in tachycardic patients) or when PE requirements are below 200 mcg/min for at least 2 hours, it is recommended to discontinue AVP. The objective of this study is to evaluate the incidence of appropriate initiation of vasopressin (AVP) according to institution-specific formulary restriction. Secondary outcomes included appropriate discontinuation of AVP along with overall compliance with formulary restriction.
Methods: Data for this study was collected using retrospective chart review of MedConnect database. Inclusion criteria consisted of all adult patients at least 18 years of age who had used AVP between April 1, 2017 and March 31, 2018. Patients were excluded if AVP was prescribed for organ donation once pronounced brain dead. Study data collected included patient demographics, NE and PE requirements upon initiation, AVP total duration, and indication for usage. Heart rate upon initiation of AVP was also recorded for all patients who were concomitantly using NE.
Results: *Baseline Characteristics:* Ninety-seven patients qualified for inclusion in this study, including 62 medical intensive care unit (MICU) patients, 33 surgery patients, 1 internal medicine patient and 1 heart failure unit patient. Most common indication for AVP usage was septic shock (35.1%) followed by post-surgery vasodilatory shock (25.8%) and cardiogenic shock (16.5%). *Primary and Secondary Outcomes*: According to institution formulary restriction, AVP was initiated appropriately in 52 patients (53.6%) and discontinued appropriately in 39 patients (40.2%). Overall compliance defined as appropriate initiation as well as discontinuation of AVP was 35.1%.
Conclusion: Although this study identified high level of noncompliance with AVP formulary restriction, a significant portion of usage was for indications other than septic shock. This study highlighted several areas for improvement in formulary restriction compliance. Because appropriateness of AVP usage relies on its indication, it is important to update the formulary restriction to reflect this. Second, providers as well as the department of pharmacy must be educated on the formulary restriction. Third, nursing must be educated on appropriate initiation and discontinuation of AVP. Finally, CPOE functionality must be re-evaluated for ordering AVP. Compliance with formulary restriction may improve upon activation of restriction alerts when providers order AVP.

Assessing the Effects of Embedding a Transitional Care Pharmacist in a Primary Care Health Center

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Objective: Compelling statistics show that the readmission rates for under-insured patients is higher than that of insured patients at primary health care clinics. The integration of pharmacists to the primary care team can help standardize practice, improve medication adherence, reduce adverse effects, and improve overall clinical outcome measures. This will as a result improve patient experience, safety, and satisfaction. This is a prospective study to examine a team-based collaborative drug therapy management (CDTM) and its effect on the therapeutic outcomes of under-insured patients with target chronic health disease managed in a primary health center.
Methods: This study was designed as a prospective study to examine a team-based collaborative drug therapy management (CDTM) and its effect on the therapeutic outcomes of under-insured patients with target chronic health disease managed in a primary health center. The target chronic care disease states for CDTM include the following: dyslipidemia, diabetes, hypertension, anticoagulation, heart failure, and COPD. The study was conducted in a 443-bed community teaching hospital following approval by the Institutional Review Board. The collaborative drug therapy management service between pharmacists and physicians at Holy Cross Health primary care clinic was recently implemented in April 2017. Inclusion criteria for this study specified that participants must be 18 years or older, and have one of the aforementioned chronic disease conditions. Patients were excluded if they were being discharged to a nursing home, assisted living facility or hospice care. The primary outcome of evaluated was percent time in therapeutic range (TTR) for INR, percent blood pressure at goal at

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last visit and mean hemoglobin A1c (HbA1c) at goal. The secondary outcome measure was emergency department visits and hospital admissions due to pharmacist intervention. Data was collected from July 2017 to July 2018**.**
Results: Patients were at INR goal 54% of the time compared to 52% at baseline (p=0.71). There was a 16.5% improvement in mean HbA1c in the intervention group when compared to baseline, 10.6% and 12.7%, respectively (p= 0.01). With pharmacist intervention, 89.5% of the patient had their blood pressure at goal at the last visit compared to 64.4% at baseline.
Conclusion: The results of this study indicate that pharmacist-physician collaborative drug therapy management shows promise in improving the therapeutic outcomes and reducing hospitalization rates of patients with hypertension, anticoagulation, or diabetes.

Assessing the impact of pharmacy-developed and led conversions of tenofovir disoproxil fumarate (TDF) to tenofovir alafenamide (TAF)
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Objective: As HIV testing becomes more convenient and accessible, an increase in treatment earlier in disease is expected, warranting improved antiretroviral therapies (ART). Prior studies suggest tenofovir alafenamide (TAF), a prodrug of tenofovir, has an improved safety profile and systemic stability compared to previously established prodrug, tenofovir disoproxil fumarate (TDF). Research established non-inferiority of TAF, however efficacy and safety data is limited past 96-weeks. Clinically, TAF ART formulations have potential to be beneficial in reducing nephrotoxicity and bone loss without compromising virologic suppression. This study seeks to assess the impact a pharmacy-developed and led tenofovir conversion initiative had based on the assessment of laboratory values gathered pre- and one-year post-conversion in patients infected with Human Immunodeficiency Virus Type-1 (HIV-1).
Methods: In 2016, Kaiser Permanente Mid-Atlantic States began converting eligible patients infected with HIV-1 from TDF containing to TAF containing products. A retrospective chart review of adult patients successfully converted (prescription data indicating sold status), from TDF to TAF formulations between December 2016 and May 2017 included: elvitegravir (EVG)/cobicistat (C)/emtricitabine (FTC)/TDF to EVG/C/FTC/TAF, FTC/rilpivirine (RPV)/TDF to FTC/RPV/TAF, and FTC/TDF to FTC/TAF. All patients who were converted to TAF were included in the analysis, despite time exposed to TAF therapy. Laboratory values including serum creatinine, LDL, ALT, and viral load were assessed pre- and post-tenofovir conversion in all eligible patients via chart review. Demographic variables also were collected. The primary outcome that will be assessed includes the evaluation of changes in viral load, serum creatinine, ALT, and LDL prior to and one-year post-conversion. The secondary outcome that will be assessed includes any reason for discontinuation of TAF formulation and/or reconversion to TDF-containing products.
Results: A statistically significant ($p<0.0001$) increase in LDL was identified one year following TAF conversion. An increase in viral load and decreases in ALT and serum creatinine were observed, however differences were not statistically significant. Bone mineral density was unable to be assessed as 0% of patients had DEXA scan results. 4% (n=11) patients discontinued TAF therapy following conversion and either reconverted back to a TDF product or to a non-tenofovir containing ART. The most common reasons for discontinuation were significant viral load elevation (n=3) and extreme fatigue (n=2).
Conclusions: Results suggest that tenofovir alafenamide containing ART formulations have minimal effect on viral load and serum creatinine, however are associated with significant increases in LDL levels as confirmed by prior literature. Additional research is warranted investigating long-term (>96 weeks) effects of therapy.

Assessment of central fill pharmacy automation implementation into academic medical center outpatient pharmacy workflow
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Objective: Automation has been shown to greatly impact efficiency and cost of service across many industries. Outpatient pharmacies have implemented automation to decrease cost of prescription filling, increase filling efficiency, and positively impact the expectations of patients. Nine outpatient pharmacy locations across two academic medical centers in Maryland are implementing central fill pharmacy automation. This project will complement centralized processes already established and increase understanding of existing processes to allow for informed decisions regarding shifts in prescription volumes and staffing requirements.
Methods: Workflow process maps for each location were generated through on-site observations to determine the best methods for implementation. Emphasis was placed on patient expectations, centralized data entry services, multiple points of pharmacist review, and robust delivery systems. Current full-time equivalent (FTE) levels and prescription volumes were collected and compared to efficiency projections and industry benchmarking. Proposed FTE shifts were calculated based on vendor requirements, anticipated volume transfer, and on-site operational requirements.
Conclusion: The workflows were evaluated focusing on three key sections: (1) patient-facing activities, (2) prescription fulfillment, and (3) delivery. The committee projects 80% of employee prescriptions and 100% of mail order prescriptions will shift to central fill automation

processing, with a 25% shift of total prescription volumes. Fifteen percent of current technician FTEs and 5.5% of current pharmacist FTEs will be shifted to central fill.
Immediate next steps include evaluating each portion of the workflow process to determine benefits and risks of centralization and finalizing recommendations for workflow modifications based on automation software and prescription fill patterns.

Characterization of Microbial Contamination and Antimicrobial Use During Total Pancreatectomy with Islet Autotransplantation

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BACKGROUND: Total pancreatectomy with islet autotransplantation (TPIAT) can relieve the pain associated with chronic pancreatitis, while preserving islet function. Islet cultures are often contaminated by enteric flora secondary to prior pancreatic manipulations. There are limited data to describe the impact of contaminated islet cultures on post-operative infection risk.
METHODS: Electronic health records for patients that underwent TPIAT from August 1, 2011 to November 15, 2017 were retrospectively reviewed. Demographics, pancreatitis history, microbiologic data, medications, post-operative infections, length of stay, and hospital readmission were evaluated.
RESULTS: Sixty-one patients were included. Twenty-nine (47.5%) patients had a positive islet culture and 23 (79.3%) of those patients received antimicrobial prophylaxis. No infections occurred in the 6 patients who did not receive prophylaxis. Twelve (41.4%) patients with a positive islet culture developed 19 infections post-operatively. Eight (42.1%) of these infections were secondary to organisms that were islet culture concordant. There was no difference in ICU and hospital length of stay or 30-day and 90-day readmission rates.
CONCLUSIONS: GI flora were commonly isolated from islet preparations in TPIAT patients. However, contaminated preparations did not impact the prevalence of post-operative infection, length of stay, or hospital readmission, despite the common use of postoperative systemic antimicrobials. Antimicrobial exposure should be minimized to prevent adverse effects.

Characterizing Variability in Calculated Vancomycin Pharmacokinetic Parameters Using an AUC-based Dosing Strategy in Hospitalized Patients

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BACKGROUND: An area under the curve (AUC) to minimum inhibitory concentration (MIC) ratio is the preferred pharmacokinetic-pharmacodynamic (PK/PD) target to describe vancomycin (VAN) activity against *Staphylococcus aureus*. AUC-based dosing allows for calculation of patient-specific PK parameters using two levels after a single dose of VAN, for earlier dose-optimization. However, individual PK may be altered early in the course of therapy, particularly in critically ill patients. The primary objective of this study was to characterize the predictive value of first-dose VAN levels in attaining desired PK parameters at steady state.
METHODS: This was a single-center, retrospective cohort of adult patients who received intravenous (IV) VAN and had two VAN serum levels drawn after the first dose (FD) and at steady state (SS) between 2/1/17 and 1/31/18. Patients were excluded if they did not have appropriately timed levels, had baseline acute kidney injury, or were being treated for central nervous system infections. PK parameters collected included rate of elimination (Ke), volume of distribution (Vd), and AUC. Pearson correlations were completed to estimate the strength of association between FD and SS PK parameters. Clinical variables associated with variance in PK parameters were identified by multiple linear regression.
RESULTS: A total of 148 patients were included. Median age was 56 (IQR 39-66) years; 60.8% were male. The median SOFA score was 4 (IQR 1-6), mean weight was 85.2 kg (SD ± 24.27), and 43.9% of patients were in an intensive care unit (ICU). There was a weak but significant positive correlation between FD and SS Ke ($R^2 = 0.234$, $P < 0.001$), Vd ($R^2 = 0.119$, $P < 0.0001$), and AUC ($R^2 = 0.063$, $P = 0.003$). All correlations except Vd remained significant when stratified by ICU and non-ICU. There was also a significant positive correlation between predicted total daily dose (TDD) using FD and SS levels ($R^2 = 0.490$, $P < 0.0001$). SOFA score was a significant independent predictor of SS Ke (-0.002, SE 0.001).
CONCLUSION: Despite variance in calculated FD and SS patient-specific PK parameters, a moderate association exists between predicted TDD. Use of an AUC/MIC dosing strategy using first-dose levels can optimize dosing regimens earlier in the course of therapy.

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Development and Optimization of Specialty Pharmacy Clinical Outcome Measures within Johns Hopkins Outpatient Pharmacy

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Background: Johns Hopkins Outpatient Pharmacy (JHOP) has recognized the need to identify and develop standardized collection methods for clinical outcome measures (COMs) to demonstrate program quality and value to third party payers, manufacturers and internal stakeholders.
Objective: To define specialty COMs and develop a framework for collecting and reporting data to demonstrate value to internal and external stakeholders.
Methods: COMs for specialty pharmacy disease states (Cystic Fibrosis (CF), Hepatitis C (HCV), Inflammatory Conditions (IC) in Dermatology, Gastroenterology and Rheumatology, and Multiple Sclerosis (MS)) were identified through literature search, collaboration with specialty pharmacists, and committee review. Once identified, these measures were distributed to internal and external stakeholders including specialty clinic providers, drug manufacturers, and third party payors for validation. A standardized process for discrete documentation and data collection of these measures was implemented using case management software, electronic medical record integration, and informatics support.
Results: A total of 31 COMs were identified. Various data sources were incorporated into a virtual dashboard, including data from electronic medical records (EMR) (n = 11), patient reported outcomes (PRO) based on responses to pharmacist-delivered questions (n = 15), and pharmacist assessment of EMR outcomes (PA-EMR) (n = 5). Adjustments to documentation were implemented into specialty pharmacy case management software to allow for standardized data collection. The data collected was used to construct a specialty services dashboard that displays both population and patient-level outcome results on a quarterly basis.
Conclusion: This project describes methods to standardize documentation, data collection, and reporting of clinical outcomes data for multiple specialty conditions in the outpatient pharmacy setting within a large, integrated health system. Through literature review and stakeholder consultation, a variety of potential COMs were identified that required evaluation for feasibility and value as it related to documentation and data collection. Incorporation of COMs into a virtual dashboard can help facilitate the evaluation of program effectiveness, quality improvement planning, and sharing with stakeholders. Additional opportunities exist to further standardize COMs across the pharmacy industry to allow for future benchmarking and a standardized evaluation of patient care programs.

Evaluation of the Brief Alcohol Withdrawal Scale Protocol at an Academic Medical Center

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Background: The standard of care for treatment of alcohol withdrawal is symptom-triggered dosing of benzodiazepines using a withdrawal scale, most commonly, the 10-item Clinical Institute Withdrawal Assessment for alcohol, revised (CIWA-Ar) scale. Shorter and more objective scales are desirable. In 2016, the 5-item Brief Alcohol Withdrawal Scale (BAWS) and treatment protocol were developed and implemented at our institution.
Objective: To evaluate the use, efficacy, and safety of the BAWS protocol among inpatients at The Johns Hopkins Hospital.
Study Design: Single center, retrospective, observational, cohort study between August 2016 and July 2017.
Methods: Benzodiazepine use, time on protocol, withdrawal severity, agitation, delirium, and over-sedation were assessed among patients on protocol. Comparisons were conducted between patients in medicine vs. surgical services, intensive care units (ICU) vs. non-ICUs, and severe withdrawal vs. non-severe withdrawal. Finally, the use of adjunctive treatments for symptom management was assessed.
Results: 799 patients were included. Patients received a median (IQR) of 0 (0-4) lorazepam equivalents (LEs) while on protocol and were on the BAWS protocol for 44.9 (22.4-77.2) hours. Of the patients that received benzodiazepines while on the BAWS protocol, a median (IQR) of 4 (2-11) LEs were given. Seventeen (2.1%) patients had severe withdrawal. Days of agitation, delirium, and over-sedation were minimal, with the median (IQR) days of a RASS $\geq$ 2, CAM-ICU positive days, and RASS $\leq$ -2 of 0 (0-0). Few patients received adjunctive medications for symptom management.
Conclusion: Most patients on the BAWS protocol received little to no benzodiazepines; severe withdrawal, agitation, delirium, or over-sedation were uncommon. These findings support the BAWS as a reasonable symptom-triggered alcohol withdrawal scale and protocol that can be used across a variety of patient populations.

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Evaluation of Intra-Procedure Heparin Dosing During Atrial Fibrillation Ablation

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Objective: Catheter ablation is recommended as a treatment option for patients experiencing symptomatic atrial fibrillation who fail drug therapy. Currently, there is no standard procedure for managing intra-procedural anticoagulation. Heparin is administered to maintain an activated clotting time (ACT) >350 seconds during the procedure to prevent the formation of clot in the left atrium.

Patients undergoing ablation for atrial fibrillation must be anticoagulated prior to the procedure. This is commonly performed with uninterrupted warfarin, however there is less consensus surrounding the optimal strategy for direct acting oral anticoagulants (DOAC). The choice of oral anticoagulant as well as the decision to interrupt therapy may have an impact on the amount of heparin required to reach the desired ACT.

A review of practices at the Johns Hopkins Hospital in 2013 revealed that intra-procedural heparin requirements differed significantly depending on pre-procedure anticoagulant. Thus, a new dosing protocol was created to guide heparin dosing and attain a therapeutic ACT more rapidly. The purpose of this study is to determine if the new dosing protocol achieves the desired ACT effectively.

Methods: This was a single-center, retrospective cohort study of adult patients who underwent atrial fibrillation ablation between July 1, 2016 and October 1, 2017. Patients were identified from a Catheter Ablation database maintained by the Division of Cardiology. Patients were excluded from this study if they did not receive heparin during the catheter ablation. The electronic medical record was used to collect data including ACT, heparin dosing, and time of last oral anticoagulant prior to ablation.

Results: A total of 163 patients were included in the cohort. Patients were predominately male (63%) and Caucasian (84%) with a median age of 66. The median $CHA_2DS_2VAS_C$ score was 2 with a mean weight of 93.2 kg, while 59 (36%) of patients weighed >100 kg. Oral anticoagulant use prior to ablation was 83% direct acting oral anticoagulants, 13% warfarin, while 4% received no anticoagulation prior to procedure. Of patients receiving a direct acting oral anticoagulant, 21% had uninterrupted therapy prior to the procedure. 47% of patients obtained a therapeutic ACT (>350 sec) after the initial heparin bolus while the average total heparin dose required to achieve a therapeutic ACT was 144 units/kg. Of patients receiving DOACs, an uninterrupted strategy led to a therapeutic ACT faster than patients who were managed with an interrupted strategy (16.5 vs 32.5 min, p=0.0193). After the initial heparin bolus, a therapeutic ACT was achieved in 53% of patients $\leq$100 kg compared to 30% patients >100 kg (p=0.010). The time to achieve a therapeutic ACT was also significantly shorter in the group of patients $\leq$ 100 kg (25 min v 42 min, p=0.0003). There were no thrombotic or major bleeding events, however3 minor bleeding events occurred.

Conclusion: The intra-procedure heparin dosing guideline performed successfully in about half of patients presenting for catheter ablation. Patients receiving uninterrupted DOAC therapy prior to procedure achieved a therapeutic ACT faster than patients with interrupted DOAC therapy although, variation in holding patterns may have impacted these results. Patients weighing >100 kg may require a larger initial heparin dose to achieve an initial therapeutic ACT.

Impact of a 48-hour targeted antibiotic "time-out" in a community teaching hospital

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OBJECTIVE: Although a 7-day "automatic-stop" strategy has reduced antibiotic overuse in a community teaching hospital, further analysis of antibiotic days-of-therapy (DOT) figures currently indicate opportunities to further de-escalate antibiotics. Organizations such as the CDC, CMS and TJC recommend timely streamlining of antibiotics and firmly urge reviewing antibiotic use within 48 hours after initiation. This strategy may contribute to the 2020 CDC goal of reducing inappropriate inpatient antibiotic-use by 20%. The purpose of this study is to implement and review the impact of a 48-hour "time-out" streamlining strategy in a community teaching hospital.

METHODS: Observational, retrospective, single-center study from August 1, 2017 to July 1, 2018. Primary endpoints include changes in days-of-therapy per 1000 patient days (DOT/1000), changes in days-of-therapy at risk per 1000 patient days (DAR/1000), and changes in hospital-acquired Clostridium difficile (C.diff) rates. Hospital-acquired C.diff rates were calculated by dividing C.diff-positive patients over the study antibiotics. Secondary endpoints include changes in per-patient costs and changes in susceptibility rates. Baseline results were determined from August 1st, 2017 to September 30th, 2017. Inclusion criteria include adults receiving any of the following antibiotics: piperacillin/tazobactam, vancomycin, meropenem, ertapenem, azithromycin, levofloxacin, ceftriaxone, ceftazidime, cefepime, ceftaroline. The study excludes inpatients not on the targeted antibiotics, surgical prophylaxis patients and outpatients. Ongoing methods for data collection include data mining and patient chart reviews. The 48-hour "time-out" interventions were initiated on October 1st, 2017 and

include methods such as clinician education, an oath-based strategy ("Antimicrobial Stewardship Pledge") and pharmacist-documented interventions. This study was IRB approved in October 15th, 2017.
RESULTS: DOT/1000 results from baseline to February 28th, 2018 are as follows: piperacillin/tazobactam use decreased by 11.2 days, vancomycin use decreased by 9.6 days, meropenem use decreased by 14.5 days, ceftazidime use increased by 2.7 days, cefepime use increased by 4.8 days, levofloxacin use increased by 6.0 days, ceftriaxone use increased by 15.0 days, and azithromycin use increased by 42.7 days. DAR/1000 results from baseline to February 28th, 2018 are as follows: meropenem use decreased by 6.76 days, vancomycin use decreased by 4.79 days, piperacillin/ tazobactam use decreased by 4.96 days, cefepime use increased by 3.01 days, azithromycin use increased by 7.39 days and ceftriaxone use increased by 14.46 days. The data-mining platforms did not generate reliable data for ertapenem and ceftaroline. Rates for hospital-acquired C.diff rates decreased by 0.179%. None of the results for primary endpoints were statistically significant. Changes in susceptibility rates over the last year for Pseudomonas aeruginosa are as follows: piperacillin/ tazobactam susceptibility improved 2%, ceftazidime susceptibility improved 6%, cefepime susceptibility improved 10%, meropenem susceptibility decreased 7%. Per patient (purchasing) costs are as follows: vancomycin costs decreased by $0.44, piperacillin/tazobactam costs increased by $1.52, meropenem costs decreased by $0.70. None of the results for secondary endpoints were statistically significant.
CONCLUSION: The significant reduction in use of our protected antibiotics such as vancomycin, piperacillin/ tazobactam, and meropenem indicate that our institution is moving in the right direction. The 48-hour review process to reduce inappropriate use of these antibiotics is starting to be a more collaborative and significant effort. The increase in use of ceftriaxone, cefepime and azithromycin was expected; a shift in use toward other broad spectrum antibiotics. The data for susceptibility rates indicates that we are preserving antibiotic effectiveness. The data for hospital-acquired C.diff rates indicate that we need to escalate our strategies to reduce inappropriate use of antibiotics. Our future direction is to share the best practice recommendations for early de-escalation with providers, incentivize physicians to perform more 48-hour interventions, approach all clinicians to take our Antimicrobial Stewardship Pledge continuously, and engage all infectious disease specialists in all our Antimicrobial Stewardship initiatives.

Impact of Changes in Diuretic Regimen and Readmission Rates Following Transcatheter Aortic Valve Replacement

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Background: Patients with severe aortic stenosis often develop symptoms of heart failure, necessitating loop diuretics for symptom control. Diuretic requirements may change with improved hemodynamics following transcatheter aortic valve replacement (TAVR). This study aims to evaluate differences in readmission rates in patients discharged on the same diuretic dose (SDD) or a different diuretic dose (DDD) after TAVR.
Methods: Data from patients receiving loop diuretics who underwent TAVR at the University of Maryland Medical Center were retrospectively collected. Patients were excluded if they were on dialysis, required surgical intervention, or died during admission. The primary endpoint was all cause readmission within 30 days of discharge.
Results: One-hundred sixteen patients met inclusion criteria. Fifty-eight patients were discharged on the same diuretic dose and 58 on a different diuretic dose. The primary endpoint in the SDD and DDD groups occurred in 20 (17.4%) and 16 (13.9%) patients, respectively (odds ratio [OR] 0.7, 95% confidence interval [CI] = 0.29-1.67, *P*=0.4)}. Seven-day readmissions were more common in the SDD group, but were not for heart failure exacerbations or acute kidney injury. Six readmissions in the 30 days after TAVR were due to heart failure exacerbations in both groups.
Conclusion and Clinical Implications: Our study suggests that discharging patients on a different dose of diuretic post-TAVR is not associated with an increased risk of hospitalization, however dose adjustments were common in the first month after TAVR regardless of discharge dose. Close follow up on diuretic doses post-TAVR may help to minimize hospital readmissions.

The Impact of Pharmacist-led Discharge Counseling in an Inpatient Setting on Readmission Rates

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Objective: Hospital readmissions are forefront of national concerns. The Centers for Medicare and Medicaid Services (CMS), as well as the state of Maryland, are increasing efforts to decrease thirty day readmission rates for high risk disease states. Additionally, it has been found that up to one-third of all readmissions may be due to medication related errors. Pharmacists, as medication experts, are ideal practitioners to provide discharge counseling to patients and increase patient understanding of medication use, compliance, and adverse

effects. The objective of this study was to evaluate the impact of a pharmacist-led medication discharge counseling in the inpatient setting on readmission rates and overall patient care experience.
Methods: This study was a single center, longitudinal, comparative, interventional study. The impact of pharmacist-led discharge counseling on readmission rates was measured for high-risk disease states including heart failure, acute myocardial infarction, chronic obstructive pulmonary disease, hip or knee replacement, and pneumonia. Patient's overall pharmacy care experience was measured through a self-reported Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey for the control group, and a survey adapted from HCAHPS for the interventional group. The study was conducted at a 455-bed community teaching hospital following approval by the Institutional Review Board. Data was collected over a span of three years in four (4) intervention phases. There were minimal differences between the phases of the study. Inclusion criteria included participants 18 years or older, admission to telemetry or acuity adaptable units, high risk disease states, and patients who were English speaking. Exclusion criteria included patients with altered mental status or dementia, pregnant women, and patients being discharged to a nursing home or hospice care. The primary outcome was 30-day readmission evaluated in comparison to a retrospective control group. The secondary outcome measure was overall patient care experience measured via post-discharge questionnaire. Discrepancies were also measured. Sixty-nine patients were included in the intervention group; 457 patients were in the control group.
Results: A decrease in readmission rates was observed between the interventional arm and the control arm, 13.3% versus 5.7%, respectively (p=0.19). A sample size of 187 in the intervention group was needed to detect statistical significance. Approximately 78.1% of study participants in Phase I-IV stated that discharge medication counseling was "excellent" and that it improved their overall hospital experience compared to 55.7% of the control group(p=0.0005). A total of 5 medication discrepancies were reconciled in the interventional group.
Conclusion: The results of this study indicate the pharmacist-led medication discharge counseling in high-risk hospitalized patients can decrease readmissions, and improve patient's satisfaction regarding their pharmacy care experience. Incorporation of pharmacists into the medication discharge process is useful to promote a team-based approach to health care and optimize pharmacists' ability to enhance continuity of care.

Impact of medication screening to increase prescribing rates of medications that improve morbidity and mortality in patients with heart failure

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Background: Compared to enalapril, sacubitril/valsartan reduces mortality and hospitalizations among patients with HFrEF. Spironolactone has shown similar benefits in North Americans with HFpEF. Inpatient initiation of other mortality-improving heart failure medications has been associated with higher rates of use at 6 months of follow-up. The objective of this study was to develop screening criteria for inpatient initiation of sacubitril/valsartan or spironolactone, identify eligible candidates for these therapies, and assess the barriers to initiation during an admission for heart failure.
Methods: Patients admitted with a diagnosis of heart failure were screened daily to assess current inpatient medications, lab values, and vital signs. Due to concerns about monitoring for hyperkalemia, spironolactone candidates were required to be established patients at the Johns Hopkins Heart Failure Bridge Clinic (HFBC). In the absence of contraindications, the primary team was contacted and a recommendation for initiation was given. Barriers to initiation were documented when candidates failed to receive therapy during the hospitalization. Daily patient screening occurred from November 1, 2017 through February 28, 2018.
Results: Two-hundred patients were screened during the study period. There were 54 patients (23 with HFrEF and 31 with HFpEF) identified to be eligible for therapy. Of those, one patient was initiated on sacubitril/valsartan and three on spironolactone. Barriers to initiation included prescriber resistance, patient refusal, high copays, and lack of adequate follow up for electrolyte monitoring. One-hundred and forty patients had not been previously seen at the HFBC, and of those, only four had a new patient appointment scheduled upon discharge.
Conclusion: This study identified several barriers to initiating sacubitril/valsartan for HFrEF and spironolactone for HFpEF during inpatient admission. These findings indicate the need for additional physician and patient education about these therapies, as well as improved coordination of patient care during transition from hospital to home through clinics like the HFBC. Targeting inpatients for initiation of medications should be a priority, as these patients are at high risk for readmission, and inpatient initiation has been associated with higher long-term rates of medication use in HF. Increasing prescribing rates of medications that improve morbidity and mortality in heart failure have positive impact on patient quality of life and ultimately reduce healthcare costs associated with this disease.

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Implementation of a mindfulness education group in conjunction with a medication management service at a Veterans Affairs Hospital

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OBJECTIVE: Mindfulness is the state of being fully aware of the present moment, without filters or judgment. It is a practice that has been shown to have a positive impact on depression, substance abuse, pain, illness, immunity, and stress. Additionally, current literature provides evidence of a correlation between mindfulness practices and reduction in blood pressure. The primary objective of this project was to implement a novel service within the Patient Aligned Care Team clinic at VAMHCS that encompasses a mindfulness education group in conjunction with a medication management service.
METHODS: Clinical pharmacy specialists collaborated with clinical psychologists to conduct eight once weekly face to face group sessions, lasting 60 minutes that provided education and training on the practice of mindfulness. The mindfulness education included a discussion of various topics, such as responding to stress and planning for resilience, and also incorporated various exercises, such as breathing exercises, mindful eating, and sitting yoga. Three of these sessions (at weeks 1, 4, and 8) had an additional one on one medication management telephone appointment with the clinical pharmacy specialist where home blood pressure readings, time spent practicing mindfulness outside of clinic, and adherence to anti-hypertensives were reviewed and medication adjustments were made based on JNC8 or ACC/AHA guidelines. The Mindful Attention Awareness Scale (MAAS) was administered at initial and final visits, along with patient satisfaction surveys at final follow-up.
RESULTS: The mindfulness education group has successfully completed three eight-week sessions. Majority of patients improved their ability to avoid breaking or spilling of things due to carelessness or not paying attention. Additionally, a vast majority of patients no longer found themselves preoccupied with the future or the past after completion of the course. This is an exceptionally important concept to note as the purpose of mindfulness is to be fully aware of the present moment. All patients (100%) noted that they would recommend the Mindful Living Class to another veteran and more than 75% of patients rated the overall quality of the Mindful Living Class as “excellent”.
CONCLUSION: The Mindfulness Education Group demonstrated and continues to demonstrate the true benefit of this service amongst the veteran population. Pharmacists can play an integral role in the daily lives of patients for overall whole health and wellness by encouraging mindfulness practices across various clinics. There still remains opportunities to improve the care provided to veterans at VAMHCS through collaboration with other services, such as clinical psychology and primary care, to implement non-pharmacological modalities such as mindfulness practice in patient care.

Implementation of a student pharmacist-driven medication history service for ambulatory oncology patients in a large academic medical center

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Objective: Patients who have an up-to-date and accurate medication list are less susceptible to medication errors and allow care teams to make more informed treatment decisions. Through utilizing student pharmacists to provide medication history services in an optimized workflow to obtain updated and accurate medication lists, we anticipate that this will lead to an improvement in patient safety and overall quality of patient care. The purpose of this project was to implement a medication history service for ambulatory oncology patients of the Sidney Kimmel Comprehensive Cancer Center (SKCCC) at the Johns Hopkins Hospital.
Methods: A phased approach was utilized to implement a standardized operating procedure for completing medication histories in ambulatory oncology patients. Patients included in the study were those receiving treatment at the ambulatory oncology infusion center within the SKCCC at the Johns Hopkins Hospital. Patients excluded were those receiving investigational infusions, those deemed poor historians, receiving infusions in their home, receiving care at a long term facility and those only receiving oral anti-cancer agents. Data collection included number of total medication discrepancies, percentage of patients with high risk medications, high risk medication classes involved in discrepancies, time spent calling patients, time spent completing patient work up, time spent with patient, and time spent by preceptor reviewing documentation.
Results: Student pharmacists completed medication histories for 60 patients. 83% of patients had at least one discrepancy with 21% of those discrepancies involving a high-risk medication. High-risk medications involved in discrepancies included oral anti-cancer agents, anticoagulants, insulin and opioids. The most common discrepancies noted were omissions and commissions. The average time spent with patients conducting the medication history was 16 minutes.
Conclusion: The majority of patients seen had at least one medication discrepancy that was identified and corrected through the medication history service. By correcting the discrepancy, the likelihood of medication errors occurring was decreased. After the implementation of the medication history service, continuous workflow changes are being made to identify the number and type of resources to expand the service to all appropriate ambulatory oncology patients at the SKCCC.

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Oral Vancomycin plus Intravenous Metronidazole for Severe *Clostridium difficile* Infection in Critically Ill Patients

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BACKGROUND: There remains a paucity of data regarding optimal treatment of patients with severe *Clostridium difficile* infection (CDI) in the intensive care unit (ICU). Based on expert opinion, the 2018 SHEA-IDSA clinical practice guidelines recommend combination therapy (oral vancomycin plus intravenous (IV) metronidazole) in fulminant CDI only. A 2015 study suggested a mortality benefit with combination therapy of IV metronidazole (MDZ) and oral vancomycin (PO VAN) for ICU patients regardless of severity. The objective of this study was to determine the impact of combination therapy on clinical outcomes in ICU patients with severe CDI, compared to PO VAN monotherapy.
METHODS: Single-center, retrospective, cohort of adult patients admitted to an ICU between April 2016 and April 2018 with a positive *C. difficile* nucleic acid amplification test and an order for PO VAN were screened for inclusion. Patients were excluded if they had life-threatening intra-abdominal complications, including toxic megacolon/ emergent colectomy. The primary outcome was 30-day in-hospital all-cause mortality. In a subgroup analysis, patients were matched using Acute Physiology and Chronic Health Evaluation (APACHE) II scores. Logistic regression was conducted to identify clinical variables associated with mortality.
RESULTS: 101 patients were included; 47 received combination therapy with IV MDZ. Baseline characteristics were similar across groups, except patients in the IV MDZ group had a higher median WBC count at diagnosis (18.4 vs 13.9, $P = 0.023$) and were more likely to receive a higher dose (500 mg) of PO VAN (36.2% vs 7.4%, $P < 0.0001$). Thirty-day mortality was 14.9% in the combination group vs 7.4% in the monotherapy group, ($P = 0.338$). APACHE II Score was the only variable independently associated with 30-day mortality (OR = 1.13, 95% CI 1.03 – 1.24). There was no difference in probability of receiving IV MDZ based on APACHE II score. In a subgroup of patients matched by APACHE II Score (n = 76), mortality remained non-significantly different (15.8% vs 9.7%, $P = 0.480$).
CONCLUSION: Our data questions the utility of IV MDZ in addition to PO VAN for ICU patients with severe CDI. There remains a possibility for confounding by indication in this retrospective analysis.

Post-Operative Nonsteroidal Anti-Inflammatory Drug (NSAID) Use for Pain in Infant and Pediatric Cardiac Surgery Patients

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Objective: To evaluate the safety and efficacy of non-steroidal anti-inflammatory drugs (NSAIDs) in pediatric patients after cardiac surgery.
Design: Retrospective cohort chart review
Setting: Academic medical center
Patients: Patients aged 1 month to 18 years old receiving NSAIDs post cardiac surgery were included. Patients with known renal failure, chronic kidney disease, history of gastrointestinal bleeds or receiving therapeutic anticoagulation were excluded.
Interventions: None
Results: There was no association between the incidence of renal dysfunction and the use or duration of NSAIDs. There was a statistically significant association between the change of SCr and patients with surgical complications ($p = 0.003$). On average, patients with surgical complications had an increase in SCr by 0.07 mg/dL compared to patients without complications. In addition, there were no association seen between total chest output and any of the variables, including the duration of NSAIDs ($p > 0.15$). There was a statistically significant reduction of patients' median FLACC scores seen within the first 24 hours after initiation of ketorolac from 2 to 0 ($p = 0.003$) and a statistically significant reduction of morphine requirements seen from day 1 to day 2 (0.3mg/kg vs. 0.1 mg/kg; $p<0.001$) and from day 2 to 3 with patients requiring no morphine ($p <0.001$). Similarly with the morphine requirements, there was a statistically significant reduction in the number of IV PRNs used from day 1 to day 2 (4 vs. 1) and again from day 2 to day 3 ($p<0.001$) in which patients were not requiring any additional IV PRN doses.
Conclusion: Routine use of NSAIDs in pediatric cardiac surgery patients is both safe and effective for post-operative pain management with regards to the incidence of renal dysfunction or bleeding complications. In addition, patients had a significant reduction of opioid use while on NSAIDs.

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Unfractionated heparin (UFH) for venous thromboembolism (VTE) prophylaxis in critically ill patients: characterization of dose-response by weight

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OBJECTIVE: Obesity has been described as an independent risk factor for VTE, however due to altered pharmacokinetics in obese patients, the standard dosing of UFH (5,000 units every 8 hours) is likely not sufficient. Retrospective studies comparing 5,000 units to 7,500 units every 8 hours in obese patients have yielded inconsistent results. Studies in bariatric surgery and pregnant patients that have utilized peak anti-Xa levels to guide dosing have targeted varying ranges, which can all be described as measurable, yet subtherapeutic levels (i.e. 0.1-0.29 u/mL). The primary objective of this study is to describe and compare the percentage of peak anti-Xa levels within goal range for patients <100 kg and patients ≥ 100 kg receiving UFH 5,000 or 7,500 units every 8 hours. Incidence of VTE and bleeding events were also evaluated between the weight groups.
METHODS: This prospective, observational study includes patients who are ≥ 18 years old, admitted to a medical or surgical intensive care unit (ICU) within the past 72 hours, and have an active order for UFH 5,000 or 7,500 units every 8 hours. Exclusion criteria includes anticipated length of stay in the ICU < 48 hours, indication for therapeutic anticoagulation, and weight < 50 kg. Each enrolled patient had a peak and trough level drawn at steady state and were followed until death or discharge for clinical outcomes.
RESULTS: Enrollment is ongoing, with 73 patients enrolled to date. The follow results are based on an interim analysis of 67 patients. Thus far, the majority of patients (92.5%) have received 5,000 units every 8 hours. There was no significant difference found in the percentage of patients with peak anti-Xa level within goal range between patients <100 kg and ≥100 kg (51.5 vs 37.0%, p=0.26). Additionally, there was no significant differences found with regards to median peak and trough anti-Xa levels. No significant differences were found regarding trough anti-Xa levels, incidence of VTE, bleeding, length of stay, or mortality.
CONCLUSION: No significant difference was found with regard to the percentage of peak anti-Xa levels within goal range at this time. Final conclusions will be made at the completion of the study.

Value of competency-based pharmacy performance metrics on patient-centered and financial outcomes in a community hospital setting

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OBJECTIVE: Pharmacists have an expanding role in the inpatient setting related to optimizing medication therapy, ensuring patient safety, and reducing unnecessary drug utilization. A report published in AJHP regarding national 2017 trends in drug expenditures showed that drug costs account for 7.7% of total hospital costs and has increased from 2015. ASHP's pharmacy advancement initiative (PAI) aims to streamline pharmacists' role in the care of patients. Prior data results have shown that implementation of competency-based pharmacy performance metrics improves specific targeted measures. The purpose of this study is to assess the financial impact and effect of utilizing performance metrics on patient-centered outcomes.
METHODS: The study is a single-centered, retrospective, comparative analysis. Performance metric data related to drug utilization, antimicrobial streamlining, and patient encounters from July 2015 to June 2018 were used to assess strategic and financial outcomes. The primary endpoint will be the monthly expenditure of high-use or high-cost medications (i.e., epoetin, IV iron, and broad-spectrum antibiotics) compared to the number of documented pharmacist clinical interventions. Secondary endpoints include annual antimicrobial and clinical interventions as well as average days of therapy and length of stay for patients on piperacillin/tazobactam. Primary outcome data were analyzed using multiple regression analysis.
RESULTS: There was a statistically significant inverse relationship between the number of clinical interventions and IV iron expenditures. However, this effect was not seen with epoetin or broad-spectrum antibiotic. For secondary endpoints, both antimicrobial streamlining and the total number of clinical interventions have decreased from FY2016, which is influenced by many external factors. Furthermore, the average length of stay and duration of therapy for patients on piperacillin/tazobactam has trended down each year since FY2016.
CONCLUSION: This gives some insight into the impact of documented clinical pharmacist intervention on changing prescribing behaviors to reduce excess utilization and reduce expenditure. Increased number of clinical interventions significantly decreased expenses for IV iron. However, this was not true in regards to epoetin or broad-spectrum antibiotics. More studies with different outcomes need to be conducted to show the impact of pharmacists due to the many external variables impacting this study.