TITLE: Population health and remote patient monitoring hypertension service alignment

Authors: Alexandra Lindo, PharmD; Andrew Stevens, PharmD, BCPS; Carolyn Hickman, PharmD, BCACP; Sushma Dey, PharmD; Jenna Lee, PharmD, BCPS, BCACP; Marie Renauer PharmD, MBA, BCACP

BACKGROUND/PURPOSE:

Only a quarter of patients with hypertension have effective management of their condition. Remote Patient Monitoring (RPM) utilizes technology to collect health-related data from patients, and securely transmit this information to healthcare providers. Literature has shown RPM helps improve blood pressure control and patient access to care. Several health system initiatives that target improving blood pressure control in our community are requesting integration of pharmacists for collaborative chronic disease management. The purpose of this project was to align pharmacist-led RPM of hypertension with existing services to allow for a scalable workflow to augment access to care.

METHODS:

An assessment was done to identify areas where pharmacists are currently providing hypertension care and to understand where there is independent management of medications. The current Collaborative Practice Agreement (CPA) was analyzed for gaps in prescribing potential through collaboration with stakeholders and review of current practice guidelines and bulletins. A comprehensive review of published literature on workflow alignment for remote patient monitoring services was conducted. Eight phases of the workflow were defined based on literature review and team member expertise to streamline the workflow: eligibility, referral, enrollment, device set-up, initiation, maintenance, and dis-enrollment. Existing workflows in these areas were reviewed and areas for optimization were identified. Current methods utilized for remote blood pressure monitoring were considered, including applications and digital devices for direct transmission of data to the electronic health record (EHR). Pharmacist and provider feedback regarding ease of use was received.

RESULTS:

The updated CPA was developed in collaboration with stakeholders to include management of hypertensive disorders during pregnancy. Providers signed onto the CPA can refer their patients to pharmacists for remote patient monitoring and pharmacologic management of hypertension. At the launch of the RPM service, patient referral will be limited to individuals seen outpatient by providers signed onto the CPA, with the potential to expand referral opportunities to the inpatient setting through pathway referral processes in the future. Various blood pressure reporting techniques, including cellular device applications, technology that connects blood pressure monitoring devices to EHRs, and manual blood pressure reporting are available to accommodate different levels of technology competency. All blood pressure readings will automatically pull into patients' charts and will notify providers via EHR messaging. Newly enrolled patients will be educated on device configuration and appropriate blood pressure monitoring techniques at the time of enrollment or initial visit. Digital education and handouts will be available as supplemental teaching tools. Intensive daily monitoring of blood pressure levels will be completed during the initial phase following enrollment. Medication adjustments will be made by pharmacists according to the CPA throughout the initial and maintenance phases. Dis-enrollment criteria to define procedures for patient graduation from the service is outlined. The workflow is defined to allow for an efficient and effective patient enrollment and referral process, successful device

configuration and education, systematic blood pressure monitoring and medication modification, and standard criteria for dis-enrollment.

CONCLUSION:

The alignment of population health and remote patient monitoring hypertension services, along with the implementation of an efficient workflow, allow for an expansion of care. Defining workflow criteria is essential to ensure an efficient and effective process is in place when workflow is scaled to a larger population. Evidence from research on similar implementations suggests that these changes have the potential to significantly improve access to care and a future project could be designed to quantify the increase in patient access.

Title: Outpatient nursing perceptions of pharmacy service at a Veterans Affairs (VA) healthcare center

Author: Lara Jocelyn Albrechcinski, PharmD

Background/Purpose:
Evidence shows a strong correlation between improved patient outcomes and successful interprofessional collaboration. Having an interprofessional team that develops mutual trust and recognition of each other's competences and skills can also improve efficiency when completing tasks as well as the overall cost-effectiveness of care. In order to facilitate effective interprofessional collaborative practice, healthcare professionals must first be provided with opportunities to learn about, from, and with each other.
Recognizing the benefits of interprofessional collaboration, a previous quality improvement study has been conducted to evaluate the opinions of inpatient nursing staff toward their interactions and collaborations with pharmacists, pharmacy technicians, and pharmacy leadership within the VA Connecticut Healthcare System (VACHS). The aim of this quality improvement project is to extend the evaluation of opinions of VACHS nursing staff towards their interactions and collaborations with pharmacy services to specifically outpatient nursing staff, to identify barriers to effective communication, and to strengthen interprofessional collaboration in order to ultimately improve patient outcomes.

Methods:
Single centered, qualitative analysis of self-assessment questions completed by outpatient nursing staff at VACHS during March 2023. Self-assessment questions were provided to outpatient nursing staff via Microsoft Forms and a printable document by nursing supervisors, clinical pharmacist practitioners, and the authors of this study. Outpatient nursing staff were asked to voluntarily complete the self-assessment by March 31, 2023.

Results:
A total of 56 outpatient nursing staff completed the questionnaire by March 31, 2023. Most participants had been employed at VACHS for more than 5 to 10 years and work in outpatient specialty clinic. Telephone communication was the most common modality used by nursing staff to communicate with pharmacy which occurred 1-2 times per shift for assistance resolving medication or patient related issues. It was found that communication with both the outpatient pharmacy staff and Clinical Pharmacist Practitioners (CPP) was timely and efficient, however was needed less frequently with the

CPPs during the nurses work shift. All participants agreed that collaboration with members of the pharmacy team improved overall patient outcomes, with 42.9% strongly agreeing that their knowledge of drug therapy has improved as a result of collaboration with the pharmacy team. Nursing staff found pharmacy to be dependable, with 61% indicating that they can always rely on pharmacy services to assist with any medication-related issues that arise. Approximately 62.5% of participants strongly agreed that nursing staff would benefit from periodic education about medication related topics, with monthly education being the most common requested frequency (44%). In addition to periodic education, 85.8% of nursing staff indicated that they would benefit from pharmacy-created handouts for patients about medication-related topics, which include storage and handling information, drug interactions, and resources for Veterans.

Conclusion:
Overall, the perception of pharmacy services at VACHS by outpatient nursing staff is positive, which confirms the quality of current practices between pharmacy and outpatient nursing services. The results of this survey found that education from pharmacy service on a periodic basis would be beneficial to nursing staff. In response to these results, the Pharmacy service intends to work to provide additional educational opportunities for nursing staff which will assist with improved patient outcomes and continued successful interprofessional collaboration.

Evaluation of Anti-Xa-Guided versus aPTT-Guided Management of Intravenous Unfractionated Heparin

Primary Investigator: Shahad Almahmoud, Pharm.D

Co- investigator: Antonia DeQuevedo, PharmD, CACP, BCACP

Background:

Unfractionated heparin (UFH) is a major intravenous therapy used for decades. When using heparin infusion for the treatment some conditions such as venous thromboembolism (VTE) or acute coronary syndrome (ACS), it is challenging to maintain its level at the therapeutic range that is safe and effective.[1] Thus, close laboratory monitoring is necessary. Most used laboratory tests are the activated partial thromboplastin time (aPTT), and anti-factor-Xa (anti-Xa). Anti-Xa is considered more direct measure of UFH activity than the aPTT and would demonstrate less variability and exhibits minimal interference from the physiologic and non-physiologic factors.[2] The objective of this study is to evaluate and compare the aPTT with the anti-Xa monitoring for the efficacy in patients who received intravenous UFH infusions.

Methods:

Single-center, retrospective, observational cohort study of patients who received heparin infusion from June 2022 to October 2023 (More patients to be included for the duration of November 2022 to March 2023). Data was collected using hospital's electronic health records (EHR) at a community Hospital. Primary endpoints include number of dose adjustments required to achieve therapeutic goal, time needed to reach to the therapeutic goal, and percentage of time within the goal. Secondary endpoint is number of bleeding events. New order sets were implemented for the use of both laboratory tests aPTT and Anti-Xa. According to the protocol, anti-Xa monitoring should be used in patients with acute coronary syndrome, venous thromboembolism, prosthetic valves, or left-ventricular assist device requiring full

anticoagulation in whom the aPTT may be an inaccurate measure of heparin response with standard dose and goal (0.3 – 0.7). Additionally, anti-Xa monitoring may be appropriate to be used at a lower dose and goal (0.2 – 0.5) for other specified patients. The statistical analyses were mainly descriptive statistics whereas chi square test was used to analyze the discrete variable endpoints. Adult patients (≥ 18 years old) who received UFH > 24 hours were included. The study was exempted by the local Institutional Review Board.

Results

Preliminary analyses captured forty-one patients treated with UFH infusion; aPTT monitoring (*n* = 30) versus anti-Xa monitoring (*n* = 11). The median number of times aPTT and anti-Xa values were ordered per day was 2.3 (range, 7 – 16.6) vs 1.7 (range, 7 – 15.5) respectively. The median number of dose adjustment to reach the target level was 2.0 adjustments with aPTT vs 1.5 adjustments with anti-Xa. The time to reach therapeutic range was 2.3 days with aPTT vs 2 days with anti-Xa which was not statistically significant. Therapeutic range (>81%–100% of the time) was achieved in only 4 (13%) patients in the aPTT group vs. 6 (55%) in the anti-Xa group which was shown to be statistically significant; range (>40% - 80% of the time) was observed in 15 (50%) patients in the aPTT group vs. 4 (36%) in the anti-Xa group which was not significant; range (<40% of the time) were observed in 10 (33%) patients in the aPTT group vs. 1 (9%) in the anti-Xa group which was not significant as well. No adverse drug events were observed.

Conclusion

Utilizing an anti-Xa protocol to monitor heparin infusion appears to show better results compared with utilizing an aPTT protocol by maintaining values within the therapeutic goal range for longer time and performing less dose adjustments. Additionally, number of aPTT labs obtained were higher compared to anti-Xa group which could have a considerable financial impact.

Optimizing Workflow for Ambulatory Pharmacy Technicians

Authors: Nada Asfour, PharmD, Emily Tang, PharmD, BCACP, Natasha Stroedrecke, PharmD, Steph Luon, PharmD, BCACP, BCPS, Jenna Lee, PharmD, BCACP, BCPS, Vincent Do, PharmD, BCPS, BCTXP, Heather Kutzler, PharmD, BCPS, Marie Renauer, PharmD, MBA, BCACP, Sera Monestime, PharmD, BCPP, Ashley Defalco, CPhT, Krystal Zook, CPhT

Background: The medication management clinics are pharmacist driven and provide high-quality, patient-centered care for patients eligible for specialty medications. Seven technicians support this service with responsibilities divided between two pods. A recent descriptive analysis of this model revealed inequities in task assignments between technicians. As ambulatory pharmacy services continue to expand, there is a need to restructure the current technician workflow. This project aims to address inequities in technician workload distribution and identify areas for workflow optimization. The resulting workflow model is intended to improve efficiency, thus providing clinical pharmacists the capacity to practice at the top of their licenses.

Methods: A team that consisted of pharmacy leadership, pharmacists, and technicians collaborated to identify workflow inefficiencies and inequalities to develop targeted interventions. An action plan was prepared to guide the team and keep track of milestones required for completion. Opportunities to enhance the pharmacy technician workflow were identified by reviewing a detailed process map of the current workflow, employee feedback, and an internal analysis of workload. In addition, data was collected through direct observation of pharmacy technicians completing daily tasks as outlined per their responsibility grid. Based on the findings of the historical analysis of technician workload and collected data, an alternative model to the existing pod model was developed. The proposed new model offers a more equitable workload that aligns technicians with pharmacists in an approximate one-to-two ratio.

Results: The proposed model was approved by ambulatory pharmacy leadership. The model aligns technicians with pharmacists in a set ratio intended to accommodate ramp-up of pharmacist patient panels. An established pharmacist and a newly integrated pharmacist will be paired together to maintain similar total patient panel sizes that each technician will support, resulting in a more equitable workload for all tasks. It was determined that the implementation of a call-center would assist in triaging phone calls, allowing for the option to send patients directly to the outpatient pharmacy or to the affiliated pharmacist's technician. By streamlining the triage process, the call-center design frees up clinical pharmacists' time to focus on clinical tasks. To communicate the changes resulting from this project, the technician responsibility grid was updated to reflect the shift in responsibilities based on this new alignment. Corresponding training and education regarding the new workflow were also provided.

Conclusion: This project identified opportunities for workflow optimization. The new alignment will provide a more equitable distribution of work amongst technicians and provide administrative support to pharmacists allowing them to focus on the clinical needs of their patients. As ambulatory services grow, this project will serve as the infrastructure for continued expansion and optimization. These findings may be used to support best practices for ambulatory pharmacy technician workflow in other healthcare settings. Continuous improvement processes, such as tracking of call-center metrics, will be established to monitor the optimized workflow and identify areas for further improvement.

Title	**Proactive Review of Elevated INR Greater than Five Quality Improvement Project**
Authors	Shea Bacon, PharmD
Background/purpose	Hospitals are ranked based on structure and practices associated with high quality and safety performance which is evaluated by annual studies. The annual Vizient Quality and Accountability study assessed data from academic facilities using safety, mortality, effectiveness, efficiency, patient centeredness, and equity domains. Elevated international normalized ratio (INR) above five was identified as an opportunity for improvement at Yale New Haven Health. Ramifications of elevated INRs include life-threatening bleeding requiring reversal agents and potentially longer length of stay. This project aims to develop a system-wide quality assurance prospective workflow to improve medication safety use of warfarin.
Methods	Using the existing warfarin-monitoring workflow as a foundation, an action plan was developed to outline proactive steps necessary for safety and quality improvement of elevated warfarin INR greater than five. First, two independent, retrospective case reviews of defect cases were performed to identify gaps in care. Using Vizient's 2021 study, cases were categorized using variables such as reason for use, reason for admission, identified drug interactions, pharmacy-to-dose or provider dosing strategies, INR trend, and dosing regimen. Cases were classified as being preventable with pharmacist protocol, preventable with clinical judgment and not preventable. Based on identified trends, a proactive workflow was developed and proposed.
Results	Based on the retrospective case review, two identifiable trends among the data included INR increases greater than 1 since last INR and provider-directed dosing strategies. These findings lead to the development of a best practices alert (BPA) and a warfarin order panel to be implemented in the revised workflow. Within the proposed workflow, the primary care team will utilize the warfarin order panel to consult pharmacy, order baseline INRs, reference drug interactions, and observe the most recent INR. Primary care members will also be able to select initiation or continuation of therapy with suggested starting doses and adjustments based on INR and patient-specific factors. Once warfarin is ordered, a BPA will alert the primary team of an INR increase >1 from last INR within 48 hours. Data will be collected based on these updated interventions to determine safety and quality improvements.
Conclusion	After reviewing the 2021 delinquent cases, an improved workflow was developed to incorporate the warfarin order panel and BPA. Future directions of this project include collecting data from the 2023 fiscal year to be utilized in identifying the efficacy of quality and safety improvement with the newest additions. BPA data will be analyzed based on acknowledgment reason and subsequent INR trend, pharmacy-driven versus provider-driven protocol, and number of supra-therapeutic INR cases. The warfarin order panel will be implemented, and data will be collected based on appropriateness of starting dose, continuation of home regimen, INR trend, and drug interactions.

Developing a Request for Proposal (RFP): Automation & Technology

AUTHOR: Bianca Bartoli, PharmD; Mark Rogers, PharmD, MBA; Nigjar Polat, PharmD, MBA, CPPS; Alex Dozier, PharmD

PURPOSE:

Automation and technology drive medication distribution within inpatient and outpatient settings. Automated dispensing solutions and technologies are essential to provide adequate medication access, optimize inventory, and enhance medication safety and security. Health-systems regularly sign a contractual agreement with automation and technology vendors to supply systems and support related to medication dispensing cabinets. In 2024, Yale New Haven Health-System's (YNHHS) automated dispensing cabinet (ADC) contract will expire, allowing the opportunity to submit an RFP to evaluate potential vendors. The purpose of this project is to describe how an RFP, suitable for submission to automation and technology vendors, was issued at YNHHS.

METHODS:

Five hospitals, including affiliated outpatient locations at YNHHS, were determined to be in-scope due to their utilization of ADCs. Locations were deemed out-of-scope if they were not a part of the health-system and/or did not use automated dispensing technologies. When identifying the material to include in the RFP, the team started by conducting research. This research included utilizing resources from our corporate partnerships and examining similar use cases and recent examples of RFPs submitted in the past. In order to collect information from potential vendors in an organized manner, an open-ended questionnaire was developed. This questionnaire format allowed for a side-by-side comparison of vendors.

These resources were reviewed, incorporated into our RFP, then adjusted to include feedback from our internal teams. Once the material was collated, the list underwent several rounds of review and editing to ensure questions were clear, specific, and in an orderly fashion. Questions were then placed into seventeen categories, which facilitated the review process for both our key stakeholders, and eventually the vendors. Once the list of categories and questions were confirmed, the team presented the list of questions at several meetings and requested feedback from key stakeholders within the organization. Utilizing these resources and incorporating stakeholder feedback ensured all necessary and pertinent questions were included.

RESULTS:

Yale New Haven Health-System developed a request for proposal (RFP) suitable for submission to automation and technology vendors in preparation for contract expiration. This RFP process prioritized clear contract communication, enhancing technology and services, and improving overall medication and patient safety.

Developing the RFP was the initial step of determining YNHHS’s automation and technology system decision. Future directions include submitting the RFP to chosen vendors and evaluating the responses when received. In order to evaluate the responses, the team will assign weights to each question. To determine the value and importance of each question asked, the team will collaborate with internal teams and area experts. In addition, as part of the evaluation process, vendors will be performing

walkthroughs to evaluate technology spaces on patient care units to propose adequate equipment to meet patient care demands. Vendors will also visit YNHHS sites to demonstrate their products. The team will include key stakeholders and nursing leadership within the organization in these site visits and technology demonstrations to receive their input and opinions. Finally, YNHHS will finalize the contract decision, sign with one vendor, and the updated automation and technology software will go-live, with the plan of standardizing technologies across the health-system.

CONCLUSION:

Institutions looking to submit a healthcare request for proposal should utilize available expertise and resources within the organization and leverage resources and partnerships external to the organization. This will ensure the health-system has created a thorough, all-inclusive RFP document for vendors to complete, and health-systems to evaluate. Asking high-quality questions allows for the most detailed responses, leading to the best-informed decision, setting organizations up for success for the next 5+ years.

Implementation of Revisions to Residency Policies and Processes to Align with the 2023 ASHP Accreditation Standard Updates

Authors: Nauka Bhalodia, PharmD, Jaclyn Kowalski, PharmD, BCPS, Michelle Kelley, PharmD, Shannon Giddens, PharmD, BCPS, BCPPS

Background: The American Society of Health-System Pharmacists Accreditation Standard for Postgraduate Residency Programs establishes criteria for the training of pharmacists to achieve professional competence. Yale New Haven Health System currently has sixteen ASHP-accredited residency programs and two candidate-status residency programs. The standard describes the criteria used in evaluation of programs that apply for accreditation and reaccreditation of their programs. The purpose of this project was to create tools to audit and revise current residency processes and policies to make sure they are compliant with the new harmonized standard going into effect on July 1, 2023.

Methods: A gap analysis was conducted between the current standard and the new harmonized standard to determine what changes the ASHP Commission on Credentialing made to the standards since their last update in 2016. Each standard was reviewed individually including the guidance, how the standard will be surveyed, existing supporting materials and policies, and determining recommended actions to achieve compliance. Workgroups consisting of residency program directors and coordinators were assigned to individual standards and tasked with reviewing existing policies/processes and/or creating tools for auditing preceptor eligibility and qualifications, learning experiences in the electronic residency evaluation system, individual programs' taught and evaluated grids, and overall pharmacy services including health/wellness standards.

Results: The workgroups have created tools in the form of excel sheets, policy reviews, and guidance documents for auditing changes to the recruitment and early commitment, leave of absence and duty hours, and licensure and dismissal policies. Graduation requirements, preceptor academic and professional records, learning descriptions for rotations found on the electronic residency evaluation system, taught and evaluated grids, leadership and medication safety, and pharmacist-technician

involvement in transitions of care and health and wellness events were also audited and updated to comply with the harmonized standard.

Conclusion: Over four policies were reviewed and six audit tools were created to guide residency program leadership in preparation for compliance to the 2023 harmonized ASHP Accreditation Standards for PGY1, PGY1 community, and PGY2 residency programs. The updates to these policies and processes will allow us to ensure adherence with the standards and ensure that our residency programs continue to train residents to be skilled in diverse patient care, practice management, leadership, and education.

Effect of community pharmacy-administered long-acting injectable medications on patient adherence, hospitalizations, and ED visits due to psychiatric reasons

Author: Jonathan Blais, PharmD

Background/Purpose:

Long-acting injectable (LAI) antipsychotic medications have been associated with greater adherence rates as well as improved health outcomes for patients compared to oral formulations. An issue for many patients, however, is that the availability of locations to receive these long-acting injectable medications is limited. In light of this, our community pharmacy has created a collaborative practice agreement with a behavioral health clinic for our pharmacy to administer LAI antipsychotics.

The purpose of this research was to examine the association of community pharmacy administered LAI antipsychotic medication on patient outcomes. The primary goal of the research was to evaluate the association of pharmacist-administered LAIs and patient adherence to their LAI medication. The secondary goal was to evaluate the association of pharmacist-administered LAIs and risk of hospitalization and ED visits in patients requiring LAI treatment.

Methods:

This was a descriptive, retrospective study that qualified for exemption from the IRB. The long-acting antipsychotic medications were administered by a pharmacist as outlined in our collaborative practice agreement with a behavioral health clinic within the health system. The primary goal of the research was to identify the impact community pharmacist administered long-acting injectable antipsychotics have on patient adherence to their medication. Adherence was defined as the percentage of patients who continued to receive LAI medication from our pharmacy during the date range of inclusion (July 1st 2022 through April 1st 2023). Non-adherence was described as the percentage of patients who, at any time, were one month late from their next due dose, or who discontinued LAI therapy completely. Secondarily, the rates of hospitalization and ED visits in patients receiving long-acting treatment were evaluated. Patients were considered as hospitalized or had an ED visit for a psychiatric purpose if their primary diagnosis upon admission was for a psychiatric concern. This information was identified through the electronic medical record system. Medications that were available to be administered by the pharmacist per the collaborative practice agreement included: Abilify Maintena (aripiprazole monohydrate), Aristada (aripiprazole lauroxil), Aristada Initio (aripiprazole lauroxil), Invega Sustenna (paliperidone palmitate), Invega Trinza (paliperidone palmitate), Risperdal Consta (risperidone), Prolixin

Decanoate (fluphenazine decanoate injection), Haldol Decanoate (haloperidol), Invega Hafyera (paliperidone palmitate), and Perseris (risperidone) for extended-release injectable suspension.

Results:

A total of 6 Patients received LAI antipsychotic injections at our pharmacy from July 1st 2022 through April 1st 2023. Of those 6, 3 patients (50%) remained adherent to therapy and have continued with the LAI service. Of the 3 patients who discontinued, 2 were lost to follow up with our service due to unclear reasons and/or loss of follow up with the psychiatric providers. Additionally, 1 patient was lost to our service due to preference for a visiting nurse (VNA) to pick up and administer the medication at their home.

No patients were seen in the emergency department or were hospitalized for psychiatric reasons while they were actively in the program. Of note, one patient was hospitalized for psychiatric reasons, however this was following discontinuation of the program and loss of follow up with the psychiatric providers. A total of 30 administrations of LAI occurred at the pharmacy.

Conclusion:

A total of 3 patients out of 6 (50%) discontinued therapy or were lost to follow up when their LAI antipsychotic medication was administered in the community pharmacy setting. While this study had a small population size, it was able to highlight key barriers to care including patient travel requirements and possible inconvenience. Meanwhile, 3 patients have remained adherent to therapy in this setting, which may be attributed to closer pharmacist follow up and involvement with the care team as well as better service or convenience. While this study shows potential for additional pharmacist interventions within the community setting, additional research may be beneficial to better examine the association and benefit on patient outcomes.

Evaluation of an inpatient penicillin skin testing program

Author: Mary Margaret Bliss, PharmD

Background/Purpose:

Many patients with reported penicillin allergies do not have true anaphylactic reactions. These patients often receive alternative broad-spectrum antibiotics, which contribute to increased antimicrobial resistance and costs. Penicillin skin testing has been validated to detect and rule out true, type one IgE-mediated allergic reactions and thus has a role in optimizing antimicrobial therapy. The inpatient penicillin skin testing program at UMass Memorial Medical Center (UMMMC) has been underutilized since its implementation in October 2020. The UMMMC Pharmacy Department prepares inpatient penicillin skin test kits on demand with an expected turnaround time of two hours. A specially trained provider administers the skin test. If the skin test is tolerated, an oral amoxicillin challenge is separately administered to conclude the procedure. This study aims to evaluate the program and identify opportunities for optimization.

Methods:

A single-center, retrospective, IRB-approved study was performed that included all adult inpatients ordered for and administered penicillin skin testing from October 2020 to October 2022. The primary outcome was to assess the skin testing program workflow. Each patient's medical record was reviewed to determine how long each step of skin testing kit preparation took. Secondary outcomes included incidence of adverse effects, rescue medication administration, penicillin allergy updates, antibiotic regimen changes, and tolerance of new antibiotic regimens if applicable. Results were evaluated using descriptive statistics.

Results:

Five patients met inclusion criteria. Four patients were excluded because testing was not administered. Of these, three patients received beta-lactam graded challenges instead. Of the included patients, gender distribution was primarily male (80%) and mean age was 52.8 years (standard deviation (SD) $\pm$ 15.7). Reported reactions included rash (60%), hives (20%), and swelling and dyspnea (20%). Indications for skin testing included pre-liver transplant evaluation (40%), osteomyelitis (40%), and pericarditis (20%). The skin testing order start time was appropriately retimed by at least two hours to allow for kit preparation in only one patient. The mean time from preparation started to preparation checked in the pharmacy was 39 minutes (SD $\pm$ 16.2). The mean total time from order placed to first step administered was 173 minutes (SD $\pm$ 40.2). The amoxicillin challenge was inadvertently administered before successful completion of skin testing in two patients (40%). No patients experienced adverse effects or required rescue medications. After skin testing, allergies were updated in all patients, but later inappropriately deleted in two patients (40%). Antibiotics were switched to beta-lactams as the direct result of skin testing in two patients (40%) and two additional patients

(40%) received and tolerated beta-lactams later during their admission. Two patients (40%) received and tolerated beta-lactams during a future admission.

Conclusion:

The results of this study suggest that penicillin skin testing was ordered infrequently, but was well-tolerated and may have contributed to beta-lactam use in most patients. The expected pharmacy turnaround time to prepare skin testing kits (two hours) may be one of many factors contributing to underutilization of this program. Data suggests a one hour turnaround can become the new standard, which may aid with scheduling. The incidence of premature amoxicillin administration led to its removal from the order set. Oral amoxicillin is now separately entered at the conclusion of the skin testing procedure. Workflows to prevent the inappropriate deletion of updated penicillin allergies with skin testing comments are being explored. Future directions include further discussion about external factors that limit the availability of this procedure for patients at UMMMC.

Oncology Pharmacy Clinical and Operational Gap Analysis for Prospect Medical Holdings

Authors: Julie Boucher, PharmD, BCPS; Nancy Beaulieu, BSPharm MBA, BCOP; Eric Cable, BSPharm, MBA; Osama Abdelghany, PharmD, MHA, BCOP

Purpose:

Yale New Haven Health has signed an agreement to acquire Health Systems from Prospect Medical Connecticut Holdings. A partnership with system leaders from Connecticut Health Systems and Smilow Cancer Center is needed to evaluate the practice of cancer care at all organizations. The workflow for oncology pharmacy services includes medication procurement and storage, order review, patient monitoring, compounding, and dispensing. The objectives are to conduct a gap analysis to identify points of difference in pharmacy workflow between Yale New Haven Health and the acquired health systems, assess pharmacy practice standardization opportunities, and ensure successful integration.

Methods:

A gap analysis tool was needed to assess the foundational model of cancer care areas including clinical and operational pharmacy services for the health systems involved in this integration in a standardized process. This tool was created by observing Smilow Cancer Center's workflow to gather information on the following areas: medication procurement, receiving, storage, prescribing, dosing, transcribing, verification, preparation, compounding, product verification, and dispensing. Compliance with governing bodies including the United States Pharmacopeia 800, the Joint Commission, and other regulatory standards were included in this analysis.

Results: in progress as acquisition of health systems has not been completed. Outcomes that are expected include several differences in oncology pharmacy workflow and many standardization opportunities.

Conclusion: in progress as acquisition of health systems has not been completed.

Implementation of a protocol and order set for low dose buprenorphine initiation at a Veterans Affairs (VA) Healthcare System

Author: Mariela Iris Burgos, PharmD

Background/Purpose:

Buprenorphine and naloxone (Suboxone) is recommended for the treatment of opioid use disorder and it has increasingly been used for chronic pain to help patients transition off full opioid agonists. One limitation with the standard induction regimen of this medication is the need to discontinue opioids prior to initiation, which may lead to patient discomfort and impact long-term treatment outcomes. Low dose buprenorphine initiation (LDBI) has been utilized to avoid this step with standard dosing, with available reports demonstrating safety and tolerability; however, there is not a lot of concise guidance for use of one standard protocol across the board. The purpose of this project is to standardize orders for LDBI by identifying current dosing practices to develop a protocol and order set for inpatient orders at a VA Healthcare System.

Methods:

The institutional review board approved this retrospective chart review as a quality improvement project. Veterans who were initiated on a LDBI strategy in the inpatient setting from January 1st, 2020 to August 31st, 2022 were included in the review. The following demographic and baseline information was collected for each patient: age, gender, race, type of opioid prior to initiating buprenorphine and

naloxone, and prior buprenorphine and naloxone trial. Also treatment information with buprenorphine and naloxone was collected, including: buprenorphine and full agonist opioid dosing schedule during the induction period, duration of induction period, duration of time during which buprenorphine and full agonist opioids were given concomitantly, buprenorphine dose at time of full agonist discontinuation, dose of buprenorphine on which patients stabilized, documentation of withdrawal symptoms during induction, and documentation of completion of induction process. The dosing strategies identified through the chart review and available literature was utilized to develop a protocol and inpatient order set to be used by providers prescribing LDBI in the inpatient setting.

Results:

A total of five patients initiated on LDBI, specifically buprenorphine and naloxone sublingual tablets, were included in the review. Four patients had a documented LDBI plan prior to initiation and two patients had an indication of chronic pain for opioid use. Baseline characteristics included four males with age ranging between 28 to 70 years. Prior to buprenorphine initiation, two patients were on methadone, two on fentanyl (with concomitant as needed opioids), and one on oxycodone. Only one patient had a prior trial of buprenorphine. The average induction period was originally planned for 8.5 days (range: 6-12 days), with an average buprenorphine and full opioid agonist concomitant administration of 7.5 days (range: 5-11 days), and an average daily buprenorphine dose at time of full opioid agonist discontinuation of 17 mg (range: 12-24 mg). Only two patients had documentation of completing the induction process, with one continuing hydromorphone as needed for pain at discharge. These two patients had an induction period of 12 and 6 days, respectively, with a buprenorphine dose of 4 mg three times a day and 8 mg three times a day at patient stabilization. The reason for stopping the LDBI schedule was the occurrence of withdrawal symptoms.

Conclusion:

The findings of this chart review demonstrate the importance of creating a protocol and order set that can help guide the initiation of a LDBI schedule. Despite the use of a LDBI schedule in some of the identified patients, there were reports of withdrawal symptoms. These patients may require longer LDBI schedules to decrease the occurrence of these symptoms. Based on these findings and the available literature, a protocol was created and distributed as a guide for inpatient use at the VA Connecticut Healthcare System.

Optimization of Formulary Management across a Five Hospital Health System

Primary Author: Matthew Caltagirone, PharmD, Bridgeport Hospital PGY1 Resident

Additional Author(s): Phu Huynh, PharmD, BCPS, Charlie Jones, PharmD, BCPS, Molly Leber, PharmD, MBA, BCPS, FASHP, and Amber Zaniewski, PharmD, BCPS, BCCCP

Background: Hospital formularies are crucial to optimizing patient care, improving patient safety, and reducing expenses. As new medications are developed and indications are expanded to existing drugs, health systems must develop processes for adjusting their formularies. There are some situations in which a high-cost medication is crucial to a patient's care, therefore an efficient process for escalating this request to a clinical expert is imperative. Within the health system, there are system subcommittees

and delivery network pharmacy and therapeutics (P&T) committees, which all report to the health system P&T committee that has final decision making authority. To ensure vetting by all of the stakeholders, it can often take several months for a medication to move through the appropriate subcommittees and P&T committees. Therefore, this project sought to assess potential to streamline the current formulary review process.

Methods: P&T meeting minutes from January 2021 to February 2023 were reviewed. The recommendations made at each delivery network P&T committee were analyzed to identify how often substantial amendments were made. Pharmacy recommendations that were presented through a subcommittee were compared to those that went directly to system P&T. Current non-formulary approval processes and escalation rates for clotting factors, non-formulary chemotherapy, and antibiotics were reviewed in addition to results of a high-cost drug medication use evaluation.

Results: In total, 24 monthly P&T meeting minutes were analyzed. Eighty-four monographs were reviewed, and 68 were approved by the system P&T as written, compared to 16 that were approved with amendments from a delivery network P&T committee. Of the monographs approved as written, 59% went through a subcommittee first. Comparatively, of the monographs that were approved with amendments, only 41% had gone through a subcommittee. For the guidelines and policy reviews, there were 194 policies reviewed, and only five had a change recommended by a delivery network P&T committee. Of these five, only one went through a subcommittee. High-cost medications were stratified by current approval process and service area. An algorithm was created taking into account current criteria for use, cost of the medication, and the providers that would be contacted for approval.

Conclusion: Based on the low volume of amendments made by subcommittees, there is an opportunity to optimize the current P&T process and reduce inefficiencies with the escalation process and approval of high-cost drugs. The next steps are to obtain approval from the system's medical board and finalize the new processes prior to implementation.

Impact of Home Electronic Blood Pressure Monitoring and Pharmacist Support Program in Achieving Blood Pressure Control Among Renal Transplant Recipients at an Urban Medical Center

Authors: Joe Camacho, PharmD[1]; Krista Mecadon, PharmD, BCTXP[1]; Reginald Gohh, MD[2]; Jaidyn De Jesus[3]; Mazen Taman[3]; Edward W. Aberger, PhD[4]; Joseph P. Wroblewski, MBA[4]; Michael J. Follick, PhD[4]; David K. Ahern, PhD[4]; Daniel Migliozzi, PharmD[5];

Lifespan - Rhode Island Hospital Department of Pharmacy, Providence, RI[1], Division of Nephrology, Warren Alpert Medical School of Brown University, Providence, RI[2], University of Rhode Island, Kingston, RI[3], Abacus Health Solutions, Cranston, RI[4], Alexion Pharmaceuticals, Boston, MA[5]

Background:

It is estimated that over 70% of renal transplant recipients are diagnosed with hypertension. Blood pressure (BP) management is important post-transplant to avoid cardiovascular complications and preserve optimal renal function. This study aims to evaluate if renal transplant recipients enrolled in the

Home Electronic Blood Pressure Monitoring (HeBPM) and pharmacist support program at Rhode Island Hospital had improved BP and renal outcomes compared to usual care.

Methods:

An IRB approved, retrospective observational, propensity matched-cohort study will be conducted to review renal transplant recipients enrolled in the HePBM and pharmacist support program at Rhode Island Hospital from October 2012 to October 2016. The historic control group will consist of 100 consecutive renal transplant recipients transplanted from January 2017 to December 2021. The primary outcome is the difference in mean BP at 1 month, 3-months, 6-months and 12-months post-transplant between the control and treatment groups. Secondary outcomes include the mean change of eGFR and serum creatinine at 1 month, 3 months, 6 months, and 12 months. Additional secondary outcomes include the incidence of cardiovascular events, rehospitalizations, biopsy proven rejection, and pharmacist interventions. Data collection from the electronic medical record will include baseline demographics, antihypertensive medications, immunosuppression regimens, vitals, and laboratory values. For the statistical analysis, a student *t*-test or Chi square test will be used to compare the baseline characteristics between groups. Propensity score matching will be used to equate the groups and adjust for any differences on relevant covariates. Linear mixed effects models will be used for continuous outcomes, logistic regression models for binary outcomes, Poisson regression models for count data, and Cox models for time-to-event outcomes.

Results:

Data collection is underway and near completion. Consequently, the results of this study are pending.

Conclusion:

We hypothesize that renal transplant recipients enrolled in the HeBPM and pharmacist support program to have improved BP control, compared to matched controls.

Heart transplant ambulatory service expansion: hyperlipidemia management

Authors: Eve Carciofi, PharmD, Stephanie Heeney, PharmD, BCTXP, Vincent Do, PharmD, BCPS, BCTXP, Mabel Wai, PharmD, Steph Luon, PharmD, BCPS, BCACP, Marie Renauer, PharmD, MBA, BCACP

Background/Purpose: Heart transplant recipients are maintained on multiple medications (calcineurin inhibitors, steroids) that increase their risk of metabolic disease. Coronary allograft vasculopathy is one of the leading causes of death in heart transplant recipients. It is well established that statins reduce CAV progression and provide mortality benefit post-heart transplant, however, there is limited literature and guidance available on the optimal statin dose/intensity post-transplant. Ambulatory clinical pharmacy services include collaborative drug therapy management agreements in our heart transplant clinic. Our project aimed to create a hyperlipidemia management guideline in effort to standardize practice within our program and improve our patient's long-term metabolic risk.

Methods: A literature review was conducted to identify published data regarding hyperlipidemia management in heart transplant recipients, as well as any literature available for coronary allograft vasculopathy prevention. Current hyperlipidemia guidelines for the general population were also reviewed. A guideline was created to standardize the management elevated low-density lipoprotein and

triglycerides post-orthotopic heart transplant based on the available literature. The guideline was reviewed by the heart transplant physician team and transplant endocrinologist to ensure all key stakeholders that would play a role in the management of these patients were in agreement on the algorithm going forward. The guideline was then brought to the transplant Quality Assurance and Performance Improvement meeting for approval.

Results: Once the guideline is approved through the local anticoagulation/cardiology subcommittee it will be implemented by transplant providers and transplant pharmacists with the goal of improving the metabolic risk of all heart transplant recipients in our center. An increase in proper statin dosing and improved lipid levels are expected.

Conclusion: The implementation of a heart transplant hyperlipidemia guideline into the collaborative drug therapy management agreement related to ambulatory pharmacy services will allow for improved lipid levels in our heart transplant recipient population. Future directions include assessment of the guideline's impact on the metabolic profile of this patient population and our program's adherence to the guideline, as well as an assessment of referrals made to the clinic pharmacist for lipid management. Comprehensive evaluation of performance will provide the foundation for future service optimization and expansion within our heart transplant clinic.

Evaluating Efficacy of Order Entry Questions for Adherence to Antimicrobial Stewardship Restrictions on Carbapenem Use

Authors: Jillian Cerullo, Diane Parente, Michelle H. Ting, Cheston B. Cunha, Ashlyn M. Norris; Lifespan Health System, Providence, RI

Background

National antimicrobial stewardship (AMS) guidelines recommend preauthorization and prospective audit and feedback as core stewardship strategies. At Lifespan, Tier 2 restricted antibiotics can be ordered with ID or AMS approval, or when specific acceptable use criteria are met. Confirmation of patients meeting acceptable use criteria is documented through order entry questions. Our specific method of using order entry questions to facilitate antimicrobial drug restriction has not been assessed within our health system or in the literature. The purpose of this study was to evaluate whether order entry questions in the electronic medical record (EMR) are an effective strategy for antibiotic restriction, based on adherence to institutional guidelines.

Methods

This was a retrospective chart review of patients who received at least 1 dose of restricted carbapenems (ertapenem and meropenem) at two hospitals within a Rhode Island healthcare system. One year of data was collected from January 2021 to December 2021. If patients had multiple orders placed for the same carbapenem within a 28-day span, only the first order of the series was evaluated. If a patient switched from one carbapenem to another within 28 days (4 weeks) each initial order for each change in therapy was evaluated. The primary objective was to determine the accuracy of prescriber responses to order entry questions in the electronic medical record (EMR) for restricted carbapenems. This was achieved by comparing the indication on the order to notes, labs, and imaging from the current and

previous encounters within the EMR. Secondary outcomes included percentage of carbapenem use that was approved by the Infectious Diseases (ID) Consult team, and percentage of orders that did not meet acceptable use criteria for meropenem vs. ertapenem, community hospital vs. tertiary hospital, and intensive care units (ICU) vs. emergency department (ED) vs. non-ICU units. Each order entry question was also evaluated for frequency of inappropriate selection.

Results

A total of 905 unique orders were evaluated and of those, 40.6% (367/905) of order entry options were answered inappropriately by providers. ID was consulted for 62.4% (565/905) of orders. The error rate for orders when ID was not consulted was 62.35% (212/340). Rates of inaccurately answered order entry questions were higher for meropenem (48.6%) compared to ertapenem (24.2%). Rates of inaccuracy were higher at the community hospital (44.5%) than the tertiary hospital (38.6%) and were higher in the ICU (54.7%) and ED (44.4%) than other floors of the hospitals (31.5%). The order entry option with the highest rate of inaccuracy was “Empiric coverage in critically ill patients with a recent ESBL organism” for meropenem orders with an error rate of 76.4%. The following order entry options are in order from highest to lowest rates of inaccuracy: "Complicated intraabdominal infections in patients allergic to both penicillin AND cephalosporins" for ertapenem (66.7%), "Empiric coverage of meningitis in penicillin allergic patients" for meropenem (62.1%), "Treatment of infections caused by multidrug resistant organisms (MDROs)" for meropenem (54.01), "Treatment of infections caused by ampC-producing organisms" for ertapenem (53.9%), "Treatment of infections caused by an ESBL-producing organism" for ertapenem (34.2%), “Infectious Disease or antimicrobial stewardship approval” for ertapenem of meropenem (4.7%).

Conclusions

High rates of inaccurate order entry option selection were observed at our healthcare system. Highest rates of inaccuracy were observed when ID was not consulted before placing the order and when orders were placed for patients in the ICU. The high variability of inaccurate order entry selection between the 7 options suggests that prescriber understanding of each acceptable use criteria may be limited and influence response. Guideline updates to clarify grey areas within the acceptable use criteria such as defining “recent” and providing examples of amp-C producing organisms have since been implemented. Further education around acceptable use criteria may improve adherence to institutional guidelines.

Hybridization of pharmacy orientation to include remote, asynchronous learning across a five-hospital health system

Author: Markella Cervenak, PharmD

Background: Previous system pharmacy orientation consisted of live sessions across five days teaching standardized system procedures and pharmacy practices for new hires. To modernize learning and optimize resource efficiency, a large academic healthcare system pursued a hybrid model incorporating newly designed, asynchronous, learning modules. The newly proposed model consists of live, in-person trainings supplemented with asynchronous remote training videos. Transitioning to online training provides new opportunity for delivery of online competency assessments to participants. This will

provide data for effectiveness of delivery and guide future optimization. Re-designing orientation also provides opportunity for updating material to reflect current practice.

Methods: To establish baseline efficacy of the previous live orientation model, a competency assessment was developed using orientation material. Assessment questions covering key concepts were converted into an online form. Competency assessments were delivered at the beginning of each orientation day based on the modules scheduled for that respective day. Submissions were scored by supervisors for accuracy to identify opportunities for clarification and improve the success of information delivery. New employees were re-trained on questions missed by a majority of individuals during dedicated new hire-supervisor discussion time. Prior to hybrid model implementation, orientation materials were evaluated and updated to reflect current policies and practices. Orientation sessions were then reviewed and assessed for appropriateness for remote, asynchronous delivery. Considerations for appropriateness included complexity of material, expected clarifying questions, and level of importance. Selected presentations were recorded by presenters to provide audio and visual material for asynchronous module development. The modules were created using a web-based learning management system (LMS) that employees have access to. Competency assessments distributed after hybrid model implementation will provide data to ensure employee engagement in remote, asynchronous training remains comparable to the previous orientation model.

Results: Following one week of survey distribution, the average pharmacist and pharmacy technician score was 75% (n=1) and 78.6% (n=4) respectively. At the conclusion of the scheduled audit, three orientation sessions were in need of an update to reflect current practice. Seven technician-specific and four pharmacist-specific sessions were deemed appropriate for LMS module conversion. An additional three sessions delivered to both pharmacists and pharmacy technicians were also considered appropriate for LMS module conversion. In total, 14 sessions were selected for remote, asynchronous module development. This translates into a 14-hour reduction per week (0.35 FTE) in live presenter requirements. Twenty-nine pharmacy personnel were involved in the presenter responsibilities of selected modules and would thus be available for additional clinical and operational responsibilities.

Conclusion: With future assessment distribution, session-specific scores will continue to be reviewed to assess for opportunities to improve orientation content delivery. With an established baseline competency score, post-hybrid implementation scores can be compared to ensure employee comprehension is maintained with asynchronous, remote, training. Asynchronous module development will provide the opportunity for orientation schedule flexibility and real-time application.

Evaluation of Clinical Pathway for Treatment of Community Acquired Pneumonia

Authors:
Lucas Clari, Pharm.D; Dayna McManus Pharm.D, BCPS, BCPID; Abriana Holzworth Pharm.D; Jeffery Topal, MD

Objective:
A five hospital health system implemented clinical pathways embedded into the electronic medical record (EMR) to improve quality and standardize patient care across all delivery networks. In 2023, the Joint Commission (TJC) applied twelve new and revised antibiotic stewardship requirements to all

accredited hospitals. One of these standards requires hospitals to evaluate the adherence to at least one evidence-based guideline that has been implemented. This evaluation assessed adherence and impact of the adult inpatient pneumonia clinical pathway to satisfy this newly established TJC requirement and improve pathway utility.

Methods:
This retrospective chart review assessed all adult inpatients who were identified as candidates for the adult inpatient pneumonia clinical pathway from July 2021 – July 2022. Inclusion criteria consisted presence of at least one pre-specified clinical symptom and radiographic evidence consistent with pneumonia. Exclusion criteria consisted of age < 18, patients only treated in ED, confirmed co-infection, immunocompromised patients, cystic fibrosis, onset of pneumonia >48 hours after admission. A sample size of approximately 100 patients that met study criteria was selected for analysis with sampling conducted to represent size of delivery networks. Data collected included demographic information, length of stay, site of admission, signs and symptoms, radiographic evidence, initial antibiotic regimen, blood culture, sputum culture, respiratory virus testing, methicillin-resistant *Staphylococcus aureus* (MRSA) nasal swab, procalcitonin, nursing swallow evaluation, antibiotic de-escalation, conversion to oral regimen, appropriate consultation placed, duration of therapy, discharge requirement met. The data were analyzed to determine appropriateness of pathway selection, initial antimicrobial management, antimicrobial therapy de-escalation and duration of therapy.

Results:
125 patients were evaluated for this assessment, 23 patients were excluded which left 102 patients included in the final analysis. The most common exclusion criteria met were no radiographic evidence of pneumonia (30.4%), confirmed co-infection (17.4%), and immunocompromised patient (17.4%). 24 of 36 (67%) of patients with risk factors for a multi-drug resistant (MDR) organism were appropriately covered for MRSA or pseudomonas. 44 of 54 (81%) of patients who did not have MDR risk factors were initiated on appropriate coverage. Swallow evaluation completion (25%) and sputum culture collection (50%) were the two initial orders with the lowest collection/completion rate. 31 of 75 (41%) eligible patients were appropriately converted from intravenous (IV) therapy to an all oral regimen. Ceftriaxone (50%) and piperacillin-tazobactam (30%) accounted for most cases where IV antibiotics were inappropriately continued. Outcomes for total antibiotic duration (inpatient and outpatient) demonstrated: 19% of patients were treated for <5 days, 42% were treated for 6-7 days, and 39% of patients treated for >7 days. Out of 25 patients where an antibiotic plan was established by provider (in the care notes), 20 of them (80%) had planned durations >5 days. Of the 30 patients who were treated for > 7 days, 23 (77%) of them were also prescribed outpatient antibiotics.

Conclusions:
This evaluation provides valuable information on the current practices in the treatment of pneumonia across the health system. Appropriate conversion to all oral regimens and duration of therapy stood out as opportunities for improvement. To improve compliance in IV to oral transition, 72-hour antibiotic time out when using ceftriaxone for community acquired pneumonia will be created. This provides the practitioner and the pharmacist an opportunity to reassess the transition from IV to an oral regimen, along with the overall plan for duration of therapy. An EMR optimization will be proposed that will alert providers of inpatient antibiotic doses that were administered upon initiation of discharge medication reconciliation (DMR). This optimization aims to improve the outpatient prescribing practices of antibiotics, since a large portion of inappropriate duration of therapy was due to the addition of an outpatient prescriptions.

Addressing polypharmacy in an outpatient geriatrics clinic within a Veterans Affairs healthcare system using the VIONE review

AUTHORS:
S. Cruz, K. Falco, J. Kloze, L. Zaets; Veterans Affairs Healthcare System, West Haven, Connecticut

OBJECTIVE: Polypharmacy is associated with an increased risk of adverse drug events, drug interactions, challenges with adherence, and increased costs. Geriatricians at the Central Arkansas Veterans Affairs created the VIONE tool to standardize and guide deprescribing processes to address the problem of polypharmacy. Medications are categorized using the "VIONE" acronym which stands for Vital, Important, Optional, Not indicated, and Every medication has a diagnosis or indication to highlight areas for intervention. This project aims to evaluate the impact of the VIONE deprescribing tool on polypharmacy within the Veteran Affairs Connecticut Healthcare System (VACHS) outpatient Geriatrics Clinic.

METHODS: This project was approved by the VACHS Institutional Review Board as quality improvement. Veterans scheduled for an appointment with the VACHS outpatient Geriatrics Clinic between July 1, 2022 and January 31, 2023, who underwent a medication regimen assessment by a pharmacist utilizing the VIONE deprescribing tool, were included in this retrospective chart review. Patient demographics and baseline characteristics related to polypharmacy-related risks were collected from the electronic health record. Outcome measurements collected included the number of deprescribing recommendations made, and those accepted within 30 days of the patient's appointment. The following additional information was collected: medication class, indication (if known), time to implementation of the deprescribing recommendation, type of recommendation (discontinuation or dose reduction), and the VIONE category that identifies the reason behind the intervention.

RESULTS: The study population (n=78) consisted of primarily white males (84% white, 97% male). On average, patients were 81.3 ± 8 years old and took 12 medications. About half (55%) required assistance with their medication management. Utilization of the VIONE tool resulted in 125 deprescribing recommendations made with 75% of the patients having at least one recommendation identified. Overall, 34% of recommendations were accepted within 30 days after patients' appointments. Of the 42 implemented recommendations, 34 were discontinuations and 8 were dose reductions.

CONCLUSION: The majority of patients included in this study had opportunities identified to decrease polypharmacy. This project demonstrates the role for a standardized, clinician-driven assessment for deprescribing opportunities in the outpatient Geriatrics Clinic at the VACHS. The utilization of VIONE can be expanded to a variety of healthcare settings to encourage periodic reassessment of medication regimens to address polypharmacy.

Implementation and expansion of an integrated ambulatory pharmacy collaborative care model in pediatrics

Authors
A. Duarte[1], J. Rosano[1], T. Papiro[1], C. Ortiz-Lopez[1], K. Boothe[2], M. Renauer[3]

[1]Yale New Haven Hospital, New Haven, CT
[2]The Kimber Boothe Group, LLC, Cincinnati, OH
[3]Yale New Haven Health, West Haven, CT

Purpose

Established pharmacy services in specialty clinics within a large academic medical center have demonstrated improved clinical outcomes, medication adherence, monitoring, and financial support for patients on specialty medications. These benefits laid the foundation for the establishment of the medication management clinic model between ambulatory care services and the health system specialty pharmacy. The purpose of this project is to expand continuity of care by implementing a pharmacist-led specialty clinic integrated model to support current pediatric practices targeting patients who are currently prescribed or eligible for a specialty medication.

Methods

Currently, pediatric ambulatory care pharmacists are embedded within multiple specialties across the health system including rheumatology, digestive health, cystic fibrosis, solid organ transplant and infusion. An evaluation of prescribing data from fiscal year 2022 was performed to identify service lines with a high-volume of specialty prescriptions which could benefit from pharmacy services. Evaluation of the health system's pediatric ambulatory practices showed growth hormone deficiency as a key disease state with a high patient volume and potential for increased clinical continuity for human growth hormone analog medications. A project team was recruited and a project plan was prepared to delineate the role of the new pharmacist position. Key stakeholders were engaged for clinician buy-in to collaborate on the initiative. A collaborative practice agreement (CPA) was created for the endocrinology service line that outlines the pharmacist's scope of practice including managed disease states, medication classes, laboratory monitoring, and immunizations. Measured service outcomes include clinical continuity defined as medication adherence, laboratory monitoring adherence and adverse effects. Patient specific clinical outcomes for those on growth hormone therapy will be captured through bone age and growth velocity.

Results

Based on prescription data and a service line assessment, one full-time equivalent (FTE) was allocated for pediatrics with an anticipated panel size of 300 patients. Clinicians with the highest prescription volume for growth hormone analogues were selected for collaboration. A collaborative practice agreement was created and will be approved by health system committees. Upon CPA approval, the pediatric ambulatory care pharmacy service line will go live.

Conclusion

Expanding and integrating additional pharmacy services in the pediatric population may support the needs of patients prescribed or eligible for novel therapies and specialty medications. Future directions include expansion to additional disease state service lines, and continued optimization of current workflow to enhance services and assess clinical outcomes.

Impact of a nurse-driven diuretic protocol on hospital length of stay in patients with acute heart failure exacerbations

Authors: Osama ElSherbini, PharmD; Tiffany Zeng, PharmD; Alexis Swist, PharmD, BCPS; Jane Mueller, PharmD, BCPS

Objective:
A heart failure protocol utilizing novel dosing strategies for loop diuretics was recently implemented at our institution. We aim to compare clinical outcomes between patients treated with this protocol and those treated with standard practice.

Methods:
This retrospective chart review aims to evaluate clinical outcomes of a protocol for loop diuretic titration in patients with acute decompensated heart failure. Patients were included if they had a history of heart failure and were prescribed diuretics prior to admission. Patients were excluded if they were admitted to an ICU or if their hospitalization was prolonged by an unrelated condition. A total of 34 patients were analyzed – 14 in the protocol group and 20 in the standard practice group. The primary efficacy outcome was hospital length of stay. Safety outcomes included incidence of hypotension, acute kidney injury, and electrolyte abnormalities. Four of the 14 patients in the protocol group were ultimately removed from the protocol; 1 due to a lab error, 1 due to an acute kidney injury, and 2 due to hypotension. Given our small sample size, we ran an intention-to-treat analysis with all patients as well as a per-protocol analysis of the 10 patients who completed treatment.

Results:
Hospital length of stay was significantly shorter for patients treated with the protocol than with standard practice (p=0.0284). However, this difference failed to achieve statistical significance in the intention-to-treat analysis (p=0.0523). Safety outcomes were similar in both groups; there was no difference in the incidence of acute kidney injury, hypotension, or electrolyte abnormalities. Baseline demographics were similar across both groups except patients treated per-protocol were on lower diuretic doses prior to admission compared to patients treated with standard practice (p=0.0212). Despite this, a regression analysis found that the only 2 significant covariates were study group and younger age.

Conclusion:
A nurse-driven protocol for loop diuretic titration in patients with acute heart failure is associated with a significantly shorter hospital length of stay and similar safety outcomes compared to standard practice. While the intention-to-treat analysis did not achieve statistical significance, the per-protocol analysis showed a significant difference in efficacy. Further studies are needed to confirm these findings and to streamline the implementation of the nurse-driven protocol.

Evaluating the effect of addition of an NK1 antagonist to standard antiemetic prophylaxis in B-cell lymphoma patients receiving EPOCH

Author: Sloane English, PharmD

Background/Purpose:
The multiday dose-adjusted EPOCH and rituximab regimen (DA-EPOCH-R) used to treat B-cell lymphoma patients contains doxorubicin and cyclophosphamide in combination, which is classified as high risk to cause chemotherapy-induced nausea/vomiting (CINV) (defined as emesis in greater than 90% of patients who are not given prophylactic antiemetics). We aim to report our CINV experience in B-cell lymphoma patients receiving DA-EPOCH-R chemotherapy with moderate risk (steroids and 5HT3 antagonist only) versus high risk (steroids, 5HT3 antagonist, and NK1 antagonist) antiemetic prophylaxis.

Methods:

We conducted a retrospective cohort study including patients 18 years of age or older who received their first cycle of DA-EPOCH-R for aggressive non-Hodgkin B-cell lymphoma inpatient from April 2016 to October 2022. We excluded any patients who were enrolled in an investigational protocol, did not receive all components of the standard DA-EPOCH-R regimen, had previous exposure to chemotherapy, were intubated or sedated while receiving DA-EPOCH-R, or died prior to the end of cycle 1. This study was approved by the institutional review board and data was obtained from the electronic medical record. Patients were classified as receiving moderate risk prophylaxis if they received steroids and a 5HT3 antagonist only, and high risk prophylaxis if they received steroid, 5HT3 antagonist and an NK1 antagonist with or without olanzapine. The primary endpoint was complete response (CR), defined as no breakthrough antiemetic medication utilization and no documented vomiting over 120 hours (5 days). Secondary endpoints included acute (0-24 hours from chemotherapy initiation) and delayed phase (25-120 hours) CR, CR without escalation of prophylactic antiemetics in cycle 2, and complete control (CR with no documented nausea over 120 hours). Statistical analysis included descriptive statistics; chi-squared test(s) to compare categorical outcomes between the two groups, and t-test(s) to compare means for continuous data.

Results:

Among the 128 patients who were included, 56 (43.8%) received an NK1 antagonist as part of their antiemetic regimen and 72 (56.3%) did not. No patients received olanzapine as part of their scheduled antiemetic regimen. CINV risk factors were similar between groups, with 30.4% and 25% of patients being less than 50 years of age, respectively, and with 46.4% and 43.1% female. Complete response was achieved in 32 patients (57.1%) in the high risk prophylaxis group and 30 patients (41.7%) in the moderate risk prophylaxis group (P=0.082). Acute complete response was achieved in 45 patients (80.4%) in the high risk prophylaxis group and 56 patients (77.8%) in the moderate risk prophylaxis group (P=0.723), delayed complete response occurred in 34 patients (60.7%) and 34 patients (47.2%) (P=0.129), complete response without escalation of prophylactic antiemetics in cycle 2 occurred in 26 patients (46.4%) and 24 patients (33.3%) (P=0.132), and complete control occurred in 21 patients (37.5%) and 22 patients (30.6%) (P=0.409), respectively. As needed antiemetics were administered to 29 patients (51.8%) in the high risk prophylaxis group and 49 patients (68.1%) in the moderate risk prophylaxis group (P=0.061), and the majority of as needed antiemetics were used in the delayed phase 39.3% versus 51.4% (P=0.173) respectively.

Conclusion:

CINV CR in hospitalized lymphoma patients receiving DA-EPOCH-R was suboptimal in both groups with CR achieved in only 57.1% of patients in the high risk prophylaxis group and 41.7% in the moderate risk prophylaxis group. The largest proportion of as needed antiemetic use occurred in the delayed phase in both groups, signaling an opportunity to improve delayed CINV management. This data supports the need to further optimize prophylactic antiemetic regimens for DA-EPOCH-R. Possible improvements include utilizing 5HT3 antagonists with delayed CINV activity such as palonosetron and/or adding olanzapine to the NK1 antagonist, steroid, 5HT3 antagonist combination.

Review of stress ulcer prophylaxis discontinuation rates after intensive care unit and hospital discharge

Christina Escobar, PharmD; Kristel Chatellier, PharmD, BCPS; Alexander Fairhurst, PharmD, BCPS; Rebecca A. Greene PharmD, BCCCP; Lifespan, Providence, RI

Background/Purpose

Stress-related mucosal disease occurs within the initial stages of critical illness in intensive care unit (ICU) patients, presenting as superficial erosive lesions which can lead to deep ulcers and gastrointestinal bleeds. There is an association between stress ulcer bleeds and a longer length of stay as well as an increased risk of death in critically ill patients. Due to this association, guidelines such as the 2021 Surviving Sepsis Campaign and the 2008 EAST Practice Management Guidelines recommend the addition of stress ulcer prophylaxis (SUP) to critically ill patients with either proton pump inhibitors (PPIs) or histamine-2 receptor antagonists (H2RAs). These guideline recommendations have resulted in both appropriate and inappropriate prescribing of PPIs and H2RAs as well as the inappropriate continuation of therapy beyond ICU and hospital discharge. The unnecessary continuation of these medications contributes to polypharmacy and may have long-term adverse effects, such as an increased risk of osteoporosis and fractures in the elderly and infection. Our institution initiates SUP in ICU patients who are mechanically ventilated or are coagulopathic, but it is unknown how many patients are inappropriately continued on SUP. This study aims to evaluate the discontinuation rates of SUP upon ICU discharge to the general medicine floors and upon hospital discharge (if applicable) at three hospital affiliates within the same academic health system. A secondary aim is to evaluate the impact of pharmacists on SUP deprescribing efforts.

Methods

A retrospective cohort study will be conducted on adult patients who were admitted to the ICU between July 1, 2021 and July 1, 2022 using data from the electronic health record. Additional inclusion criteria were mechanical ventilation and receipt of SUP. Patients were excluded if they were on acid-suppression therapy prior to admission, if coagulopathy was present, or if their current diagnosis included gastrointestinal bleed, hematemesis, or melena. Patients who were not intubated during their admission were also excluded. This study was approved by the Lifespan Institutional Review Board. Data on demographics, hospital stay, and clinical factors indicating the need for SUP were collected. Rates of SUP discontinuation from ICU to medicine floor, and to hospital discharge will be evaluated. Potential pharmacist impact on SUP discontinuation will be reviewed by analyzing associated pharmacist interventions. Outcomes will be reported using descriptive statistics.

Results

Data collection is near completion. We expect to see SUP continued after ICU and hospital discharge. Pharmacist intervention will likely contribute to the appropriate discontinuation of therapy. The anticipated benefit from this study will inform if a pharmacist-led SUP monitoring program or the implementation of a discontinuation protocol is needed at our health system.

Optimizing selection and timing of P2Y12 inhibitors when switching therapy after percutaneous coronary intervention

Author: James Farrell, PharmD

Background/Purpose

Clinical guidelines and trial evidence support using ticagrelor or prasugrel as first-line options over clopidogrel for patients with an acute coronary syndrome (ACS) who receive a coronary stent. While ticagrelor is often used as initial therapy, patients may need to switch their P2Y12 inhibitor due to cost or side effects from the medication. Previous medication use evaluations (MUEs) have shown that when switching from ticagrelor, patients switched to clopidogrel more often than to prasugrel, despite many patients lacking documented risk factors where clopidogrel may be favored. Additionally, when patients switched from ticagrelor to prasugrel, patients were often switched earlier than expert recommendations to wait 24 hours after the last ticagrelor dose. Pharmacokinetic studies have demonstrated that when switching P2Y12 inhibitors, there is evidence of increased platelet reactivity that may have the potential to increase thrombotic risk. These findings prompted a quality improvement evaluation to optimize P2Y12 inhibitor selection and improve adherence to expert consensus guidelines when switching agents.

Methods

This quality improvement evaluation was conducted within a five-hospital health system. The objective of this project was to identify and implement an intervention to promote optimal P2Y12 inhibitor selection and provide guidance when switching therapy. Integrating prescribing guidance into the electronic health record (EHR) streamlines the ordering process and encourages evidence-based care. Embedding prescribing guidance within the EHR also allows for patient-specific recommendations based on information available within the patient's medical record. With periodic review and updating of resources, ordering guidance can adapt to new evidence and provide the medical team with a valuable tool to improve patient care.

Results

This IRB-exempt project leveraged EHR optimization to guide providers toward appropriate P2Y12 inhibitor prescribing when switching agents. By engaging provider stakeholders to gather feedback, and by evaluating existing resources within the EHR, an opportunity was identified to add EHR ordering guidance when switching between agents.

In the order panel, providers are asked whether the patient's ACS event occurred ≤ 30 days ago or ≥ 30 days ago. This question helps determine whether the patient is in the acute-phase or late-phase of therapy to develop an appropriate dosing recommendation. After the provider selects which type of switch they are making (example: ticagrelor to prasugrel), the order panel generates an order for the loading dose, if applicable, as well as subsequent maintenance doses of the agent that the provider intends to switch to. This auto-generated order is based on expert consensus recommendations which are referenced in the order panel. By providing readily accessible answers to two questions, providers are able to rapidly generate an order that considers the optimal dose and timing based on a variety of patient-specific factors.

The order panel is currently being reviewed by system committees and will be integrated into the health system's EHR once approved. After implementation, a future aim of this project will be to re-assess P2Y12 inhibitor prescribing to evaluate the effectiveness of this intervention.

Conclusions:
In an effort to strengthen existing EHR resources, an order panel was developed to aid providers in appropriately switching P2Y12 inhibitors in patients with ACS who receive a coronary stent. This order panel is expected to improve the utilization of prasugrel in patients who cannot tolerate ticagrelor and improve adherence to expert consensus recommendations when switching P2Y12 inhibitors.

Evaluation of risk factors associated with Pneumocystis jirovecii pneumonia in patients with plasma cell dyscrasias

Author: Jennifer Marie Giulietti, PharmD

Background/Purpose: Plasma cell dyscrasias (PCDs), including multiple myeloma (MM), are a heterogenous group of disorders characterized by aberrant monoclonal proliferation of plasma cells resulting in defective immunoglobulins, often putting patients at increased risk of infection. *Pneumocystis jirovecii* pneumonia (PJP) is a rare, life-threating opportunistic fungal infection that impacts the respiratory system. While it is the most associated with human immunodeficiency virus, incidence is rising in patients with innate immune dysfunction, suggesting anti-infective prophylaxis should be considered in certain high-risk populations. In light of clinical trials highlighting neutropenia and all-cause pneumonia as the most common adverse events in patients undergoing treatment for MM, in addition to anecdotal observations of a few recent of PJP incidences in practice at Massachusetts General Hospital (MGH), we seek to characterize both the real-world incidence of PJP as well as any patient specific factors that may contribute to increased risk in patients treated for plasma cell dyscrasia.

Methods: A retrospective case series analysis of patients treated at MGH for plasma cell dyscrasia and treated for PJP between April 2016 and August 2022 was performed. Institutional review board approval was obtained prior to data collection. Electronic health records were reviewed for all patient characteristics, PJP data, and treatment regimens. Patient characteristics were compared for any similarities.

Results: Six patients were included in the case series analysis. Of the 6 patients, 5 patients were diagnosed with multiple myeloma (5/6, 86%), and 1 patient had Waldenstrom macroglobulinemia. All patients were male, diagnosed with PJP no earlier than 2021, and did not receive PJP prophylaxis. Two patients were diagnosed with PJP during first-line treatment (range line of treatment – 2 [1-4]) for their PCD, though time to PJP diagnosis did not seem to correlate to line of treatment (median 59.5 days [18 – 1436 days]. Three patients (50 %) were diagnosed with PJP within 90 days of starting their most recent PCD treatment. A majority of patients were treated with proteasome inhibitors as part of their regimen (4/6; 67 %), followed by anti-CD38 monoclonal antibodies as part of their current or previous regimens (5/6; 83 %). While almost all patients had elevated mycologic evidence of fungal disease (5/6; 83 %), only 4 patients had confirmed PJP PCR from bronchoscopy (67 %). While most patients were exposed to corticosteroids, only 2 patients met elevated risk with exposure of prednisone-equivalence of 0.2 mg/kg/day for > 14 days. Given the increased incidence of PJP in patients starting in 2021, we investigated COVID-related factors to characterize any potential correlations. Of our cohort, 1 patient was definitively diagnosed with severe COVID within 90 days before PJP diagnosis, for which the patient was treated with remdesivir and dexamethasone.

Conclusion: Incidence of PJP does not seem to be correlated with specific treatment regimens or timing of treatment initiation for the underlying PCD. Empiric prophylaxis of PJP does not seem warranted based on the small number of patients treated for PJP since 2016 at MGH. The increased incidence of PJP in the

past few years seems to correlate to increased opportunistic infection in patients treated for cancer at our institution. Future investigations will focus on incidence of other opportunistic infection in an effort to better understand the increased prevalence of PJP in the last few years.

Comprehensive Review of High-Alert Medications

Primary Author: Kevin Ho, PharmD

Additional Author(s): Anthony J Renzoni, PharmD, BCPS; Sharareh Molaei, PharmD Candidate 2023; Julie D'Ambrosi, PharmD, BCPS, CPPS; Stacy Vaeth, PharmD, MS

Background:
The 2022-2023 Institute for Safe Medication Practices (ISMP) targeted medication safety best practices for hospitals includes a best practice of "layer numerous strategies through the medication use process to improve safety with high-alert medications." The objective of this study was to identify and assess frequently occurring errors within this system's practices associated with the current list of high-alert medications. Once identified, this analysis aims to establish areas to reinforce or introduce new error-prevention strategies within the medication-use process to reduce the risk of harm with high-alert medications.

Methods:
A comprehensive review of this system's medication events reporting, between April 1st, 2022, to September 30th, 2022, was conducted. This review analyzed all inpatient medication events (MEs) that involved medications considered high alert by the health system's designated list. MEs filed were initially screened for the medication involved and classified as a "high alert," "sound-alike, look-alike drug (SALAD)," or neither. Any medications classified as SALAD that were also high alert were included in the analysis. Duplicate MEs, outpatient infusion sites, and off-site centers were excluded. Microsoft Excel pivot tables was utilized to analyze and assess the data.

Results:
Of 4614 MEs reported, 775 events were associated with high alert medications. After excluding duplicate events, 669 unique events were included in the analysis. The top medication class identified was anticoagulants with 188 events, of which 74 events were related to heparin and were analyzed separately from the other anticoagulants. Among the 113 non-heparin anticoagulant events, 52 (46%) reached the patient. When looking at the medication use process, 7 (13.5%) of events reaching the patient were related to medication administration, 13 (25%) were related to medication monitoring, and 24 (46.2%) were related to medication prescribing. Of the 74 events related to heparin, 45 (60.8%) reached the patient. Six (13.3%) of these events were related to medication administration, 11 (24.4%) events were related to medication monitoring, and 21 (46.7%) were related to medication administration. Additionally, this review identified other non-anticoagulant, high-alert medications related to medication errors. Of the 99 non-anticoagulant events, antineoplastics were associated with 23 (23.2%) events. Next highest were events related to total parenteral nutrition with 18 (18.2%), then insulins with 15 (15.2%).

Conclusion:
This study had identified anticoagulants, both heparin and non-heparin, to be the top medications to address and reinforce as nearly half of all high-alert medication events were due to anticoagulants.

Other top medication classes that may benefit from re-evaluation of risk mitigation strategies include insulins, total parental nutrition, and antineoplastics.

Allergy and Immunology Clinic Workflow Optimization

Authors: Yujin Hong, PharmD, Van Vu, PharmD; Kristian Pretashi, PharmD; Marta Stueve-Brunot, PharmD, MHA; Ju Young Song, PharmD; Arvind Bhatt, PharmD; Jessica Bootle, PharmD, BCACP, BCPS; Chandra Cooper, PharmD, BCPP; Eric Cabie, RPh, MBA; Phuc Tran, PharmD, MBA, MS; Jason Kwah, MD, MSc; Christina Price, MD

Objectives: The allergy and immunology services within a five-hospital health system have expanded its need for pharmacy services. There is an opportunity to optimize and standardize clinic and pharmacy workflow across all sites to improve efficiency, safety, regulatory compliance, and patient experience. The purpose of this project is to standardize the ordering of medication skin tests and oral challenges within the electronic medication record (EMR) while optimizing pharmacy workflow to enhance patient experience and clinic throughput.

Methods: During the initial phase, stakeholders of the allergy and immunology clinics, including physicians, nursing, and pharmacy evaluated the need for expanding allergy testing services across all sites. As a response to growing needs, an analysis of current workflow was conducted at two sites between January and February 2023. The current workflow analysis was completed by in-person observation of pharmacy order processing to identify areas of optimization and opportunities for standardization. The scope of this project included streamlining pharmacy workflow, developing a system-wide pharmacy standard operating procedure, and outlining a staff education plan. In addition, a non-standard medication allergy test process was developed for high-cost or non-formulary products.

Results: Workflow analyses identified that providers were utilizing free-text orders for a number of common allergy tests. Furthermore, these orders did not interface with existing sterile compounding technology and could not be charted within the electronic medication administration record. Differences in workflow across sites including volume of allergy tests, staffing, drug procurement, and care settings were identified and further supported the need for workflow optimization and standardization. The top 20 skin tests and oral challenges were built as part of the order entry process optimization from February and April 2023. Corresponding orders were built in sterile compounding technology to improve safety and ensure regulatory compliance. Standard operating procedures outlined the process for evaluating and approving non-standard allergy tests as well as the process for chart review, order verification, and sterile pharmaceutical production. To facilitate future EMR order set development, a system-wide ticket submission platform was created to capture newly identified common allergy tests.

Conclusion: The allergy and immunology service workflow will be standardized across the health system by allowing a streamlined and efficient workflow to potentially increase the clinic throughput and to promote safety and regulatory compliance. Standard operating procedures will provide a system-wide guideline to minimize inconsistency in practice. The ability to capture future allergy test requests with a new non-standard process will allow the pharmacy to build a more inclusive order set. Additionally, this workflow optimization can drive the growth of our allergy and immunology services within the health system, leading to increased patient satisfaction.

Evaluation of emergency department-initiated buprenorphine for treatment of opioid withdrawal syndrome

Author: Vanamrung Isaragumpot, PharmD

Background:

Opioid use disorder (OUD) is associated with high rates of mortality and morbidity, including death from opioid overdose, viral hepatitis, HIV, and bacterial infections. Buprenorphine (BUP) is a partial opioid agonist that has been shown to lower mortality, improve treatment retention, and decrease risk of infection in the setting of OUD, and is recommended by the American Society of Addiction Medicine (ASAM). Treatment of OUD in the emergency department (ED) with BUP is challenging due to social stigma, patient's unpleasant experience, and up until recently, the need for the prescriber to have a DATA 2000 waiver to prescribe BUP at discharge. The purpose of this study is to assess the impact of three ED-initiated BUP strategies for the treatment of OUD.

Methods:

This IRB-approved, single center retrospective cohort study evaluates ED patients between January 1st, 2018, and June 30th, 2022. Patients were identified using the electronic medical records. Patients were included if they are 18 years or older and presented to ED with opioid withdrawal. Exclusion criteria included pregnancy, active treatment with methadone, and inpatient admission. The patients were stratified based on whether they received BUP in the ED only, were discharged with a BUP prescription without receiving a dose during their ED visit, or received BUP in the ED and were discharged with a BUP prescription. The primary outcome is continuation of BUP therapy based on prescription fill for BUP on the Prescription Drug Monitoring Program (PDMP) history within 30 days following ED admission. The PDMP records will be obtained from the Rhode Island Department of Health (RIDOH) database. The secondary outcomes include incidence of precipitated withdrawal, incidence of respiratory depression, ED length of stay (LOS), and 7- and 30-day readmissions to the ED for opioid overdose or withdrawal. T-test will be used to analyze the primary outcome and ED LOS. Chi-squared test will be used to analyze the incidence of precipitated withdrawal, incidence of respiratory depression, 7- and 30-day readmissions to the ED for opioid overdose or withdrawal.

Results:

One-hundred and ninety-five patients were admitted to the RIH ED between January 1st, 2018, and June 30th, 2022, with opioid withdrawal as primary diagnosis with 210 admissions. The statistical analysis and final results are pending. Based on the preliminary analysis, the mean age was 39 years, 68% were male, and 83% were Non-Hispanic or Latino. Minority of patients had baseline comorbidities, including psychiatric disorders (3%) and substance use disorders (2%). Twenty-eight percent of patients had received BUP in the ED. The average dose administered was 7.8 mg. Data on whether patients had received take-home BUP is being obtained. The primary outcome is pending the RIDOH IRB approval and PMDP fill history. Only 1.2% of patients had Clinical Opiate Withdrawal Scale (COWS) score documented with mean of 9 prior to BUP administration, but no post-BUP COWS scores were documented. The median ED LOS was 5 hours in the overall cohort and 5.21 hours that received BUP in the ED. There was no incidence of respiratory depression. Other secondary outcomes are currently being evaluated.

Conclusion:

Since 2018, most Rhode Island Hospital ED providers have been DATA 2000 waivered, allowing them to write outpatient prescriptions for BUP for OUD, allowing more patients to get discharged from the ED on BUP. This provides continuation of medication assisted treatment for OUD beyond the ED visit. We hypothesize that the final results will show the patients who received BUP in the ED and take-home prescriptions will have higher rates of prescription fill for BUP on the PDMP history within 30 days following ED admission. As a partial opioid agonist, we expect to see minimal adverse effects from BUP, including hypotension and respiratory rate depression.

Implementation and evaluation of a pharmacist-driven rapid HIV pre-exposure prophylaxis protocol

Investigators: Justin Jackson, PharmD, Noelle Cordova, PharmD, Ann-Marie Coroniti, PharmD, BCIDP, Amy Brotherton, PharmD, AAHIVP, BCIDP

Background

Daily HIV pre-exposure prophylaxis (PrEP) can reduce the risk of HIV transmission from sex by 92-99%, however its use is disproportionately low compared to the number of people for whom PrEP may be indicated. Barriers to HIV PrEP access include low awareness, limited knowledge, limited transportation, high costs, and stigma.[1] A study evaluating same-day PrEP initiation suggests that providing a free 30-day PrEP starter pack is safe and increases the proportion of individuals receiving PrEP care, with no cases of HIV seroconversion at 6 months.[2] In a review of pharmacy-based interventions, four studies evaluating pharmacist-initiation of PrEP in eligible patients demonstrated successful initiation in 54-100% of participants.[1,3-6] Pharmacists can perform HIV screening, identify individuals who may qualify for PrEP, and may even form Collaborative Practice Agreements (CPAs) to allow for them to order baseline HIV PrEP labs and to prescribe, modify, or discontinue PrEP therapy.[1]

Purpose:

The overall objective of this research is to compare the effectiveness of pharmacist-driven rapid HIV PrEP initiation to HIV PrEP initiation by a healthcare provider other than a pharmacist in an outpatient infectious disease clinic. The central hypothesis of this proposal is that implementation of pharmacist-led rapid HIV PrEP initiation will lead to outcomes at least as good if not better than in patients initiated on HIV PrEP by another healthcare provider.

Methods

This is a retrospective cohort study evaluating the effectiveness of pharmacist-driven rapid HIV PrEP initiation. Adult participants were identified through a electronic medical record query of patients with an encounter for new HIV PrEP initiation within a single outpatient Infectious disease center. Eligible participants were enrolled from the date of first appointment into one of two groups: (1) patients who received PrEP initiation and follow up by a non-pharmacist healthcare provider. (2) patients who received rapid PrEP initiation following the implementation of the pharmacist-driven PrEP protocol. The primary outcome is HIV PrEP uptake. The secondary outcomes are time to first PrEP prescription (days), rate of HIV seroconversion at 6 months, retention in care at 6 months, and safety/adverse effects.

Results/Conclusions:

Results for this study are still pending; however, this study can provide pertinent data on the role of the pharmacist in increasing access to PrEP. Studies have shown that decreased costs, and improved access increase PrEP use. The implementation of a pharmacist-driven rapid HIV PrEP protocol can expand the use of PrEP with outcomes comparable to care provided by other healthcare providers.

Implementation of Equitable Remote Staffing Models in Ambulatory Care Clinics

Authors: Jane Jang, PharmD; Jamie Kwok, PharmD, BCACP; Jenna Lee, PharmD, BCACP, BCPS; Steph Luon, PharmD, BCACP, BCPS; Melanie Cvercko, PharmD; Sera Monestime, PharmD, BCPP; Marie Renauer, PharmD, MBA, BCACP

Objective: Our healthcare system has a rapidly expanding ambulatory care team where pharmacists manage various diseases under collaborative practice agreements. Telehealth visits are utilized to increase patient care access and promote an attractive work-life balance for employees. In the current staffing model, pharmacists work 8-hour shifts, Monday through Friday, rotating onsite and remote shifts. With the increased use of telehealth and its associated benefits, there is interest in exploring fully remote positions and expanded clinic hours to increase accessibility for patient care. We aim to create operationalize an equitable remote and hybrid staffing schedule amongst ambulatory pharmacists while enhancing access to care.

Methods: A literature review was conducted to discover novel remote models for ambulatory care pharmacy clinics. Our team also looked for examples of fully remote or hybrid models within our healthcare system. Three different remote and hybrid schedule options that would work specifically with our ambulatory care clinics' hours were created. A survey was built to assess pharmacist shift scheduling preferences from the three options, explore additional scheduling opportunities, and seek pharmacists' concerns. Once the survey result was collected, our team determined the number of shifts needed to cover onsite clinic hours. An action plan was created to identify coverage gaps and required adjustments to complete the model. A pilot model was presented to leadership for approval prior to model implementation.

Results: Based on the survey responses, a new staffing model was piloted amongst ambulatory dermatology pharmacists. Feedback from the pharmacists was collected to identify opportunities for improvement in the operation of the schedule and sustainability of the model. The dermatology pharmacists participating in the pilot unanimously reported that they were satisfied with the new schedule model. An equitable and sustainable scheduling model has been proposed for implementation in the near future.

Conclusion: This project demonstrates that a fully remote and hybrid schedule model will support the expansion of the ambulatory care team with greater flexibility in scheduling while improving access to care for patients.

Improvement of polypharmacy-related outcomes utilizing the VIONE tool for deprescribing fall risk-inducing drugs (ImPROVED)

Author: Dominique Cheri Jeanty, PharmD

Background/Purpose

Fall risk-inducing drugs (FRIDs) are medications that increase the risk of falls, particularly among patients over 65 years old. Pharmacist interventions such as comprehensive medication reviews and deprescribing may decrease the risk of falls among this patient population. A previous quality improvement project at VA Connecticut (VACT) comprised of a pharmacist utilizing the VIONE deprescribing tool to make recommendations to providers in electronic medical records. This study's objective was to build upon that project by evaluating polypharmacy and fall-related outcomes following a VIONE review and identify areas of process improvement to facilitate an increased recommendation acceptance rate and decreased rate of falls.

Methods

This is a retrospective review of patient information intended as a quality improvement project at VACT. Patients with a high polypharmacy risk were identified utilizing the clinic appointment VIONE risk dashboard from January 1, 2022, through May 31, 2022. Clinic appointment locations included those in the VACT West Haven and Newington campuses. Patients with primary care providers located in the West Haven and Newington Patient Aligned Care Team (PACT) were included in this study. In addition, patients who had at least one visit to the West Haven emergency department were also included. Patients without VIONE reviews were included as comparators to those with VIONE reviews within the same primary care clinic, using equal or similar VIONE and CAN (Care Assessment Need) risk scores as factors for inclusion. Those with VIONE reviews completed outside of the specified time period and those with VIONE reviews conducted at VA locations outside of VACT were excluded.

The primary outcome was the number of documented falls within one year before and one year after the VIONE review. Secondary outcomes included the number of emergency department visits and hospital admissions within one year pre- and post-VIONE review. Additional outcomes measured included the acceptance rate of FRID-related VIONE recommendations and the number of FRIDs in each medication class identified.

Results

Among 40 total patients, 15 were identified with VIONE reviews completed, and 25 comparators without VIONE reviews. All patients were males, with a median age of 76 years, an average VIONE risk score of 6.7 (range 2-9), and an average CAN score of 92.8 (45-99). The total number of documented falls was 89, with 44 (49.4%) in patients with VIONE reviews and 45 (50.6%) in patients without VIONE reviews. Of those with VIONE reviews conducted, 40 falls (90.9%) occurred before the VIONE review, and 4 (9.1%) after. The total number of emergency department (ED) visits was 230, with 96 (41.7%) in patients with VIONE reviews and 134 (58.3%) in patients without. Of those with VIONE reviews, 55 ED visits (57.3%) occurred before the VIONE review, and 41 (42.7%) after. The total number of hospital admissions was 89, with 36 (40.4%) in patients with VIONE reviews and 53 (59.6%) in patients without. Of those with VIONE reviews, 24 admissions (66.7%) occurred before the VIONE review, and 12 (33.3%) after.

There was a total of 25 FRID-related recommendations with an acceptance rate of 28%. There was a total of 231 FRIDs documented, with the most common drug classes being antihypertensives (33.8%), anticholinergics (18.2%), and sedative/hypnotics (15.6%).

Conclusion

Falls, ED visits, and hospital admission rates were similar between patients with and without VIONE reviews in this retrospective analysis. VIONE reviews were associated with a decrease in these outcomes after review was conducted. This may indicate that pharmacist interventions from VIONE reviews may improve fall-related outcomes in older patients taking multiple fall risk-inducing drugs. Some limitations of this study include the small sample size, the possibility of falls occurring that were not documented, and that the falls may not be associated with the FRIDs the patients were taking at the time.

Effect of esketamine on PHQ-9 score, emergency department visits, and hospitalizations of patients with treatment resistant depression in a community hospital setting

E. Kalinski, L. Drozd, J. Moyher; Middlesex Health, Middletown, CT

PURPOSE: Esketamine is a rapidly acting, intranasal antidepressant FDA approved for the treatment of treatment-resistant depression (TRD). TRD is characterized by the failure of two or more antidepressants with adequate dosing and duration of therapy. Use of esketamine has been shown to decrease TRD symptoms by at least 50% in more than 70% of patients. The purpose of this study was to investigate the impact of esketamine on clinical outcomes as quantified by Patient Health Questionnaire-9 (PHQ-9) scores throughout treatment.

METHODS: This study was a descriptive, retrospective chart review of patients with TRD treated with esketamine at Middlesex Health from April 1, 2022 to March 31, 2023. Any patient aged 18 or older referred to the Middlesex Health esketamine clinic based on the diagnosis of TRD and meeting all criteria of the Spravato Risk Evaluation Mitigation Strategy (REMS) program was included. Patients were excluded if they failed to comply with the REMS program, had a diagnosis of bipolar depression or active opioid use disorder, or were actively using medical marijuana. Patients were followed during the esketamine treatment period to monitor for the primary outcome of PHQ-9 score improvement. The primary endpoint of this study was PHQ-9 score at 1 week, 4 weeks, 8 weeks, and 16 weeks during treatment. Data that was collected included age, sex, race, PHQ-9 scores, dates of esketamine administration, dosage of esketamine administered, current medications, and dates of ED visits/admissions (if applicable).

RESULTS: A total of 32 patients with TRD received esketamine treatment at Middlesex Health between April 1, 2022 and March 31, 2023. Patient age ranged from 18-88 years with a median of 49 [IQR 42-60.5] and 23 of the patients were female (71.9%). 31 patients completed 4 weeks of treatment, 25 patients completed 8 weeks of treatment, and only 6 patients completed 16 weeks of treatment. One patient stopped treatment after 1 week. The median baseline PHQ-9 score was 17.5 [IQR 13-21]. After 1 week of treatment, the median PHQ-9 score decreased to 14 [IQR 8-18.75]. After weeks 4, 8, and 16 the median scores were 10 [IQR 7-15.5], 9 [IQR 5-12], and 4.5 [IQR 2-2], respectively. However, due to small sample size, no statistical analysis could be performed to determine the significance of these changes.

CONCLUSION: Esketamine may be an effective treatment option for patients with TRD, as indicated by decrease in PHQ-9 scores, but further research is required to determine its impact on other clinical outcomes.

Analysis of the heparin induced platelet antibody assay in the diagnosis of heparin induced thrombocytopenia at an academic medical center

Authors Priya Kavalam, PharmD, Kathleen Sargent, PharmD, BCPS, Renu Nathan, PharmD, BCPS; UMass Memorial Medical Center, UMass Memorial Medical School

Background: Heparin-induced thrombocytopenia (HIT) and heparin-induced thrombocytopenia with thrombosis (HITT) are complications with potentially life-threatening consequences. Diagnosis is aided by both the 4T score pretest assessment and heparin-induced platelet antibody (HIPA) non-functional assay. While higher optical density (OD>2.0) values are associated with a higher likelihood of HIT, a weakly positive assay (OD 0.3 – 0.5 at UMMMC) warrants further assessment and may lead to unnecessary anticoagulation exposure and prolonged hospitalization while waiting for the gold standard functional assay. The purpose of this study is to evaluate the positive predictive value of the HIPA assay based on OD values in patients assessed for heparin-induced thrombocytopenia over 7 months at a large academic medical center.

Methods: This study was designed as a single-center retrospective review conducted at UMass Memorial Medical Center in patients for whom a HIPA assay was sent between October 1, 2021 to May 1, 2022. The primary outcome was defined as the positive predictive value stratified based on OD unit ranges (negative: less than 0.3 OD, weak positive: 0.3 – 0.5 OD, positive: greater than 0.5 OD). Secondary outcomes included the percentage pretest accuracy of 4T scoring 4-5 and $\geq$6 for positivity with HIPA and SRA, the percentage of positive SRAs stratified based on OD range, the incidence of major bleeding and clinically relevant non-major bleeding during hospitalization, and any new thrombosis once HIPA was collected. This study was approved by the UMass Memorial Medical School institutional review board.

Results: A total of 87 patients met the inclusion criteria, of which 14 had an SRA sent after testing positive or weakly positive with the HIPA assay. The positive predictive value of the HIPA assay was calculated to be 35.7%. All of the patients who tested positive for HIT with the SRA assay had a positive HIPA assay (OD > 0.5). For those with OD > 0.5, the positive predictive value was 45.5%. Focusing on the correlation between reported 4T scores and HIPA results, 9 of 30 patients with a score between 4-5 also had HIPA results with OD $\geq$ 0.3. Additionally, 2 of 6 patients with a score between 6-8 had HIPA results $\geq$0.3.

With respect to anticoagulation management during HIT assessment, 16 patients (18%) had heparin or enoxaparin continued, 39 patients (45%) had anticoagulation held with no alternative agents used, and 32 patients (37%) had either alternative therapeutic anticoagulation or alternate anticoagulation for DVT prophylaxis used. None of the patients who had a weakly positive HIPA were started on alternate anticoagulation. 13 patients (15%) had new or progressive thrombosis at the time the HIPA assay was collected and 3 patients (3.5%) developed new thrombosis after the it was sent. Of those patients who developed new thromboses, all were on alternate anticoagulation (2 on argatroban for therapeutic anticoagulation, 1 on argatroban for chemoprophylaxis). Two patients (2.3%) had episodes of major bleeding or clinically relevant non-major bleeding after the HIPA was sent. Of those with bleeding events, neither were attributable to alternate anticoagulants used.

Conclusion: All patients included in the study with a diagnosis of HIT based on a positive SRA assay also had a positive HIPA assay with OD >0.5. The HIPA assay was calculated to have an overall positive

predictive value of 35.7%. Given that no patients with weakly positive HIPA assay results had confirmatory positive SRA results, no further stratification of positive predictive value based on OD ranges could be calculated. This study was limited by a low overall rate of SRA assays that were sent during the study period; however, the low calculated positive predictive value of the HIPA may further call into question the reliability of using lower OD cutoffs as markers for HIT.

"Challenges pharmacists encounter with alprostadil orders"

Author: Muryam Kham, PharmD

Background:

Neonatal intensive care units (NICU) treat high-risk patients, and most adult hospitals lack pharmacists dedicated solely to NICU order verification. Thus, pharmacists who verify adult medication orders are also responsible for verifying NICU orders. Medication dosing for the neonatal population differs from the typical dosing seen in the adult population, and neonates in critical conditions require careful and diligent monitoring. Pharmacists unfamiliar with NICU orders may not feel confident or comfortable verifying high-risk orders due to the lack of training. Medication errors causing patient harm or death are three times more prevalent in children compared to adults, with most common errors being incorrect weight-based dosing and dosing-interval mistakes.[1,2]

The benefits of clinical pharmacists in the NICU include: "appropriate use of medication, detection, and prevention of potential medication errors which occur in respect of neonates".[1,3-5] In addition, the two factors which showed improvement in medication safety in NICUs are input from clinical pharmacists and computerized physician order entries.[2] One medication that requires careful dosing and monitoring is alprostadil. Alprostadil is a prostaglandin, which causes vasodilation on the smooth muscle vasculature.[6] In neonates with congenital heart defects, alprostadil is used to maintain the patency of the ductus arteriosus to ensure adequate oxygenation in the body.[7]

In this study, we collected survey responses from pharmacists. The data collected in this study will be used to characterize non-NICU/non-pediatric trained pharmacists' confidence when verifying neonatal medication and critical orders such as alprostadil.

Methods:

This study received approval by Hartford Healthcare Institutional Review Board. This research will be conducted as a prospective, descriptive survey study that will collect pharmacists' responses

across the Hartford HealthCare (HHC) system. This study will exclude pharmacy students, community pharmacists and individuals less than 18 years of age.

Invitations to the surveys will be distributed via e-mail through utilizing the listserv for pharmacists within the HHC system. A link to a REDCap form will be provided. Upon clicking that link, potential participants will be asked to check a box indicating that they have read the study information sheet and that by continuing, they will be participating. The survey requires participants to specify the pharmacy specialty they work in, which will allow us to differentiate between pharmacists from various specialties.

Results: Pending

Conclusion: Pending

Evaluation of cardiac toxicities in patients treated with Bruton tyrosine kinase inhibitors

Authors: Eunice H. Kim. PharmD; Maria Fernandez Turizo, MD; David J. Sermer, MD; Caroline Mejías-De Jesús, PharmD, BCOP; Beth Israel Deaconess Medical Center (BIDMC), Boston, MA

Background/Purpose: Bruton Tyrosine Kinase inhibitors (BTKis) have transformed the treatment landscape of B-cell malignancies, such as chronic lymphocytic leukemia (CLL), mantle cell lymphoma (MCL), marginal zone lymphoma (MZL), diffuse large B cell lymphoma (DLBCL) and Waldenström macroglobulinemia (WM). BTKis are associated with an increased incidence of cardiac events, including hypertension, atrial fibrillation, and even ventricular tachyarrhythmias. The first generation BTKi, ibrutinib, has a greater association with cardiac related events as compared to the second generation BTK inhibitors (acalabrutinib and zanubrutinib). The predisposing factors that increase the risk of cardiac toxicities in patients who start BTKi therapy have not been well established. The primary objective of this study was to identify cardiovascular risk factors that may contribute to cardiac toxicities for patients starting BTKi therapy.

Methods: A retrospective chart review was performed on adult patients who received treatment with a BTKi from November 2013 to November 2022. The patients were identified via diagnosis codes on the medical charts. Patients were excluded if they were being treated with a BTKi for graft-versus-host disease, were previously treated with a BTKi, were ordered for but did not receive BTKi therapy, and if there was a loss to follow up after initiation of BTKi therapy. Patients were evaluated for the type of BTKi initiated in addition to preexisting cardiovascular diseases. The primary endpoint of this study was the incidence of cardiovascular toxicities that occurred during a patient's course of BTKi therapy. For all patients who experienced the primary endpoint, prior cardiovascular diseases were identified through chart review of records prior to BTKi initiation. Cardiovascular toxicities were defined as any of the following: atrial fibrillation, new or worsening hypertension, ventricular arrhythmias, and/or sudden cardiac death. Secondary endpoints assessed the rate of each of the cardiac toxicities in addition to discontinuation of therapy and all-cause mortality. Exploratory endpoints included the incidence of

cardiovascular toxicity in the following patient subgroups: combination versus monotherapy, frontline versus relapsed treatment, age <50 years, 50-70 years, or >70 years, and patient sex.

Results: A total of 274 patients were identified and 180 were included for chart review. 116 (64.4%) patients were male, 148 (82.2%) patients were white, 106 (58.9%) patients were diagnosed with CLL/SLL, and 141 (78.3%) patients received ibrutinib as their initial BTKi, with the most common initial dose of ibrutinib identified as 420 mg daily (95, 53.1%). Twenty-two patients (12.2%) experienced cardiovascular toxicity during BTKi therapy (21 patients on ibrutinib and 1 patient on acalabrutinib). Ten of the twenty-two patients (45.5%) were identified to have preexisting cardiovascular disease (CVD). Forty-seven (26.1%) of the total patients were found to have preexisting CVD and ten (21.3%) experienced cardiovascular toxicity during BTKi therapy. Fourteen (7.8%) patients experienced new or worsening atrial fibrillation, 1 patient (0.6%) experienced ventricular arrhythmia, and seven experienced new or worsening hypertension (3.9%). Of the patients who experienced cardiac toxicities, eighteen (81.8%) were being treated monotherapy with a BTKi, fourteen (63.6%) were treated with BTKi as frontline treatment, 15 (68.2%) were >70 years of age, and sixteen (72.7%) were male. 102 (56.7%) of the total patients included in this study discontinued therapy, with the most common reason for discontinuation being progressive disease (23, 22.5%) and adverse effects (56, 54.9%). All-cause mortality was identified for five patients (2.8%).

Conclusion: Patients treated with BTKi therapy showed incidences of cardiovascular toxicities. Most of the cardiac toxicities were identified as new or worsening atrial fibrillation due to initiation of ibrutinib. Nearly half of the patients who experienced cardiovascular toxicity had preexisting cardiovascular disease. Larger trials are necessary to evaluate the rate of cardiac toxicities among patients who have preexisting CVD.

Real world practices of luspatercept at an academic medical center

Author: Madison Rose Koons, PharmD

Background/Purpose:

Luspatercept is an erythroid maturation agent approved for patients with very low to intermediate-risk myelodysplastic syndrome (MDS) with ring sideroblasts and thrombocytosis that failed treatment with an erythropoiesis stimulating agent and remain transfusion dependent requiring 2 or more red blood cell units over 8 weeks.

Luspatercept dosing is based on pre-dose hemoglobin levels and transfusion requirements. The goal of this study is to evaluate if a site that has a pharmacist prospectively reviewing luspatercept doses more frequently, achieves dose optimization compared to a site that does not have a pharmacist prospectively reviewing luspatercept doses.

Methods:

We performed a retrospective chart review involving patients at MGH main campus, which does not have a pharmacist prospectively review luspatercept doses, and MGH North Shore satellite campus infusion center, which has a pharmacist prospectively review doses, who have received at least one dose of luspatercept between January 1, 2017, to August 31, 2022. The study was approved by the

International Review Board at MGH. Eligible patients were 18 years of age or older that received at least one dose of luspatercept at either center with MDS. Patients were excluded if they received luspatercept for beta-thalassemia or myeloproliferative neoplasm, started therapy at an outside institution, or had MDS and were transfusion independent at baseline.

The primary endpoint is the percentage of luspatercept doses not consistent with prescribing information (PI) recommended dose adjustments. Off label doses were defined as patients who should have received a dose escalation who did not, patients who received a dose escalation that were transfusion independent, and patients that discontinued luspatercept prior to receiving the maximum dose (3 consecutive doses of 1.75 mg/kg and still not transfusion free). Secondary endpoints included the number of patients that underwent correct dose modifications for pre-dose hemoglobin levels or rapid hemoglobin rise. Other secondary endpoints evaluated efficacy and safety.

Results:

A total of 35 patients were reviewed with 17 meeting the inclusion criteria. There were 11 patients evaluated from MGH Main Campus vs. 6 patients from MGH North Shore. The median age was 79 (78 – 86), 77% were male, and majority of patients had low-risk disease. Overall, patients' baseline characteristics were balanced between groups.

Of the 162 doses evaluated, 37 (23%) were off label. Off label dosing at the center without a pharmacist conducting prospective review was more common than at a center with a pharmacist conducting prospective review of luspatercept dosing (29.6% vs. 2.4%; P<0.003). Of the 37 doses that were not consistent with the PI, 17 (10.5%) required a dose escalation, 4 (2.5%) did not require a dose escalation, and 12 (7.4%) met requirements for discontinuation. but received a dose. More doses at MGH Main Campus required a dose escalation but did not vs. MGH North Shore (28.1% vs. 2.4% P <0.006).

Transfusion independence, defined as ≥2 weeks transfusion free, was achieved in 47.1% of total patients. More patients achieved transfusion independence at MGH North Shore vs. MGH Main Campus (83.3% vs. 27.3% P <0.39).

A total of 17.6% of patients discontinued luspatercept due to adverse drug events (ADE). The most common ADEs included dizziness, headache, and confusion.

Conclusions:

There was a higher percentage of off label dosing at a center without a pharmacist's prospective review versus a center with a pharmacist's prospective review. The most common dosing error not consistent with the PI were doses that should have been escalated based on transfusion requirements that were not. On label dose optimization may lead to a higher percentage of patients achieving transfusion independence. Enhancements in the current ordering and review process can be improved with the involvement of a pharmacist's prospective involvement at both centers.

Identification of Pharmacy Interventions Aimed at Reducing Missing Medications at a Large Academic Medical Center

Author: Aleksandar Kuznetsov, PharmD

Background

Missing medication doses can lead to worse outcomes for patients, including increased hospital stay, significant patient harm, and delays in the recovery from a disease. A missing medication is a patient-specific ordered medication that is not available to the nurse at the planned administration time. Each instance leads to increased phone calls, pharmacy workflow disruptions, decreased staff satisfaction, and time spent away from direct patient care delivery. By identifying targets for potential intervention, we hope to improve our efficiency in medication delivery and availability, and therefore see a reduction in missing medications at our institution.

Methods

This quality improvement study took place at Beth Israel Deaconess Medical Center (BIDMC) in Boston, MA. It was approved by the Institutional Review Board at BIDMC. Data was accessed via PowerBI, which ingests information from our electronic health record (EHR), including data regarding medication order dispensing and extra dose request processing. Data was collected from 9/1/2022 through 3/31/2023, analyzing each full month separately. Data collected includes the name of the missing medication, the route of administration, the dispensing code, the reason for the extra dose request, and the location. "Let Call" dispensing codes are used as part of the intentional dispensing process of certain medications (IV drips, inhalers, creams, other bulk items not dispensed on a set schedule). Items with this dispense code were excluded from the 'missing' medications group. Items that were marked as a "missing medication" by the pharmacist processing the extra dose were included. This data was used to determine which medications are most frequently requested as an extra dose and/or presumed missing at the time of planned administration. Additionally, a fishbone diagram was put together to identify potential contributing factors to missing medications, as well as identify areas of intervention within our pharmacy department. The fishbone diagram was constructed based on pharmacy staff interviews and observation of our medication dispensing process.

Results

The fishbone diagram displays 22 identified contributing factors. The rate of missing medications (number of missing doses/total doses dispensed per category, per month) ranged as follows: total missing 2.90%-3.27%; unit dosed missing 1.15%-1.33%; IV missing 6.80%-8.01%. Thus, we pursued IV missing medications as a target. The most frequently missing IV medications were vancomycin and piperacillin/tazobactam. In response, the targeted intervention proposal is to include these medications as normal stock on units where these medications were missing more than 5 times/month. Additionally, there is a sharp increase in missing medications at 0900. We hypothesized that this may be related to pharmacy technicians returning medications prematurely, resulting in the medication not being available for the nurse to administer. To address this, we proposed to extend the time that medications are to be kept on the medicine floor before being returned to pharmacy from 24 hours to 48 hours. Another hypothesis is that medication order changes that happen during rounds are not captured. Splitting the daily IV fill from 24 hours into 12 hours allows for changes on rounds to be accounted for in the second IV fill that day and for the adjusted doses to be available when due for administration.

Conclusion

Through this quality improvement project, we identified a variety of potential interventions that may benefit the pharmacy department by reducing missing medications. The interventions that have potential to make a large impact are those targeting missing IV medications. This included proposed changes to the daily IV label print, adding select IV medications to normal floor stock, clarifying expiration and BUD on labels, and using due times as a reference when bringing back IV medications. Future directions of this project include implementing these interventions and assessing the impact that they have on the rate of missing medications at our institution.

Association with SSRI/SNRI use and incident hyponatremia after aneurysmal subarachnoid hemorrhage

Author: Jacqueline Lange, PharmD

Background/Purpose: Hyponatremia is a common complication following aneurysmal subarachnoid hemorrhage (aSAH) with an incidence of up to 50%. It is associated with worse outcomes including delayed cerebral ischemia (DCI), and risk factors for its development are poorly defined. Selective serotonin reuptake inhibitors (SSRIs) and selective norepinephrine reuptake inhibitors (SNRIs) are pharmacologic agents implicated in hyponatremia in the form of syndrome of inappropriate antidiuretic hormone secretion (SIADH). No studies have evaluated the incidence hyponatremia in aSAH patients taking these medications prior to admission. The purpose of this study is to evaluate whether pre-admission SSRI/SNRI use is associated with an increased risk of developing clinically significant hyponatremia following aSAH.

Methods: Adult patients presenting to Massachusetts General Hospital with SAH between January 2017, and December 2021 were included in this single-center retrospective, observational cohort study. Data was obtained from the Epic Data Warehouse (EDW), Get with the Guidelines Repository (GWTG), and supplemented with manual retrospective chart review. Institutional review board approval was obtained prior to project initiation (2022P002472). Patients were included if subarachnoid hemorrhage was observed on computed tomography angiography (CT) imaging or magnetic resonance angiography (MRA) that was then confirmed to be aneurysmal or nontraumatic. Patients were excluded if they were hyponatremic on admission (serum sodium < 135 mEq/L), had SAH secondary to reversible cerebral vasoconstriction syndrome or cerebral amyloid angiopathy, or experienced mortality within 24 hours of admission. The primary endpoint was the incidence of clinically significant hyponatremia, defined as a serum sodium < 135 mEq/L on two consecutive basic metabolic panels, between patients who were and were not on an SSRI/SNRI pre-admission. Secondary endpoints include specific hyponatremia therapy utilization, aneurysm securement method, and time to hyponatremia. Data was analyzed using *R* (version 4.2.1). Categorical variables including baseline characteristics were analyzed utilizing Chi-squared T test and continuous variables were analyzed with student t-tests. Time to incident hyponatremia, adjusted for baseline confounders, was assessed with Kaplan Meier survival analysis.

Results: Of the 292 patients included, 49 patients were prescribed an SSRI or SNRI prior to admission. Baseline demographics were similar between groups with respect to age, race, and comorbidities. The most common site of aneurysmal rupture in both cohorts was anterior (43% in the SSRI/SNRI cohort vs. 55%; p = 0.086), and the median aneurysm size between groups was similar (5.0 mm vs. 6.0 mm; p = 0.30). The incidence of clinically significant hyponatremia occurred in 37% of patients prescribed SSRIs or SNRIs compared to 30% in the patients not prescribed these medications prior to admission (OR 1.35;

95% CI, 0.70 to 2.55; p = 0.35). The time to incident hyponatremia was consistent between groups (6.0 days vs. 5.5 days; p = 0.80), and there was an insignificant trend towards increased incidence of vasospasm in the SSRI/SNRI cohort (33% vs. 21%; p = 0.065). There were similar rates of rebleeding (4.1% vs. 5.4%; p > 0.99) and delayed cerebral ischemia (12% vs. 14%; p = 0.80) between groups.

Conclusions: The results of this study do not support increased risk of pre-admission SSRIs and SNRIs for incident hyponatremia. SSRIs and SNRIs were also not associated with increased risk of clinically relevant complications of SAH, including rebleeding, vasospasm, or DCI. Additional larger studies are required to further characterize the relationship between SSRI/SNRI utilization and patient outcomes in aSAH.

Implementation of a medication contract price surveillance and management process at a large academic medical center

Authors: Maria Latta, Sara Cohn, Brian Miller, Melissa Silver, Catherine McGeary, Michael Guerra, Marina Yazdi

Background: Our health system is comprised of five delivery networks – three of which are covered entities. Medications are purchased on over 60 accounts, which include 340B, group purchasing organization (GPO), disproportionate share hospital (DSH) and wholesale acquisition cost (WAC) classes of trade. Prior to this project, we did not have a single contract catalog of all current pharmacy contracts and pricing, nor was there a proactive, standardized process for identifying contract price load errors, ultimately leading to overspending. In 2022, our health system identified over $1 million in pricing errors. This cost was recovered through credit-rebills, however, many discrepancies likely remained undetected and those savings unrealized.

Methods: The health system evaluated available contract price management software on the market to assist in ongoing real-time pricing surveillance. A standardized process that integrated the selected software was then developed. Pharmacy contract specialists were engaged to ascertain their current workflow and identify gaps, which were subsequently documented in a current state process flow map. A contract repository was created to provide a consolidated, single reference point for all prices. An optimized workflow and standard operating procedure were created to address initial contract price load workflow as well as ongoing price variance identification and resolution, incorporating the contract price management software. Cost avoidance was identified utilizing the contract price software was evaluated weekly since go-live.

Results: Pharmacy contract specialists update the contract price repository upon contract execution and input the correct reference price into the wholesaler purchasing platform. The contract specialists review the contract price management software weekly to identify pricing discrepancies and ensure they are rectified by engaging the manufacturer or distributor as appropriate. Addressing discrepancies involves credit-rebills and adjusted price loads in our purchasing platform to reflect active contract prices. By acquiring this software and integrating it via a standardized workflow, our entire health system can regularly and routinely monitor contract pricing and identify discrepancies in real-time. We have identified 4 major cost avoidance opportunities, totaling approximately $400,000 within a 4-month period since the implementation of this software and workflow.

Conclusion: By implementing a medication contract price surveillance and management process, major cost avoidance opportunities have already been identified. Our team continues to partner with the contract management software team to address unmet needs and gaps in the process, including integrating a contract price repository directly into the software for added efficiency. This project reinforces the need for a standardized process for contract management and demonstrates the benefit of leveraging technology to improve this process.

Incidence of mucositis and graft-versus-host disease (GVHD) among hematopoietic stem cell transplant patients receiving reduced-intensity fludarabine/melphalan conditioning and low-dose methotrexate as GVHD prophylaxis

Author: Natalie Leung, PharmD

Background/Purpose

Reduced-intensity conditioning (RIC) regimens for allogeneic hematopoietic stem cell transplant (HCT) are generally associated with a lower incidence of mucositis and improved tolerability as compared to traditional myeloablative conditioning. Potential trade-offs include higher relapse rates and decreased overall survival. Similarly, GVHD prophylaxis with lower doses of methotrexate has been associated with comparable rates of GVHD but faster engraftment and lower non-relapse mortality. Given the limited published data regarding the use of reduced-intensity fludarabine/melphalan 100 mg/m^2 conditioning and low-dose methotrexate 5 mg/m^2 on days 1, 3, and 6 and tacrolimus as GVHD prophylaxis, we evaluated the incidence of mucositis and GVHD, as well as efficacy and safety outcomes, associated with this regimen.

Methods

This retrospective, IRB-approved, single-arm observational study evaluated all allogeneic HCT patients 18 years and older who received this regimen at Massachusetts General Hospital between January 1, 2016 and December 31, 2021. Patients who received post-transplant cyclophosphamide, sirolimus, or mycophenolate for their initial GVHD regimen were excluded. Primary outcomes included the incidence of mucositis and acute and chronic GVHD through 12 months post-transplant. Secondary efficacy outcomes included hospital length of stay, time to absolute neutrophil count (ANC) and platelet engraftment, and graft rejection during transplant admission, in addition to rates of relapse, non-relapse mortality, progression free survival, and overall survival at 12 months post-transplant. Secondary safety outcomes included rates of febrile neutropenia during transplant admission; nephrotoxicity, infections, and tacrolimus toxicities within 100 days post-transplant; as well as rates of readmission through 12 months post-transplant. All statistical analysis was conducted by an independent statistician.

Results

A total of 117 patients were included in this study. Forty-three (36.8%) experienced mucositis, and no baseline factors were significantly associated with mucositis. However, mucositis was associated with a higher incidence of febrile neutropenia ($p = 0.037$) and longer hospital length of stay ($p < 0.001$). The overall rate of acute GVHD was 36% (95 CI, 27% to 45%), of which 16% (95% CI, 10% to 24%) was grade II-IV and 6.8% (95% CI, 3.2% to 12%) was grade III-IV. The overall rate of chronic GVHD 12 months post-

transplant was 50% (95% CI, 41% to 59%), 37% (95% CI, 28% to 46%) of which was moderate to severe acute GVHD. The median time to ANC and platelet engraftment was 12 and 18 days, respectively. There were two reported cases of graft rejection. At 12 months post-transplant, the relapse rate was 15% (95% CI, 9.6% to 23%), non-relapse mortality rate was 15% (95% CI, 9% to 22%), progression free survival was 70% (61% to 77%), and overall survival was 76% (95% CI, 67% to 83%).

Conclusion

Compared to historical data, RIC fludarabine/melphalan 100 mg/m^2 conditioning and low-dose methotrexate 5 mg/m^2 on days 1, 3, and 6 and tacrolimus as GVHD prophylaxis was associated with lower rates of mucositis and grade II-IV acute GVHD, as well as comparable rates of grade III-IV acute GVHD, chronic GVHD, relapse, non-relapse mortality, progression free survival, and overall survival. These results support current institutional utilization of this regimen, particularly in patients unable to tolerate myeloablative conditioning regimens.

Evaluation of guideline-directed medical therapy at discharge in patients hospitalized with heart failure with reduced ejection fraction

AUTHORS

Q. Lin, S. Kothari, S. Bhatt, K. Nguyen; Beth Israel Deaconess Medical Center (BIDMC), Boston, Massachusetts

BACKGROUND/PURPOSE

The 2022 American Heart Association (AHA)/American College of Cardiology (ACC)/Heart Failure Society of America (HFSA) Guidelines for the Management of Heart Failure strongly recommend four classes of guideline-directed medical therapy (GDMT) as standard of care for patients with heart failure with reduced ejection fraction (HFrEF). Hospitalization provides a critical opportunity for GDMT initiation and titration due to close monitoring of vital signs, volume status, and laboratory values. The primary objective of this study is to explore prescribing patterns and adherence to new guidelines at Beth Israel Deaconess Medical Center (BIDMC), while simultaneously evaluating patient-specific factors and barriers to GDMT implementation during hospitalization.

METHODS

A retrospective chart review was conducted to assess GDMT prescribing patterns in patients with HFrEF admitted to BIDMC between May and August 2022. Patients were identified based on ICD codes. Patients receiving home inotropes prior to admission, those with a left ventricular assist device (LVAD), chronic dialysis, a history of cardiac transplant or undergoing evaluation for cardiac transplant were excluded from this study. The primary outcome was the percentage of patients receiving all four pillars of GDMT: angiotensin receptor neprilysin Inhibitor (ARNi)/angiotensin-converting-enzyme inhibitor (ACEi)/angiotensin receptor blocker (ARB), beta blocker (BB), mineralocorticoid receptor antagonist (MRA) and sodium-glucose cotransporter 2 inhibitor (SGLT2i) at time of discharge. Secondary outcomes evaluated include the percentage of patients with GDMT uptitration during hospitalization, patients discharged on 50% and 100% of target doses for each medication class, medication intolerances and

contraindications, documented plan for outpatient GDMT uptitration and the percentage of patients with 30-day hospital readmissions.

RESULTS

A total of 365 patients were identified and 137 patients were included after exclusion. The percentage of patients with HFrEF on all four pillars of GDMT at discharge was 10.9%. The percentages of patients who received ACEi/ARB/ARNi, BB, MRA, or SGLT2i were 63.5%, 86.9%, 40.1%, and 24.1%, respectively. The percentages of patients discharged on target doses of ACEi/ARB/ARNi, BB, MRA, and SGLT2i were 16.1%, 12.6%, 52.7%, and 100%, respectively. The percentages of patients who were discharged on greater than 50% target dose of ACEi/ARB/ARNi, BB, MRA, and SGLT2i were 41.4%, 31.9%, 100%, and 100%, respectively. Among patients already on GDMT at admission, the percentages of patients who received uptitration of ACEi/ARB/ARNi, and BB were 21.8% and 13.4%, respectively. No patients received uptitration of MRA at discharge. The percentages of patients with documented reasons for not initiating ACEi/ARB/ARNi, BB, MRA, and SGLT2i were 58.0%, 90%, 39.5%, and 31.7%, respectively. Medical charts that included a documented plan for outpatient GDMT initiation of each pillar were 51.0%, 30.0%, 29.6%, and 29.8% of patients, respectively. Lastly, 7.3% of all patients included were readmitted within 30-days post-discharge.

CONCLUSION

In this study, the overall adherence rate to all four pillars of GDMT in patients with HFrEF admitted to BIDMC at time of discharge was low, primarily due to low use of MRAs and SGLT2is. The percentage of patients on target dose for ACEi/ARB/ARNi, BB, and MRA were similar to the results from the CHAMP-HF registry. Given these evident gaps in the use of GDMT and dose titration of GDMT at BIDMC, there are ample opportunities for pharmacy intervention to improve adherence to new heart failure treatment guidelines and to improve overall patient outcomes.

Does adherence to updated asthma guidelines utilizing inhaled corticosteroid-formoterol as preferred therapy reduce exacerbations requiring hospitalization?

Author: Jessica Kristin Lopes, PharmD

Background/Purpose: Past asthma guidelines recommended short-acting beta 2 agonists (SABA) alone or with inhaled corticosteroids (ICS), but therapy standards have changed. The National Asthma Education and Prevention Program 2020 update and Global Initiative for Asthma updates in 2019 through 2022 contained new recommendations to use ICS-formoterol as an earlier and preferred step in outpatient asthma management. Single inhaler ICS-formoterol combinations have demonstrated superiority with treatment adherence and improved outcomes compared to well-established and effective ICS inhalers alone, as indicated in SYGMA1, SYGMA2, SMART, and PRACTICAL trials. This study aims to assess controller therapy in children requiring hospitalization for asthma exacerbations.

Methods: A retrospective single-center analysis of patients with an asthma exacerbation who presented for care at UMass Memorial Children's Medical Center between June 1, 2017 and June 1, 2021 was conducted. Patients were included if they were 5 to <18 years old, diagnosed with asthma, and prescribed either fluticasone HFA or budesonide-formoterol MDI for controller therapy. Exclusion

criteria included patients <5 and >18 years old, patients without asthma diagnosis and patients with concomitant cystic fibrosis or other pulmonary disease. The primary outcome assessed was hospitalizations rates due to asthma exacerbations in patients receiving ICS-formoterol versus ICS + SABA. Secondary endpoints included dose and frequency prescribing practices, the use of other agents for asthma management, classification of asthma severity, hospital length of stay, and hospital readmission for subsequent asthma exacerbations. Safety endpoints addressed were incidence of thrush, nasopharyngitis, upper respiratory tract infection, and mortality.

Results: Between June 1, 2017, and June 1, 2021, 1,497 children were screened for asthma exacerbations, however, 461 patients were excluded for age, 523 patients for lack of fluticasone HFA or budesonide-formoterol MDI, 105 patients due to lack of asthma diagnosis, and 44 patients because of concomitant pulmonary disease. Overall, 364 children met the inclusion criteria and were assessed. Across both groups the mean age was 9.3 years (SD 3.5), sex was 46% female, 44% of patients were diagnosed with asthma for over 5 years, and 64% of patients were only seen in the emergency department. The hospitalization rate due to asthma exacerbations in the budesonide-formoterol group was 8.24% (N=30/364) versus 91.76% in the fluticasone HFA + SABA group (N=334/364). There were significantly more patients with step 2 and 3 asthma severity in the fluticasone HFA + SABA group ($p<0.001$) while 63% of the patients prescribed budesonide-formoterol were at least step 4. Average hospital length of stay was 32 hours for the budesonide-formoterol group (IQR 4,54) compared to 5 hours for the fluticasone HFA + SABA group (IQR 3,27) ($p=0.01$). During this study period, there were 7 readmissions in the budesonide-formoterol group compared to 65 readmissions in the fluticasone HFA + SABA group at UMass Memorial. All other secondary and safety endpoints were not significant.

Conclusion: Among children presenting with asthma exacerbations at UMass Memorial Children's Medical Center, there was an increased hospitalization rate associated with patients prescribed fluticasone HFA + SABA compared to budesonide-formoterol. These findings support the changes in asthma guidelines recommending ICS-formoterol as an earlier and preferred step for treatment, which can be used to bolster practitioner education to reduce exacerbation and hospitalization rates.

Impact of sodium bicarbonate on mortality in cardiac arrest matched for initial presenting rhythm

Authors: M Machnicz, A West , K Shepard, AR Levine, D O'Sullivan, AL Zeiner; Hospital of Central Connecticut, New Britain, Connecticut

Background/Purpose:

The 2020 American Heart Association Advanced Cardiac Life Support guidelines do not recommend administration of sodium bicarbonate in patients with undifferentiated cardiac arrest. This recommendation is based on conflicting literature showing sodium bicarbonate has either improved, worsened, or no impact on return of spontaneous circulation (ROSC). The initial presenting rhythm is a potential confounding variable that has not been accounted for in previous studies and may explain the variability of responses seen with sodium bicarbonate. Therefore, the objective of this study was to assess the impact of sodium bicarbonate administration on mortality based on initial presenting rhythm in cardiac arrest.

Methods:

This study was an Institutional Review Board approved multi-center, retrospective chart review. Patients were divided into two groups based on whether sodium bicarbonate was administered or not. Each group was then matched in a 1:1 fashion based on initial presenting rhythm (shockable vs. non-shockable). Patients were included in the study if they were 18 years or older with a witnessed cardiac arrest and had documentation describing the start time of the code, the initial presenting rhythm, and whether or not sodium bicarbonate was administered. The primary outcome was the percentage of patients with sustained ROSC for greater than or equal to 20 minutes. The secondary outcomes were survival to 24 hours and survival to discharge. To account for the influence, if any, of differences that were observed with univariate testing such as location of cardiac arrest or total length of code, a multivariate logistic regression was used to calculate the odds ratio (OR) with 95% confidence intervals (CI) for each covariate that was associated with any of the primary or secondary outcomes.

Results:

There were 1252 patients screened, resulting in 200 patients meeting the inclusion criteria. Baseline characteristics were similar between both groups except for location of cardiac arrest and total code time. Patients who did not receive sodium bicarbonate with an initial shockable rhythm were 3.53 times more likely to obtain ROSC ≥20 minutes (OR=3.53; 95% CI: 1.10-11.30; p=0.034), 4.65 times more likely to survive to 24 hours (OR=4.65; 95% CI: 1.72-12.56; p=0.002), and 7.88 times more likely to survive to discharge (OR=7.88; 95% CI: 3.06-20.25; p<0.001) compared to those who received sodium bicarbonate. A longer code duration was also associated with a lower chance of survival to 24 hours in the shockable (OR=0.928: 95% CI: 0.889-0.969, p=0.001) and non-shockable groups (OR=0.803: 95% CI: 0.724-0.892, p<0.001), respectively. In the non-shockable group, a longer code duration was also associated with a lower chance of survival to discharge (OR=0.871; 95% CI 0.780-0.972, p=0.013). Patients in the non-shockable group with an in-hospital cardiac arrest were associated with a lower likelihood of survival to 24 hours compared to those with an out-of-hospital cardiac arrest (OR=0.076; 95% CI: 0.011-0.508; p=0.008).

Conclusion:

After matching for the previously unstudied impact of initial presenting rhythm on ROSC in cardiac arrest, this study found that sodium bicarbonate negatively impacts mortality in shockable rhythms. This study adds to the growing body of literature that sodium bicarbonate administration during cardiac arrest has a potential negative impact on ROSC, survival to 24 hours, and survival to discharge.

Reducing COPD readmissions at a large academic medical center

Authors: Palna Mehta, PharmD; Gresa Ajeti, PharmD, BCPS; Sagune Sakya, PharmD, BCPS; Kristina Shvets, PharmD, BCPS; Jessica Bootle, PharmD, BCACP, BCPS; Emalee Collins, PharmD, BCGP; Nino Laquidara, PharmD, BCACP

Purpose: Chronic obstructive pulmonary disease (COPD) causes airflow blockage and respiratory symptoms that impact 200 million people and is the third-leading cause of death worldwide.[2] COPD is a major cause of hospitalization and readmission in the United States. Studies suggest that medication discrepancies can frequently contribute to hospital readmission rates, and that pharmacist involvement in patient care can aid in identification of those discrepancies.[3-7] Studies assessing the impact of

inpatient and outpatient pharmacist interventions on hospital readmission are limited. This study aims to assess the impact of multimodal pharmacist led interventions on readmission rates.

Methods: This was a prospective randomized study that investigated hospitalized patients with COPD at risk for readmission from January 2023 to April 2023. Patients were identified via an electronic report if they were age 18 years and older, admitted with a COPD exacerbation to one of four internal medicine units across two hospital campuses. For the selected patients, potential interventions included one or more of the following: a guideline directed therapy management note, discharge medication reconciliation and referral to the associated outpatient pulmonary clinic for established patients. The primary outcome evaluated was the overall incidence of 30 day readmission. Secondary outcomes included incidence of 30 day readmission for COPD exacerbation, accepted interventions, scheduling of a follow up appointment for patients with referral to the clinic, and the incidence of 30 day readmissions in a subgroup of patients who had completed discharge medication reconciliations or follow up pulmonary clinic appointments.

Results: Of the 37 patients evaluated thus far, 14 in total were readmitted within thirty days (38%). Of those, a total of 6 (16%) patients were readmitted for COPD exacerbations. within thirty days. At least one pharmacist intervention was accepted in 25 (68%) patients. Common accepted interventions included the administration of a pneumococcal vaccine (44%), addition of a nicotine replacement therapy (44%), escalation of inhaler therapy (42%), and tobacco cessation (36%). In a subgroup analysis of 19 patients who had discharge medication reconciliations completed or follow up pulmonary outpatient clinic appointments, a total of 10 (53%) were readmitted, of which 4 (21%) were readmitted for COPD exacerbations. In patients with follow up pulmonary outpatient clinic appointments (n=6), 1 patient (17%) was readmitted for COPD. In patients with discharge medication reconciliation completed (n=17), a total of 10 (58.82%) were readmitted, of which 4 (24%) were readmitted for COPD. Of the 10 patients with established care at the outpatient pulmonary clinic, 6 (60%) scheduled a follow up appointment.

Conclusion: Preliminary data from this evaluation may suggest that thirty day readmission rates for COPD were decreased upon integration of a multimodal pharmacist-led intervention into the inpatient management of high risk COPD patients. However, acceptance rate of interventions from guideline directed therapy management notes were limited. In conclusion, integrating this multimodal approach into daily transitions of care pharmacist workflow may prove to be beneficial in helping reduce COPD exacerbation rates at the institution.

Relationship between exam-taking time and exam score among PharmD candidates

Authors: Rachel Meilan, PharmD; Erin Connolly, PharmD; Lisa Cohen, PharmD, CDE, CDOE, CVDOE

Background/Purpose

The rigorous and high stakes nature of exams within a pharmacy curriculum makes this population of particular interest in understanding if a relationship between exam-completion speed and exam score exists. Results may be able to be extrapolated to medical education as a whole. Although this relationship has been studied broadly, variability in methodology and inconsistent results prevents us from drawing conclusions that can be applicable in academia. Being able to develop a better

understanding of this relationship could potentially influence exam construction and test taking strategies for the future. The purpose of this study is to utilize electronic examination software to determine if a relationship between exam time and exam score does exist.

Methods

This prospective cohort study utilized ExamSoft's computer-based examination software to assess 105 first year PharmD students' exam-completion speed and exam score. A total of three exams (two course exams and one final exam) were evaluated. The primary outcome of interest of this study is to determine if a relationship between time taken to complete exam and exam score exists. Test completion time was assessed using histogram analysis and Shapiro-Wilk test to test for evenly distributed results. Pearson correlation was used for normally distributed data and nonparametric Spearman correlation was used for data that was not normally distributed. Linear regression analysis was used to assess prediction of time to complete exam as compared to the overall grade. Data was analyzed using IBM's Statistical Package for the Social Sciences (SPSS) software, version 27.

Results

A Spearman's rank-order correlation was run to determine the relationship between 105 students' time to take the exam and exam grade. There was a strong, positive correlation between Exam 2 and the time to take exam 2, which was statistically significant ($r_s(8) = .-0.226$, $p = .006$). In addition, the overall combined grade with over all time for all 3 exams showed a strong positive correlation between the time to take the exam and overall grades and was statistically significant ($r_s(8)=-0.338$, $p<0.00)1$. However, for the other 2 exams to time to take the exam and their grade for each exam were not significantly correlated.

Conclusion

There is a trend towards a strong correlation where students who fall in the middle perform better on exams, however a statistically significant correlation between exam time and exam score does not exist. Further studies with a larger student cohort, increased number of exams, and adequate blinding of participant are needed to determine if a relationship between exam score and time exists in pharmacy education.

Algorithm for auto-verification of medications in the emergency departments in a large health system

Authors: Edgardo Mendoza, PharmD; Lauren Rubio, PharmD, BCPS, BCCCP; Evan Zahn, PharmD, BCCCP; Julie D'Ambrosi, PharmD, CPPS; Alexandra Barton, PharmD; Stacy Vaeth, PharmD, MS

Background/Purpose:

An FAQ from The Joint Commission Standard regarding MM.05.01.01 EP1 addresses use of auto-verification technology for medication orders. The standard states that prospective pharmacist's review of medication orders may be excepted in limited circumstances such as when a licensed practitioner is present to supervise the ordering, preparation, and administration of medications. The Joint Commission's stance on prospective review of all medication orders is very important. Yale New Haven Health (YNHHS) is a 5-hospital system with differing practices on medication order verification in the

emergency departments. Almost all emergency departments in YNHHS use auto-verification technology to some degree. Pharmacists prospectively verify medication orders to ensure safety in the medication use process. This study aims to provide an algorithm describing what types of medications need prospective medication review.

Methods:

The medications on auto-verification were reviewed. Literature search was done to identify medications where the prospective review by a pharmacist added significant value/patient safety. An algorithm outlining groups of medications that can be removed from auto-verification was drafted based on a consensus among emergency medicine pharmacists in alignment with the YNHHS Override Medication List.

Results:

The algorithm lists medications that would promote medication safety. The list consists of warfarin, aminoglycosides, renally dose adjusted order with frequency outside of once, weight-based orders without an actual weight recorded within the encounter, drugs where the patient has a documented (severe) allergy, those with "high" or "contraindicated" drug-drug interaction warning, or medications currently on the YNHHS shortage list. This algorithm is planned to be presented to nurse and physician leadership in the emergency department for review and feedback.

Conclusion:

The results of this algorithm will provide a framework for removing medications from auto-verification status as these will promote medication safety.

Evaluation of AUC-based vancomycin dosing at a Veterans Affairs (VA) Hospital

Author: Maura Elizabeth Miller, PharmD

Background/Purpose:

Vancomycin is a glycopeptide antibiotic with broad coverage against gram-positive organisms. Therapeutic drug monitoring is employed to reduce the risks of nephrotoxicity associated with vancomycin. Serum trough concentrations and area under the curve (AUC) can both be used for monitoring vancomycin therapy. At present, VA Connecticut (VACT) utilizes trough dosing. However, in 2020, the Infectious Diseases Society of America (IDSA) changed the standards of care by recommending AUC monitoring when using vancomycin for MRSA infections. Discrepancies in dose adjustments can occur when comparing concentrations of troughs versus AUC. The goal for this project is to evaluate patients receiving vancomycin by comparing serum trough levels to calculated AUC.

Methods:

A retrospective chart review was performed on patients who received intravenous (IV) vancomycin at VACT over a 90-day time period from October 27, 2022 to January 25, 2023. Patients were included if they received at least 3 doses of vancomycin and obtained a vancomycin trough value. Patients with unstable renal function who were being dosed based on random vancomycin levels were excluded.

Patient age, gender, height, weight, serum creatinine, and vancomycin dosing regimen at the time the vancomycin trough was drawn were inputted into a vancomycin dose calculator, VancoPK. The VancoPK calculator determined vancomycin AUCs for patients and recommended doses for future treatment. The calculated AUC level was compared to the vancomycin trough level obtained at VACT, and dose adjustments made based on trough values were compared to those recommended based on AUC by VancoPK. If patients had a second vancomycin trough value, the process was repeated.

Results:

In a 90-day period, 63 vancomycin trough levels were identified for potential analysis. After evaluating inclusion and exclusion criteria, 28 patients with 38 corresponding trough values were included. Of these 28 patients, 11 had goal trough values of 10-15 for urinary tract infections (UTI) or wound/skin and soft tissue infection (SSTI) indications, and the remainder had goal trough values of 15-20. Additionally, none of the patients had MRSA bacteremia, the primary indication for AUC-based vancomycin dosing. When trough values were compared, it was more likely that patients had an acceptable AUC and trough out of goal than both acceptable AUC and trough with AUC values. Only 9 of 38 troughs drawn were both at their goal trough level and goal AUC level of 400-600. Meanwhile, 10 troughs drawn were subtherapeutic but had an AUC level of 400-600, indicating they are within AUC goal. Two patients had a goal trough value, however, when their AUC was assessed, it was greater than 600. Of the 20 patients that continued to receive vancomycin after their first trough, only 5 of the vancomycin doses matched the recommendations from VancoPK to maintain AUC between 400-600.

Conclusion:

Discrepancies between trough-based and AUC-based vancomycin dosing were common in this evaluation. This can precipitate adverse effects, such as kidney injury, if a dose is unnecessarily increased based on a low trough but acceptable AUC. Alternatively, accumulation can result in toxicity if dosing is unchanged due to a perceived therapeutic vancomycin trough despite having a supratherapeutic AUC value. Although no patients analyzed had an MRSA infection, AUC-based dosing using VancoPK has the potential to lead patients to better therapeutic outcomes and less potential for toxicity.

Evaluation of Antibiotics Order Sets Implementation in Electronic Health Records (EHR) for Utilization and Impact

Author: Mohannad Nasser, PharmD

Background

Standardized order sets (SOS) have shown a contribution to minimizing medication ordering errors. There have been several studies showing their correlation with many beneficial outcomes. Krive et al studied the effect of standardized order sets for patients with pneumonia and found that these orders reduced mortality, readmissions, and length of stay. The standardized order sets particularly for antibiotics prescribed for various infections was incorporated during the implementation of EPIC in April 2022 at a community hospital. This quality improvement project aims to enhance the utilization and adherence to these order sets and evaluate their impact on antibiotic use and patient outcomes.

Methods

This quality improvement project is a retrospective chart review using EPIC's report functionality. IRB exemption was obtained. The analysis included antibiotic orders prescribed between October 2022 – Mar 2023 at medical floors, emergency department, and intensive care units. The intervention was to conduct education sessions for prescribers to enhance the utilization of order sets for antibiotic prescribing starting from January 2023. The study was divided into two phases: the pre-education phase between Oct 2022 -Dec 2022 and the post-education phase between Jan 2023 – Mar 2023. The study excluded any antibiotic orders not included in the targeted order sets, vancomycin orders since its managed by the pharmacy not captured by order sets, and orders for antibiotics for surgical procedures at procedural floors (surgical, labor and delivery). The primary endpoint was the percentage of orders entered directly by computerized provider order entry (CPOE) utilizing order sets. Secondary endpoints were the impact of SOS utilization on patient outcomes including days of antimicrobial therapy pre and post-education for the most used antibiotics and length of hospital stay between order set and non-order set groups post-education. The statistical analysis included descriptive statistics for baseline data, chi-square test for measuring adherence to SOS utilization pre/post-prescriber education, and t-test for measuring secondary outcomes.

Results

Pre-education analysis included 4090 antibiotic orders while post-education included 3806 orders. Pneumonia was the most common source of infection in both periods (41.2 % pre-education and 35.4 % post-education), followed by urinary tract infections 19.5% for pre-education and abdominal infections (17.3 %) for post-education. Ceftriaxone (26% pre and post) and doxycycline (15.9 % pre and 17.9 % post) were the most prescribed drugs for both study periods. For the primary outcome, the percentage of orders entered directly by CPOE utilizing order sets was increased significantly from 0.85 % to 4.8 % ($P < .00001$) in the post-education phase. There was a decrease in trend in antibiotic days of therapy post-education for the most used antibiotics (ceftriaxone, cefepime, piperacillin-tazobactam, levofloxacin, and doxycycline) but was not significant. The mean hospital length of stay for the non-order-sets group was 5.1 days while the mean for the order-sets group was 4.8 days ($P=0.35$).

Conclusion

There appears to be a decrease in antibiotic days of therapy and hospital length of stay. Despite the significant increase in compliance, rates were still low and might have contributed to the non-significant benefits noticed in secondary outcomes. Several studies suggested different compliance rates accomplish significant benefits but remained fairly low as well. Education and awareness about antibiotic order sets must be continued and enhanced to achieve more conclusive results. Also asking prescribers about the barriers to not using the order sets would give us more insights into the low compliance rate.

Implementation of an inpatient workflow for pharmacist-driven warfarin to direct-acting oral anticoagulant conversion

Authors: B. Nelson, N. Kindelin, D. Kubicsko, S. Sakya, N. Scarpelli, J. Lee, L. Tran, T. Papstein; Yale New Haven Health (YNHH)

Background: Clinical practice guidelines support direct-acting oral anticoagulants (DOACs) over warfarin as first-line therapy for stroke prevention in non-valvular atrial fibrillation (NVAF) and prevention and treatment of venous thromboembolism (VTE). DOACs have a superior bleeding profile compared to warfarin, a fixed dosing schedule, less frequent laboratory monitoring, and fewer drug-drug and drug-food interactions. Evaluation for DOAC eligibility is within the scope of clinical pharmacists, however, there is currently system variation in the workflow for evaluation. This project was designed to create a standardized, proactive, pharmacist-driven, system-wide workflow to increase warfarin to DOAC conversion.

Methods: A team of pharmacists was assembled to create a proactive, standardized workflow to enhance communication between inpatient and ambulatory care pharmacists. The current warfarin monitoring process was reviewed to identify opportunities for optimization and standardization. Inpatient pharmacists are evaluating patients for DOAC conversion individually, without a systematic approach or consistent form of documentation. Ambulatory care pharmacists are using an electronic health record (EHR) tool to evaluate patients for DOAC eligibility. A report was created to identify the selected target population for DOAC eligibility. Additionally, an analysis of possible EHR solutions was completed to support a warfarin to DOAC conversion process.

Results: A proactive, pharmacist-driven, system-wide workflow to increase warfarin to DOAC conversions was designed to enhance transitions of care across a five-hospital health system. Patients will by identified by inpatient pharmacists through a clinical decision support prioritization system in the EHR, which flags patients that may be eligible for conversion based on the documented indication for warfarin use. The pharmacist will then evaluate the patient for DOAC eligibility using an EHR tool. If the patient is deemed eligible for DOAC conversion, the pharmacist will collaborate with the care team for DOAC conversion. Lastly, the pharmacist will document the assessment within the EHR. The DOAC assessment EHR tool will enhance transitions of care for clinical pharmacists across the continuum of care, inpatient and ambulatory care. Feasibility and sustainability of the new standardized workflow were assessed by requesting feedback and approval from key pharmacy stakeholders and leadership.

Conclusion: A proactive, pharmacist-driven, system-wide workflow for warfarin to DOAC conversion was designed to standardize the DOAC assessment and conversion process. Ultimately, EHR tools can be leveraged to improve communication between inpatient and ambulatory care pharmacists. This workflow will increase guideline-directed therapy, facilitate transitions of care, and improve safety and monitoring of a high-risk medication.

Medication Related Length of Stay Reduction in Patients Admitted for Urinary Tract Infection

Authors: William Osei-Bonsu, PharmD; Stefanie Zassman, PharmD, BCPS; Charlie Jones, PharmD, BCPS; Dayna McManus, PharmD, BCPS-AQ ID; Jeffrey Topal, MD

Background:

A Vizient analysis of various diagnosis related groups (DRGs) revealed an increase in length of stay (LOS) for inpatients with urinary tract infection (UTI) admitted at an academic health system compared to peer institutions. The increased LOS prompted a review of these inpatients to determine if antibiotic selection and/or duration were contributing factors. The objective of this medication use evaluation is to determine if there are potentially modifiable factors to reduce LOS in patients admitted for UTI across a five-hospital health system.

Methods:

A retrospective analysis of patients admitted for DRG 689 (UTI with major clinical complication) and DRG 690 (UTI without major clinical complication) was completed across the five delivery networks within the health system. The period for the Vizient analysis was from June 2021 through May 2022. Patients were selected for review if the calculated difference between the expected and actual LOS was half a day or more. Twenty-five patients from each delivery network within the health system with DRG 689 and an additional twenty-five patients with DRG 690 from one delivery network were estimated to be collected for review. Patients were excluded if they were admitted for renal transplant, neutropenia, dialysis, and those awaiting bed placement at a skilled nursing facility, psychiatry hospital or long-term acute care hospital. The following data points were collected: time to final urine culture, duration of inpatient antibiotic use, conversion of parenteral to enteral antibiotics, and UTI and non-UTI related factors prolonging LOS.

Results:

A total of 178 patients were identified from the Vizient analysis within the period under review. Twenty-seven patients were excluded from the review due to either having a primary diagnosis other than UTI or a calculated difference in LOS less than half a day. The mean time to final urine culture was 2.2 days. The mean duration of inpatient antibiotic therapy ranges from 5 to 7.1 days. The percentage switch from parenteral to enteral antibiotics ranges from 36 to 70% across the delivery networks. Factors that were identified to have contributed to the prolonged LOS of patients beyond the treatment of UTI included altered mental status, disposition, *C. difficile* infection, intensive care unit admission, and other acute medical problems.

Conclusion:

The longer LOS seen across the health system for patients admitted for UTI is likely due to other factors beyond the treatment of UTI. However, there is opportunity to optimize the switch from parenteral to enteral antibiotics when appropriate oral options are available.

De-labeling false penicillin allergies in primary care

Authors: Katherine Owens, PharmD; Safiya Naidjate PharmD, BCACP, CDCES; Iris Tong, MD; Andrew Zullo, PharmD, ScM, PhD

Background: Penicillin allergies are one of the most frequently reported allergies in patient medical records. However, most reports of penicillin allergies are resulted from a remote history of an allergic reaction that occurred in childhood, or non-allergic responses such as adverse drug events or intolerances. There are many reciprocations of false penicillin allergy documentation, including overuse

of broad-spectrum antibiotics and increased rates of antimicrobial resistance. The purpose of this study is to describe the overall cohort of patients with a documented penicillin allergy within a single primary care clinic and evaluate the extent to which penicillin allergies are re-classified following detailed review of penicillin allergy histories.

Methods: A report was generated of all patients with a documented penicillin allergy seen at a single primary care clinic between 5/1/2017, and 5/1/2019. Patients were provided a questionnaire either in person, by telephone, or by online patient portal regarding specific details pertaining to their penicillin allergy history. Questionnaire responses were then independently reviewed by a pharmacist and physician to determine if the allergy should be retained, reclassified as an intolerance, removed from the electronic medical record, or whether further penicillin allergy testing was indicated.

Results: Complete results of this study are pending. A total of 975 patients had documentation of a penicillin allergy in the electronic medical record, of which 80.2% of patients completed the questionnaire. Following a review of questionnaire results, 14.7% of documented allergies were retained in the medical record, 4.4% were removed, 7% were reclassified as an intolerance. The remaining 54.2% of patients were recommended for referral to an allergist for further testing. Of the 528 individuals that were recommended for allergist referral, 197 were referred and 65 patients saw an allergist. Of the patients who saw an allergist for penicillin skin testing and subsequent oral challenge, 83.1% had penicillin allergy documentation removed from their medical chart. The remaining 13.8% of patients had a positive skin test or oral challenge and therefore had penicillin allergy documentation retained, and 3.1% of patients had their allergy reclassified as an intolerance following allergy testing.

Conclusions: Accurate documentation of penicillin allergies in patient medical charts is important to antimicrobial stewardship practices. This study demonstrated that penicillin allergies in primary care are overreported, which is consistent with data from existing literature. Results of this study can be used to improve assessment of penicillin allergies across primary care settings.

Use of full-dose direct oral anticoagulants in patients with peripheral arterial disease

Alex Peterson-Weber, PharmD; Ji Liu, PharmD, BCCCP; Pansy Elsamadisi, PharmD, BCPS, BCCCP

Background: Peripheral arterial disease (PAD) is a vascular condition characterized by progressive occlusion of the peripheral arteries via atherosclerosis and plaque formation, potentially leading to acute limb ischemia, amputation, and even death. Although antiplatelets and anticoagulants have been utilized to maintain graft patency following revascularization, data supporting the use of full-dose anticoagulation is limited. Low-dose rivaroxaban is currently the only FDA-approved direct oral anticoagulant (DOAC) available for the management of PAD but full-dose DOACs are still sometimes used for graft patency. The aim of this single-center, retrospective cohort study is to evaluate the safety and effectiveness of full-dose DOACs in PAD patients following revascularization at a large academic medical center in Boston Massachusetts.

Methods: Patients admitted to the vascular service from July 2020 to July 2022 were identified via clinical surveillance software and dispensing records. Patients were included if they were initiated on a full-dose DOAC for graft patency after a vascular procedure. Patients were excluded if they received a low-dose DOAC or were receiving a DOAC for other indications. The primary safety endpoint was the

proportion of patients experiencing a bleeding complication while on a full-dose DOAC per the Modified-International Society on Thrombosis and Haemostasis (ISTH) Major Bleeding criteria. Secondary endpoints assessed DOAC efficacy and included rates of readmission, revascularization, re-occlusion, thrombosis, major adverse cardiac events (MACE), limb events, and DOAC discontinuation rates. Descriptive statistics were utilized for all statistical analyses and IRB approval was received prior to data collection.

Results: One hundred thirty-eight patients were identified and screened for inclusion. Thirty-seven patients met the inclusion criteria and were included in the final analysis. The median age was 73 (interquartile range [IQR], 61-79) years, 67.6% of patients were male, and the median body mass index (BMI) was 25.7 (IQR, 23-28.3) kg/m^2. Twenty-two (59.5%) patients received apixaban while 15 (40.1%) received rivaroxaban. Thirteen major bleeding events occurred in 10 (27.0%) patients. Two (20.0%) patients suffered intracranial bleeds and ultimately died while receiving a full-dose DOAC. The remaining 8 (80%) patients experienced bleeding requiring re-hospitalization or presentation to an acute care facility. For secondary efficacy outcomes, there were 49 PAD-related readmissions that occurred in 26 (70.3%) patients. Additionally, repeat revascularizations occurred in 25 (67.6%) patients, graft re-occlusion occurred in 8 (21.6%) patients, limb events were observed in 15 (40.5%) patients, and no MACE occurred. Full-dose DOACs were discontinued in 12 (31.6%) patients.

Conclusion: Full-dose DOAC for maintenance of graft patency in our cohort of PAD patients was associated with a high incidence of major bleeding. Larger trials are necessary to fully elucidate the efficacy of full-dose DOACs in this patient population. Given these findings, risk stratification should be done prior to initiation of DOAC given safety concerns and lack of strong evidence supporting their use. These findings will be presented to hospital vascular surgery leadership to improve patient safety outcomes.

Evaluation of a pharmacist led vancomycin AUC:MIC dosing protocol compared to traditional trough monitoring at an academic medical center

Authors: Jacqueline Plant, PharmD; Jessica Lomanno, PharmD, BCIDP; Kathleen Belusko, PharmD, BCPS

Objectives: In December 2019, UMass Memorial Medical Center (UMMMC) implemented a pharmacist-led area under the curve to minimum inhibitory concentration (AUC:MIC) dosing protocol with the goal of decreasing toxicity of vancomycin treatment. The purpose of this single-center, retrospective study was to evaluate the safety and efficacy of a pharmacist led AUC:MIC vancomycin protocol compared to traditional trough monitoring.

Methods: Patients with an AUC:MIC pharmacy to dose consult order at UMMMC between September 1, 2021 and September 1, 2022 were reviewed. This was compared to inpatients with an infectious disease consult receiving at least two weeks of vancomycin with trough-based monitoring during the same time period. Patients were excluded if they were less than 18 years of age, receiving renal replacement therapy, or were comfort measures only. The primary outcome was the incidence of acute kidney injury (AKI) while receiving vancomycin. Secondary outcomes were 30-day re-hospitalization, duration of vancomycin treatment, change to alternative therapy, 30-day mortality, patient specific trough goal (as calculated per protocol based on achievement of therapeutic AUC:MIC and patient-specific

pharmacokinetic parameters), days on vancomycin prior to initiation of AUC:MIC protocol, time to therapeutic level, number of vancomycin levels drawn, time to blood culture clearance, vancomycin dose on the first day of therapeutic level, length of hospital stay, and development of neutropenia.

Results: A total of 129 patients met inclusion criteria, with 70 patients in the AUC:MIC dosing group and 59 in the traditional trough monitoring group. Baseline characteristics were similar, with no significant differences between the groups in terms of sex, age, or weight. More patients in the trough monitoring group developed AKI during treatment than the AUC:MIC group (51% vs 21%; p = 0.001). AUC:MIC patients spent an average of 24 ± 20 days hospitalized compared to 41 ± 46 days for trough patients (p = 0.01). Alternatively, length of vancomycin treatment was longer in AUC:MIC patients compared to trough patients (37 ± 12 vs 24 ± 12 days; p<0.0001). There were no significant differences in time to negative culture (3.7 ± 2.2 vs 5.4 ± 4.7; p = 0.08), development of neutropenia (8.5% vs 17%; p = 0.15), re-hospitalization at 30 days (29% vs 29%; p = 0.98), or mortality at 30 days (8.5% vs 10%; p = 0.77) between the trough monitoring and AUC:MIC groups, respectively.

Conclusion: Patients treated with an AUC:MIC vancomycin protocol were less likely to develop AKI and spent less time hospitalized than those with traditional trough monitoring. This data supports the continuation of our institutional AUC:MIC protocol. Future directions for UMMMC may include expanding our current inclusion criteria to patients being treated with vancomycin for less than 14 days. Additionally, this study supports advocating to start AUC:MIC as early as possible rather than waiting for a finalized assessment and plan in regards to vancomycin duration. Larger, multi-center, or prospective trials may be needed to collect further data regarding effect of vancomycin dosing protocols on re-hospitalization and mortality.

Evaluating initiation and discontinuation of stress ulcer prophylaxis in the critical care setting and beyond

Primary Author: Hannah Ploch, PharmD

Co-Author: Mark Baker, PharmD, BCPS

Purpose: The purpose of this study is to examine if patients initiated on stress ulcer prophylaxis (SUP) have an appropriate indication for use as well as examine if SUP is appropriately discontinued once therapy is no longer indicated. SUP often is prescribed in the intensive care unit due to the high acuity of illness; however, the benefits of SUP are not seen once the patient recovers, risk factors resolve, or enteral feeding resumes. While existing guidelines and evidence support discontinuation of SUP in these cases, this is not always seen in practice.

Methods: This study is a single-center retrospective chart review of eligible records approved by the Hartford HealthCare Institutional Review Board. Patients aged 18-89 years old in the intensive care unit (ICU) or progressive care unit (PCU) who were administered more than one dose of a formulary H2 receptor antagonist (H2RA) or proton pump inhibitor (PPI) were included for chart review. Data obtained from patient records included: ICU/PCU length of stay, disposition from the critical care units, hospital length of stay, type of acid suppressive therapy used, total duration of therapy, location and time of acid suppressive therapy discontinuation, organ system based primary diagnosis for critical care admission, pertinent stress ulcer risk factors, and nothing by mouth status during critical care stay.

Descriptive statistics were used for interpreting data. Continuous, normally distributed data was presented as a mean and standard deviation in which the mean matches the median. Continuous data that was not normally distributed was presented as a median with interquartile range. Categorical variables were presented as a frequency, using percentages.

Results: A total of 200 patients were included in this review. The average age of participants was 62.15 years. The range of hospital length of stay was 2-137 days, with the average length of stay being 11.6 days. The range of ICU/PCU length of stay was 1-56 days, with an average length of stay of 4.76 days. Most patients (92%) were transferred to a general ward following ICU/PCU discharge. The most common primary organ-based diagnoses for ICU/PCU admission were cardiovascular (40%), multiple diagnoses (19%), and central nervous system (16%). The majority of patients did have a stress ulcer risk factor (86.5%), with the most common stress factors being mechanical ventilation (54%) and multiple risk factors (21%). 9.5% of patients who were started on SUP were receiving enteral nutrition. The acid suppression therapy type was split between PPIs (36.5%), H2RAs (49.5%), and a mixture of the two drug classes (14%). The average number of days on SUP was 6.89, with a range of 136 days. Most patients were not discharged on SUP (95%). Hospital discharge was the primary transition when SUP was discontinued (42%).

Conclusion: While the vast majority of patients were not discharged from the hospital on SUP, continuation of therapy during admission beyond risk factor resolution was frequently observed in this review. Although the majority of patients did have a valid reason for initiation of acid suppressive therapy, this is still an area of improvement for preventing extra medication therapy in an already complex set of patients. Strategies to improve the appropriate use of SUP may include: provider and pharmacist education, enhancing best practice advisories in the electronic medical record, and creating a pharmacy-managed acid suppressive therapy protocol.

Implementation of a pharmacist managed opioid-analgesia stewardship consult service.

Authors: Joseph Polidoro, Michelle Pheng, Shannon Kelly, Bill Sergiy, Michael Guerra, Michelle Kelly, Amber Zaniewski

Background/Purpose: Deaths due to illicit drug overdose have steadily increased in the United States since 1999, with marked increases in recent years. In 2015, there were 33,091 deaths due to illicit drug overdose rising to 70,630 in 2019. Chronic opioid use at one year after hospital discharge is more common among opioid naïve patients who received a prescription for an opioid at discharge compared to those who did not. This statistic suggests a potential need for inpatient pharmacist opioid stewardship intervention to help address the epidemic. The goal of an opioid stewardship program is to ensure safe and effective analgesic prescribing using a multimodal approach to optimize postoperative analgesia, reduce adverse effects, opioid consumption, and ultimately the rates of opioid use disorder.

Methods: The proposed process for our protocol involves the patient's primary team placing a pharmacist managed pain consult within 24 hours of surgery, which will outline the associated surgical procedure and reason for consult. The pharmacist will conduct a chart review to evaluate for inclusion and exclusion criteria. Inclusion criteria are adults (age ≥ 18 years of age) post-operative, opioid naïve (defined as

patients without active prescription for opioids for seven consecutive days within the previous 30 days) with acute pain needs. Patients are excluded if they are receiving chronic opioids (defined as daily use of opioids for at least 90 days), comfort measure only, end of life care, palliative care, cancer pain, sickle cell pain, patients with history of substance use disorder currently receiving treatment with buprenorphine, methadone, or naltrexone. If the patient meets inclusion criteria, the pharmacist will optimize the use of non-opioid analgesic medications, make recommendations to add a bowel regimen, change the route of administration of medications when appropriate (intravenous to enteral or subcutaneous) and assess pain control, escalating or deescalating therapy as appropriate. All interventions recommended by the pharmacist will be communicated with the patients' primary team and will be documented in the electronic health record.

Results: The development and implementation of a pharmacist managed opioid-analgesia stewardship consult service in our health system is currently in process. Once the protocol is approved by the appropriate stakeholders and committees, pre- and post-implementation data will be collected and analyzed in future research. Variables to be collected and analyzed in future research include, but are not limited to, the rate of pharmacist intervention, recommendation acceptance, milligram morphine equivalents (MME) daily usage, patient pain scores, and adverse events.

Conclusion: With the development of a pharmacist-managed opioid analgesia stewardship consult service, pharmacists can aid in the optimization of pain management and potentially reduce adverse effects commonly associated with opioid medications. It is anticipated that this protocol will be fully implemented into practice within our health system in FY24.

Use of high-intensity heparin infusion for bridging non-critically ill, hospitalized patients with atrial fibrillation

Author: Melissa Nicole Porter, PharmD

Background: Patients with non-valvular atrial fibrillation (AF) are at an increased risk of ischemic stroke compared to those without AF and are often maintained on oral anticoagulation (OAC). Intravenous unfractionated heparin (UFH) is commonly used for hospitalized patients with AF who need temporary interruption of OAC. The optimal initial heparin infusion rate and bolus dosing strategy for bridging patients from OAC with atrial fibrillation in the hospitalized setting is unknown. The purpose of this study is to assess the efficacy and safety of bridging patients with a high intensity UFH dosing strategy.

Methods: This retrospective review included adult patients with AF on home OAC admitted to an acute care, cardiology unit from September 1, 2020 to August 31, 2022. Inclusion criteria included patients initiated on a high-intensity UFH infusion with a starting rate of 18 units/kg/hour (with or without an initial bolus) and monitored with a partial thromboplastin time (PTT) goal of 70 to 100 seconds. A detailed chart review was performed to assess incidence of supratherapeutic PTTs, time to therapeutic

PTT, percent time in therapeutic range, median therapeutic heparin rate, and incidence of bleeding or thromboembolism.

Results: A total of 69 patients were included in the analysis. The median CHA_2DS_2-VASc was 5 and median HAS-BLED score was 3. A total of 60.9% of patients were on apixaban, 26.1% of patients were on warfarin, and 10.1% of patients were on rivaroxaban prior to the heparin bridge. The primary outcome, incidence of first PTT greater than 100 seconds, occurred in 52 patients (75.4%). Thirty patients (43.5%) had two PTTs greater than 150 seconds in the first 48 hours, while 66 patients (95.6%) had at least one PTT greater than 100 seconds. The median time to therapeutic PTT was 25.2 hours and the median percent time in therapeutic range was 34%. For the 47 patients (68.1%) who achieved therapeutic PTTs within 48 hours of heparin initiation, the median heparin rate when PTTs were therapeutic was 13 units/kg/hour. A total of 20 patients (29.0%) received an initial heparin bolus. Bleeding events during the heparin infusion or within 6 hours of heparin discontinuation occurred in 4 patients (5.8%), and no thromboembolic events occurred.

Conclusion: The results of this study show that bridging AF patients with an initial heparin infusion rate of 18 units/kg/hour resulted in supratherapeutic PTTs within the first 48 hours in the majority of patients. Therapeutic PTTs were achieved with a median heparin infusion rate of 13.0 units/kg/hr. Further prospective research is needed to identify the optimal initial heparin infusion rate and bolus dosing strategy for bridging patients with atrial fibrillation in the hospitalized setting.

Optimization of Antidotes in a Large Healthcare System

AUTHORS: Philippe Recalt, PharmD; John Tyrrell, PharmD; Evan Zahn, PharmD BCCCP; Jesse Albano, PharmD; Alex Aliling, PharmD

BACKGROUND/PURPOSE:
In recent years, the American College of Emergency Physicians and the American Society of Health-System Pharmacists published literature which recommended guidelines on how hospitals should adequately stock antidotes within their respected pharmacy departments and emergency departments. The Yale New Haven Health System Emergency Medicine Leadership and Pharmacy team reviewed these recommendations and update the health systems current antidote protocol to reflect these recommendations. The purpose of this project is to access the health systems current utilization and stocking of antidotes to reflect best use practices recommended by current literature.

METHODS:
A literature review was conducted to identify which antidotes are recommended to stock within a hospital. There are currently 45 antidotes, 44 are recommended to stocked within a hospital, of which 23 should be immediately available. Of these 44 antidotes, we compiled a list of every indication associated with each antidote. Most of these antidotes have multiple indications and are not used solely for the reversal of toxic agents. From this, we narrowed our antidote list to 18 agents. We excluded

agents that have multiple indications and antidotes that are routinely used within our health system (i.e., insulin, calcium chloride and gluconate, glucagon, naloxone, thiamine, etc.). We then compiled the utilization data of each remaining antidote from each of the 7 hospitals and the 9 emergency departments within our health system over a 5-year period (January 1st 2018 to January 1st 2023). We then assessed each of the 44 antidotes order panels within or electronic medical record to ensure that providers are able to order the recommended dosing for each antidote. Then we finally, analyzed where each antidote is currently stocked within each hospital and emergency department using BD Pyxis Enterprise Server.

RESULTS:
From the utilization data we collected of the 18 antidotes we focused on, we identified that these were administered a total of 49,659 times in all departments through the 7 hospitals in our health system. Of these 49,659 administrations, only 564 doses were administered within one of our 9 emergency departments. 1.14% (564/49,659) of all antidote administrations within our health system over a 5-year period occurred within our emergency departments. When looking at the current stocking location of each antidote, we identified 12 antidotes that are considered to be immediately required with low PAR numbers within our Pxyis machines within the emergency department. We also identified 14 antidotes with incorrect order panels (14/44; 36%), the majority of which omit the recommended antidote dosing for their respected agents.

CONCLUSIONS:
Most antidotes within our health system are currently administered in departments other than the emergency department. Based on our current data, our hospitals procurement is adequate for our utilization of each antidote. While we have enough of each antidote within our hospitals, our current stocking of these agents within our emergency departments and our antidote order panels need to be revisited in order to ensure enough drug is present and that providers are able to order these agents using best practice principles.

Standardization of clinical pharmacy services: A continued review of clinical workflow differences across a five-hospital health system

Authors: Christian Rohach, PharmD; Jessica-Vital Corona, PharmD; Michelle Kelley, PharmD; Kristina Shvets, PharmD, BCPS; Dayna McManus, PharmD, BCPS, BCIDP; Christopher Flores, PharmD, BCPS, BCSCPS

Objective:

Determining a care signature within a health system establishes a standard of care, improves health outcomes and reduces healthcare disparities.

In large health systems with multiple delivery networks it is inevitable that differences in clinical practice will exist. Patients should be afforded the same signature of care regardless of which delivery network they receive treatment. Therefore, identifying variations in clinical practice and establishing a consistent standard of care is an ongoing process for any health system. A previous project involving a gap analysis of system clinical pharmacy services has already been conducted. However due to limitations of the COVID-19 pandemic, increased patient volume and pharmacist workload, a second analysis of clinical pharmacy services is required to reflect changes since that time. The objective of this quality improvement project is to continue to identify variations in clinical pharmacy services across the health system and enhance uniformity.

Methods:

A comprehensive inventory of pharmacy services was completed by cross-referencing system standard operating procedures, guidelines, protocols, and pharmacist responsibility documents for each delivery network. A survey was constructed and disseminated to clinical pharmacy managers at each delivery network. The managers were then tasked with distributing the surveys to clinical pharmacists at their site, so that one survey for general medicine, pediatrics, emergency medicine/critical care, and antimicrobial stewardship would be completed for all shifts. Results of this survey were used to conduct a gap analysis of clinical pharmacy services. An action plan that highlights variations in clinical pharmacy practice was then created to be delivered to key stakeholders so that a standard care signature can be determined.

Results:

508 distinct documents outlining system policies, procedures, guidelines, collaborative drug therapy management agreements, standing orders, and investigational drug sheets were identified in the comprehensive inventory of clinical pharmacy services. Of these, 148 documents were not a system-wide document, and were applicable to at least one, but not all delivery networks.

Forty-two separate survey questions were evaluated by clinical pharmacists at each delivery network, for every shift, split between four different clinical categories. Seventy-six surveys were distributed, and sixty-one surveys were completed by pharmacists (80.26%). Of the 42 questions contained within the surveys, 31 (73%) differences in practice were identified.

Conclusions: While the health system has made great progress towards developing a care signature, there are still opportunities for practice alignment. Standardization can be achieved by developing and implementing an action plan in collaboration with key stakeholders at each delivery network. Lastly, this research makes a compelling argument for additional pharmacist resources. Consistency of care is something every health system should strive for, and identifying differences in practice is the first step towards that goal.

Defining Accountability and Management of an Override Medication Dashboard for Controlled Substances

Authors: Cara Rotatori, PharmD, Julie D'Ambrosi, PharmD, CPPS, Stacy Vaeth, PharmD, MS

Background/Purpose: Yale New Haven Health developed an online dashboard to monitor medication overrides throughout the system. This tool can help nursing leaders to provide feedback to staff about minimizing the number of times a controlled substance is taken out of the ADC without an order in compliance with our override policy and minimizing the potential for drug diversion. In order to assign ownership and accountability, a standard operating procedure will be proposed surrounding controlled substance overrides.

Methods: Controlled substance overrides from profiled automated dispensing cabinets across the Yale New Haven Health System from January 1, 2022 to December 31, 2022 were included. Of the controlled substance overrides, those that were not linked to a provider order were also evaluated. A system-wide Drug Diversion Prevention Detection and Response Nursing Workgroup, consisting of pharmacy and nursing leadership, formed to develop a standard operating procedure (SOP). This SOP outlines the

responsible personnel required to review the override dashboard for all profiled ADCs with controlled substances, the frequency of that review, as well as the reporting and escalation process if noncompliance with the override policy is suspected.

Results: In 2022, less than 1% of all orders removed from the ADC were done on override across the entire health system. Of those medications that were done on override from an automated dispensing cabinet, there were a total of 55,186 overrides of controlled substances. 13,931 of those controlled substance overrides were linked appropriately to a provider order compared to 41,255 overrides that were not linked to a provider order. After discussion with the nursing workgroup, the SOP defines that nursing mangers for each unit with an automated dispensing unit that contained controlled substances would be responsible for consistent review of the override medication dashboard, so that action could be taken in a timely manner to resolve any unlinked controlled substance overrides and provide general education about medication overrides. Additionally, language was added to the SOP to define how nursing managers should report and escalate any concerns of noncompliance with the override policy.

Conclusion: By partnering with nursing managers, a standardized procedure was developed to outline a process for ownership of the override medication dashboard in a manageable way so that nursing managers would have the capacity to evaluate and intervene on controlled substance overrides on a consistent basis. Future directions include education for frontline nursing staff and nursing managers across the entire health system and development of an on-boarding education module for new nurse managers. Additionally, the established nursing workgroup will continue to meet an on a routine basis and monitor engagement with the dashboard.

Development of a Guideline for Strategies for Weaning Off Continuous Benzodiazepine Infusions

Authors: Marissa Saber, PharmD; Thomas Warzecha, PharmD; Mahmoud Ammar PharmD, BCPS, BCCCP

Background/purpose: Continuously infused benzodiazepines are typically reserved for last line treatment in critically ill patients requiring sedation. Patients receiving benzodiazepines often develop tolerance, requiring higher doses over time. Prolonged sedation due to drug accumulation from continuous benzodiazepine infusions is a common complication that may increase the duration of mechanical ventilation, intensive care unit length of stay, and risk of intensive care unit delirium. One potential strategy to limit this risk is by transitioning to intermittent benzodiazepine administration. The purpose of this quality improvement project is to establish a guideline to aid in the transition of adult patients off continuous benzodiazepine infusions to intermittent benzodiazepine dosing. Furthermore, this guideline will provide strategies for weaning off intermittently dosed benzodiazepines used for sedation.

Methods: A literature review was conducted to identify strategies for transitioning from a continuously infused benzodiazepine to intermittent administrations. This review included international guidelines from both pediatric and adult care teams. Benzodiazepine pharmacokinetic information and potency data was also obtained to assist in determining a regimen. This guideline is intended to be used in patients who are ready to be transitioned off a continuous infusion. This is defined as patients who are maintained on a continuous benzodiazepine infusion for at least two days and have remained at the same infusion rate for the past 12 hours to ensure that the patient is being adequately treated and is

not experiencing episodes of agitation requiring dose adjustments. Patients excluded will be those who are on a benzodiazepine infusion for status epilepticus, simultaneously also receiving a continuously infused neuromuscular blocking agent, on a benzodiazepine infusion for prevention of withdrawal syndrome including alcohol and benzodiazepine withdrawal, and patients on extracorporeal membrane oxygenation.

Results: A comprehensive guideline was developed including conversions from benzodiazepine infusions to intermittent intravenous or oral lorazepam. This also provides a taper schedule on guidance for discontinuing the infusion. Additionally, a taper schedule on how to come off the intermittent dosing was included for when the patient is ready to be completely removed from sedative benzodiazepines. The guideline also provides recommendations on as needed orders for benzodiazepine withdrawal and ways to manage withdrawal symptoms without utilizing benzodiazepines. The guideline also contains steps on how to manage a patient if they are not appropriately tolerating the taper off the infusion or intermittent benzodiazepines. This guideline will be presented at various critical care leadership meetings across the health system to gain interprofessional support from nursing, pharmacists, and providers.

Conclusion: This guideline was created with the goal of implementing a process to facilitate the reduction of negative outcomes associated with extended continuous benzodiazepine infusions. This will be directly incorporated into our electronic health record as easy to follow step by step instructions. Future directions of this project include analyzing the effects of this guideline by collecting information regarding duration of mechanical ventilation, intensive care unit length of stay, and hospital length of stay.

Implementation of a Hub and Spoke Model in a Medication History Program Across a Large Academic Health System

Primary Author:
Emily Sajda, PharmD, Yale New Haven Hospital

Additional Authors:
Hansik Kim, PharmD, BCCCP, Yale New Haven Hospital
Lydia DeRienzo, PharmD, Lawrence + Memorial Hospital
Jessica Carona, PharmD, Yale New Haven Health System

Background/Purpose:
Medication errors can be attributed to inadequate reconciliation during transitions of care. Within our current large academic healthcare system consisting of a five-hospital delivery network, medication history technicians (MHTs) are not available 24/7 at every medical campus. A method of care delivery termed the Hub and Spoke model was previously developed to improve access to medical services in rural locations. Similar to this model, MHTs from the main medical campus will represent the centralized “hub” location. MHTs at the main campus will provide virtual coverage for the offsite “spoke” sites that have not historically had overnight medication history coverage. The goal of this service implementation is to enhance medication history capture rates and accuracy for overnight emergent patient cases with acute admit medication history needs.

Methods:
A quality assurance evaluation of admission medication history capture rates was performed between November 2018 to March 2023. The primary objective was to increase medication history capture rates by 5% from baseline without additional resources. Inclusion criteria consisted of medication reconciliations collected from patients admitted during the study time period at three hospital campuses. Two delivery network sites within the health system were excluded as they are currently meeting maximum admission medication history capture rates. Ambulatory care site medication reconciliations were excluded due to differences in workflow. Data was collected from electronic medical records via intervention documentation recorded by MHTs. For data reporting purposes, the main "hub" campus will be referred to as hospital 1 followed by the "spokes" termed hospital 2 and 3. The standardization between medical campuses included utilizing pre-constructed, uniform documentation and a pre-interview documentation template. The first phase of the Hub and Spoke Medication History Program implementation started in January 2023 where MHTs from the main campus were provided with the opportunity of virtual cross-coverage shifts available using reallocated work-from-home resources. Future directions include further electronic resources distributed to MHTs throughout the implementation to expand virtual staffing and analyzing post-implementation medication history capture rate trends monthly.

Results:
Retrospective review revealed that annual average medication history capture rates have increased for all three sites between the 2018 fiscal year to the first quarter of the 2023 fiscal year. Rates for hospitals 1, 2, and 3 in 2018 were 54%, 56%, and 33% with rates in quarter one of the 2023 fiscal year resulting in 72%, 66%, and 56% respectively. The combined average number of medication histories completed monthly by hospitals 1, 2, and 3 amounted to 4,646 for the 2018 fiscal year and has increased steadily to 5,757 medication histories monthly on average for the first quarter of the 2023 fiscal year. Since the beginning of the first phase of the model, rates for hospitals 1 and 2 in December 2022 have increased from 66% and 66% upward to 76% and 70% respectively. Hospital 3 rates have fluctuated during this period. Data collection will continue monthly as the implementation process progresses. Limitations to the study include variations in individual MHT capture rate, ongoing optimization of the medication reconciliation process, and hospital census fluctuations.

Conclusion:
Data will continue to trend the impact that the Hub and Spoke Model Medication History Program has on medication history rates compared to a documented historical baseline and assess for future optimization. Preliminary data from this evaluation suggests that the first phase of increased virtual shift cross-coverage will lead to an overall increase from prior baseline rates. Continued expansion in virtual shift cross-coverage for overnight emergent patient cases with this model across a large academic health system has the potential to have a significant impact on patient outcomes.

Evaluation of initial dosing of benzodiazepines for the treatment of seizure disorder at a tertiary academic medical center

Authors: S. Samel, P. Vallabh, M. O'Brien, N. Jaber; UMass Memorial Medical Center, Worcester, Massachusetts

Background/purpose:

Aggressive benzodiazepine dosing for seizures often leads to safety concerns, which contributes to underdosing. This single-center, retrospective cohort study aimed to assess the safety and efficacy of initial benzodiazepine dosing for active seizures.

Methods:

This study included patients who were ≥18 years of age, had a confirmed acute seizure episode, and were administered either IV lorazepam, IM midazolam, or IV diazepam as the initial inpatient treatment for seizure termination between October 1, 2020 and October 1, 2022. Patients were excluded if they received benzodiazepines for other indications, received other medication for the initial treatment of the acute seizure episode, had a history of refractory status epilepticus, were intubated prior to seizure activity, were pregnant, or were incarcerated. Guideline-directed therapy for seizure control was defined as IV lorazepam 0.1 mg/kg/dose (max 4 mg/dose), IM midazolam 10 mg (>40kg), or IV diazepam 0.15-0.2 mg/kg/dose (max 10 mg/dose). Efficacy endpoints included seizure cessation per documentation in the medical record, the use of escalating or repeat doses of benzodiazepines, and the addition of second- or third-line agents used within 60-minutes of the initial benzodiazepine dose. Safety endpoints included the need for intubation within 24-hours, a subsequent diagnosis of refractory status epilepticus, the need for continuous anesthetics, admission to the ICU, hospital and ICU length-of-stay, and all-cause mortality. This study was approved by the UMass Memorial Medical School institutional review board.

Results:

A total of 1534 patient records were obtained using ICD-10 codes, 470 patients were screened, and 50 patients were included. The average age was 56 years (range: 19-90 years; median 60 years), 28 patients (56%) were female, and 21 (42%) had a history of seizures prior to the current encounter. For initial treatment of the acute seizure episode, 47 patients (94%) received IV lorazepam, 1 (2%) received IV diazepam, and 2 (4%) received IM midazolam. Thirty-nine patients (78%) received the initial benzodiazepine treatment in the emergency department. Four patients (8%) received a guideline-recommended dose as the initial treatment while 46 patients (92%) were underdosed. Seizure cessation occurred in 27 patients (54%) while 23 (46%) received an additional dose/medication (78% of these patients received an additional dose of lorazepam). The average time to additional medication administration was 13.04 (+/- 8.41) minutes. For safety outcomes, 13 patients (26%) required intubation within 24-hours, 4 (8%) required continuous anesthetics, 5 (10%) had a new diagnosis of refractory status epilepticus, 23 (46%) were admitted to the ICU, and 3 (6%) died.

Conclusion:

Ninety-two percent (92%) of patients received less than guideline-recommended dosing for the initial treatment of an acute seizure episode. Seizure cessation occurred in a little over half of patients (54%)

while safety outcomes such as intubation, ICU admission, and the need for continuous anesthetics occurred in <50% of patients. While further studies are needed to assess the safety and efficacy of over- and under-dosing, it is anticipated that the results will help improve the standardization of initial benzodiazepine dosing for seizures as well as allow for the creation of an initial seizure medication order set for application at our institution.

A Digoxin Load Pathway for Atrial Fibrillation in the Emergency Department

Authors: Elizabeth Sauers, PharmD[1]; Bryan D. Hayes, PharmD, DABAT, FAACT, FASHP[1,2]; Lanting Fuh, PharmD, BCPS[1].
[1]Massachusetts General Hospital, Boston, MA
[2]Harvard Medical School, Boston, MA

Purpose

Traditional digoxin loading dose strategies for atrial fibrillation in the emergency department (ED) setting are complicated by digoxin's pharmacokinetic parameters, narrow therapeutic index, and risk of toxicity. A digoxin load pathway was implemented in our ED in April 2019 to guide providers in making clinically appropriate dose adjustments and provide recommendations for serum drug level monitoring. The purpose of this study is to evaluate the efficacy of the pathway in achieving target post-load heart rate and serum levels, and to assess overall adherence to the pathway since its implementation.

Methods

A retrospective chart review was conducted on adult patients who received an intravenous (IV) digoxin load for rate control of atrial fibrillation/flutter in the ED between April 2019 and December 2022. Patients were excluded if a serum digoxin level was not obtained within 5-12 hours following the initial loading dose, or if multiple IV digoxin doses were administered prior to the level draw. The primary endpoint was heart rate (HR) control, defined as HR < 110 beats per minute at the time of serum digoxin level monitoring. Secondary endpoints included serum digoxin level (> 0.6 or ≤ 0.6 ng/mL) and adherence to the digoxin load pathway. Baseline characteristics and endpoints were analyzed using descriptive statistics.

Results

The 36 patients meeting criteria for evaluation had a mean age of 71 years, were 75% male, and 93% white. A majority of patients (83%) were receiving beta-blockers prior to admission to the ED, 64% had concomitant heart failure, and 42% had impaired renal function. Most patients received IV or PO beta-blockers and IV magnesium either within 6 hours leading up to the digoxin load or prior to digoxin level draw at 5-12 hours. The mean serum digoxin level was 1.1 ng/mL, with 22% of patients ≤ 0.6 ng/mL and 78% > 0.6 ng/mL. At the time of the 5-12 hour digoxin level, 46% of patients achieved HR control vs 54% of patients who were not controlled. For the initial digoxin loading dose, 58% of patients received 250 mcg, 36% received 500 mcg, and the median total loading dose given in the ED was 500 mcg. Overall adherence to the pathway was 22%, and common reasons for non-adherence included no electrolyte repletion prior to load and additional doses given when HR was uncontrolled but the digoxin level was > 0.6 ng/mL.

Conclusion

This medication use evaluation suggests that IV digoxin loading dose strategies primarily included a one-time dose of 250 mcg or 500 mcg, aligning with pathway recommendations. The HR control of 46% at 5-12 hours and a mean serum digoxin level within the normal therapeutic range indicate that a 1000 mcg load is not always needed to reach target HR and level goals. Adherence to the pathway was low, but identified causes of pathway deviation will aid in increased education to ED staff when prescribing and administering an IV digoxin load. Ideas for implementation of changes include creation of an order panel, implementation of a clinical decision report notifying providers of patient-specific factors to consider for empiric dose reduction, and education focused on the risk of supratherapeutic digoxin levels and toxicity with doses given after a resulting level > 0.6 ng/mL.

Effect of overlapping insulin glargine administration in decreasing incidence of hyperglycemia after discontinuation of intravenous insulin infusion

Authors: Jillian B Searle, PharmD; Veronika Latawiec, PharmD; Micaela Carroll Powner, PharmD, BCPS; Feryal Alhamadani, PharmD Candidate

Background/Purpose:

Glycemic control in patients with diabetes is crucial due to the significant potential for negative outcomes surrounding uncontrolled blood glucose. Both hyper- and hypoglycemia among hospitalized patients are associated with an increased risk for complications, prolonged length of stay, an exorbitant medical cost burden, and worsened mortality. The American Diabetes Association currently recommends a target glucose between 140 and 180 mg/dL for hospitalized patients. The study purpose was to assess the incidence of hyperglycemia in patients being transitioned from an IV infusion to subcutaneous (SC) insulin. Study staff evaluated whether overlapping SC with IV insulin decreased the incidence of hyperglycemia.

Methods:

This study is an Institutional Review Board-approved retrospective chart review. Patients were included if they were between the ages of 18 and 89, admitted between 3/1/20 and 12/31/21, received an IV insulin infusion for at least 24 hours and were previously diagnosed with diabetes. Patients diagnosed with diabetic ketoacidosis or hyperosmolar hyperglycemia syndrome on admission were excluded. Patients that received a continuous IV insulin infusion and SC insulin glargine were evaluated for eligibility criteria and compared. Patients transitioned to SC insulin glargine after stopping the IV insulin infusion were compared to those receiving overlap with SC insulin glargine and the IV insulin infusion. The primary outcome was the occurrence of hyperglycemia in the 24-hour period after the continuous insulin infusion was stopped. Secondary outcomes investigated the occurrence of hypoglycemia in the 24-hour period prior to the IV infusion being stopped, the correction of hypoglycemia, adjustments made to the glargine dose, and the need to restart the IV insulin infusion during that same hospital admission. Based on the hypothesis of a 30% difference in the incidence of hyperglycemia between groups, 36 patients per group were needed to achieve 85% power.

Results:

There were 72 patients included in data analysis, with 36 patients receiving overlap and 36 being transitioned directly from the continuous IV infusion to SC insulin without overlap. There was no difference in the incidence of hyperglycemia between the overlap group (100%) and the group without overlap (97.2%). No difference was detected in the incidence of hypoglycemia (p=0.496) between groups. The need to restart the continuous insulin infusion was similar between groups (p=0.306). Patients receiving overlap required more insulin glargine in the 24 hours after the insulin infusion was stopped than those who did not (p=0.021). No difference was detected between the incidence of hyperglycemia by gender or diabetes mellitus diagnosis of type 1, 1.5 or 2. The group that received IV and SC overlap upon transitioning were numerically more likely to have received corticosteroids, though this endpoint did not achieve statistical significance.

Conclusion:

Glycemic control in patients with diabetes is crucial as hyper- and hypoglycemia among hospitalized patients are associated with an increased risk for complications, length of stay, cost burden, and mortality. The results of this study were aimed towards outlining the need for a protocol establishing the appropriate transition from intravenous insulin to subcutaneous insulin to reduce the incidences of hyper- or hypoglycemia in hospitalized patients. No difference was detected between groups for all endpoints, suggesting there is no preferred method or overlap required upon transitioning IV to SC insulin in hospitalized patients. However, results are limited by study design and high incidence of hyperglycemia in both groups.

De-escalation of daratumumab and hyaluronidase-fihj pre-medications at a VA Medical Center

Authors: Grace Sheridan, PharmD, John Szymanski, PharmD, BCOP, Rhandin DeSantis, PharmD, Amanda Lal, PharmD, BCPS; VA Connecticut Healthcare System (VACHS)

Background/Purpose: Daratumumab and hyaluronidase-fihj is an IgG kappa monoclonal antibody used for the treatment of multiple myeloma and amyloidosis. Due to the high rates of infusion related reactions associated with intravenous administration, it's controversial about whether the recommended pre-medications should be continued following subsequent injections of this newer formulation. This research aims to compare the incidence in the rates of hypersensitivity reactions following a pre-medication de-escalation protocol with daratumumab and hyaluronidase-fihj administration. Additionally, this will determine the total amount of chair time saved at the VACHS Cancer Center and the overall reduction in pre-medications administered over a 3-month study period.

Methods: This single-centered, retrospective chart review evaluated three months of patient data from September 1, 2022, to November 30, 2022, who were on daratumumab and hyaluronidase-fihj and received pre-medications according to a standard protocol. The data was then compared with three months of patient data from December 5, 2022, to February 28, 2023, who received pre-medications according to a revised protocol. Specifically, famotidine, dexamethasone, acetaminophen, diphenhydramine, and montelukast were administered sixty minutes prior to the first two injections. This was then de-escalated to dexamethasone, acetaminophen, and diphenhydramine prior to the third injection. All pre-medications were then eliminated for subsequent doses if no hypersensitivity reactions

occurred. For some patients, dexamethasone continued if it was a part of their treatment regimen. Exclusion criteria consisted of patients actively receiving intravenous daratumumab, those who could not receive a reduction in pre-medication due to baseline health conditions, or those whose treatment with daratumumab and hyaluronidase-fihj injections were held. The following information was collected and analyzed for patients that met inclusion criteria: age; gender; diagnosis; chemotherapy regimen; total number of daratumumab and hyaluronidase-fihj injections received under the revised pre-medication protocol; total amount of pre-medications received; and the incidence of hypersensitivity reactions.

Results: The final analysis evaluated 17 patients who received daratumumab and hyaluronidase-fihj at the VACHS Cancer Center. Fifteen patients (88%) had a diagnosis of multiple myeloma, and 2 patients (12%) had a diagnosis of amyloidosis. The average age of patients was 77 years; 94% were male. The majority of patients received treatment with daratumumab and hyaluronidase-fihj in combination with lenalidomide or pomalidomide, and dexamethasone. Additionally, most patients received treatment on a monthly schedule. The primary outcome, or the incidence in the rate of hypersensitivity reactions to daratumumab and hyaluronidase-fihj using a revised pre-medication protocol in comparison to the standard protocol was 0%. A total of 61 injections were administered using the new pre-medication protocol and a total of 58 hours of chair time was saved over a 3-month time period. The overall reduction in pre-medications included: 35,750mg of acetaminophen, 2,025mg of diphenhydramine, and 238mg of dexamethasone. Further stratified, an average of 2,103mg of acetaminophen and 119mg of diphenhydramine were saved per patient. Of the 7 patients (41%) who were successfully tapered off all pre-medications, an average of 34mg of dexamethasone was saved amongst each of these patients.

Conclusions: This study demonstrated no difference in the incidence of daratumumab and hyaluronidase-fihj hypersensitivity reactions in patients receiving a revised pre-medication protocol. The use of a revised protocol improved chair time turn over and overall workflow at the VACHS Cancer Center including minimizing the time spent prescribing pre-medications, verifying orders, and restocking. Although there was a relatively small sample size, this study demonstrates the utility of a reduction in pre-medications. Further data is needed to confirm a definite relationship between the use of a de-escalated protocol and the incidence of hypersensitivity reactions in patients newly started on daratumumab and hyaluronidase-fihj.

Optimization of Auto Verification of Medication Orders Placed in a Community Hospital Emergency Department

Author: Austen Sholudko, PharmD

Background:

The emergency departments (ED) of hospitals are associated with an increased risk of medication errors due to time and staffing demands, transition of care challenges, and the regular use of “high alert” medications. Auto verification of medications is a tool used by some organizations to improve their efficiency by bypassing the pharmacist’s review of medication orders. However, quality organizations

such as the Joint Commission and the Institute for Safe Medical Practices recommend against the auto verification of medications except in emergency situations. At Tufts Medicine Melrose Wakefield Hospital (MWH), most medication orders in the ED are auto verified for non-admitted patients, which allows for immediate access to medications, but can lead to potential medical errors. This project was done to implement an auto verification exception list in the ED without creating significant delays in time to medication administration, creating a burdensome workload for pharmacy staff, or causing patient harm.

Methods:

This is a single center, pre and post, observational study that is a quality improvement project at Melrose Wakefield Hospital. The study received a Not Human Subjects Research designation by the Tufts Medicine IRB. Medications that are stocked in the automated dispensing cabinets in the ED are auto verified for non-admitted patients with a few exceptions. Medication orders from a pre-specified list will be compared before and after the removal of auto verification status. The pre-specified list was broken down into pharmacologic categories including vasopressors, sedatives, antidotes, insulins, intravenous anti-infectives, anticoagulants, cardiac medications, psychiatry medications, certain pain medications, electrolytes, and paralytics. The primary endpoint is the mean number of medication orders verified and auto verified pre and post intervention. The secondary endpoints include median time from order placed to order verified for medications from the pre-specified list pre and post intervention and the number of medication overrides in the ED post intervention. The removal of auto verification for medications on the pre-specified list went into effect on April 11, 2023. The pre-intervention data will be collected from March 7, 2023- April 10, 2023. The post-intervention data will be collected from April 11, 2023- May 15, 2023. An unpaired Student's t-test will be used to compare the mean number of verified orders per day pre and post intervention, and the Mann-Whitney U-test to compare the median times from orders placed to verification pre and post intervention.

Results:

In the pre-intervention group, a total of 21908 medication orders were evaluated to determine the primary endpoint. Prior to the intervention, the mean number of orders verified by pharmacists was 428.4 orders per day in the hospital, and it was 47.46 orders per day in the emergency department. The median time from order placed to verification was 5 minutes for the vasopressor group, 6 minutes for the sedatives group, 4 minutes for the antidotes group, 3 minutes for the insulins, 5 minutes for IV anti-infectives, 7 minutes for anticoagulants, 8 minutes for the cardiac group, 11 minutes for the psychiatry group, 6 minutes for the pain group, 5 minutes for the electrolytes, and 1 minutes for the paralytics. The post-intervention results are pending and will be collected and analyzed after May 15, 2023.

Efficacy of secondary oral vancomycin prophylaxis (OVP) in a high-risk patient population receiving systemic antibiotics

Authors: O Shutov[1], K Shepard[1], AR Levine[1], L McMann[1], C Dempsey[1], D O'Sullivan[2]; Department of Pharmacy Services, The Hospital of Central Connecticut, New Britain, Connecticut[1] and Department of Research Administration, Hartford Hospital, Hartford CT[2]

Background

Clostridioides difficile infection (CDI) is a common cause of antibiotic-associated diarrhea. Each infectious episode increases the risk for recurrence, resulting in increased morbidity and mortality. Oral vancomycin has been extensively studied for the treatment of CDI, however there is no formal consensus on its efficacy in secondary prevention. Evaluating the use of OVP in patients at high risk for recurrent CDI may provide additional evidence for efficacy in secondary prevention and help guide clinicians with selecting an appropriate dose and duration of therapy.

Methods

This study was an Institutional Review Board approved multicenter, retrospective chart review within a large healthcare system that evaluated the efficacy of OVP to prevent recurrent CDI in patients at high risk for recurrence who received systemic antibiotics between September 3, 2019, and December 31, 2022. Patients were included if they were 65 years or older, or at least 18 years old and immunocompromised, with a history of CDI in the past 12 months, who received at least one dose of a systemic antibiotic. High-risk patients receiving OVP were compared against high-risk patients who qualified yet did not receive secondary OVP. Patients were excluded from this study if they had an oral vancomycin allergy, received concurrent treatment with fidaxomicin, were not categorized as high-risk, or were hospice patients not expected to survive the hospital stay. The primary outcome was CDI within 90 days of discontinuing systemic antibiotics. Secondary outcomes included any CDI reoccurrence within 90 days that led to hospitalization or death due to all causes. Among patients hospitalized for CDI, the length of stay and need for intensive care unit level of care or surgery was calculated.

Results

Of the 1,467 screened patients, a total of 100 patients, with 50 patients in each cohort, met the study inclusion criteria. Similar baseline characteristics between groups were gender, ethnicity, immunocompromised status, number of toxin-positive CDI within 12 months, and antibiotic choice for initial CDI. Notably, the OVP cohort was younger, received a longer duration of therapy for the initial episode of CDI, had an increased length of time on systemic antibiotics, and were more likely to have an infectious diseases consult. Sixty-three percent of patients in the OVP group received more than 125 mg of vancomycin per day compared to 37% of patients that received the guideline-recommended regimen of 125 mg daily. There was no difference in the incidence of CDI recurrence within 90 days of discontinuing systemic antibiotics between patients who received OVP and those who did not [7/50 (14%) vs 5/50 (10%); P=0.760]. There was also no difference in the incidence of hospitalization due to CDI [5/50 (10%) vs 3/50 (6%); P=0.715] or all-cause mortality [5/50 (10%) vs 5/50 (10%); P=1.00] in the OVP cohort as compared to the non-OVP cohort, respectively.

Conclusions

This retrospective, multicenter chart review did not identify a difference in CDI recurrence within 90 days of discontinuing systemic antibiotics in a cohort of high-risk patients who received OVP as compared to those who did not. The findings of this study are limited by the imbalance in the baseline characteristics between the two cohorts and higher than guideline-recommended daily doses used in the OVP group. Larger, prospective, randomized, controlled trials that utilize a low-dose oral vancomycin regimen are necessary to determine if OVP successfully prevents recurrence.

Outcomes associated with platelet infusion for reversal of antiplatelet medications in the setting of traumatic brain injury

Author: Christian Silva, PharmD

Over the last decade, utilization of more potent P2Y12 inhibitor medications such as ticagrelor and prasugrel has increased significantly in response to national guideline updates for the management of myocardial infarction. The expanding use of these drugs in standard practice has perpetuated interest in antiplatelet reversal strategies for severe bleeding events such as traumatic intracranial hemorrhage (tICH). Reversal strategies that have been investigated include platelet transfusion and desmopressin administration. However, due to a lack of evidence, neither therapy is strongly recommended by any current guidelines leaving providers with little guidance when treating these patients.

The purpose of this study is to examine the impact of platelet infusions for the reversal of a broad range of antiplatelet medications in the setting of tICH. The primary outcome of interest will be hemostasis based on the presence or absence of bleed expansion on the 6-hour repeat brain CT scan. Thrombotic rates, in-hospital mortality, hospital length of stay (LOS), ICU LOS, and neurosurgical intervention will be assessed as secondary outcomes. A subgroup analysis will be performed to evaluate differences in the aforementioned outcomes based on which antiplatelet agent(s) the patient is taking.

The patient population for the study was retrospectively identified through the electronic medical record (EMR) and the Rhode Island Hospital (RIH) Trauma Registry from January 1st, 2018, through June 30th, 2022. Patients were included if they were admitted to the RIH emergency department (ED) with a diagnosis of tICH confirmed by a computed tomography (CT) scan of the brain and were being treated with at least one antiplatelet medication including aspirin, clopidogrel, ticagrelor, or prasugrel prior to admission. Patients were excluded if they were transferred from an outside hospital, expired within 6 hours of arrival, sustained the injury more than 24 hours prior to arrival, did not receive a repeat brain CT scan, had baseline thrombocytopenia, or were on concomitant anticoagulant medication. Patients who received platelets for reversal of antiplatelet therapy will be compared to those who did not. Demographic and clinical data were obtained from LifeChart and the RIH Trauma Registry.

Due to an unforeseen delay in attaining exemption status from the Institutional Review Board (IRB), this project is still in the process of data collection. The investigators hypothesize that the results of this study will be similar to those reported by other observational studies which showed no difference in achieving hemostasis when platelet infusions were administered for antiplatelet agent reversal in the setting of tICH. Based on preliminary data collection, the investigators hope to include a larger percentage of patients who were taking P2Y12 inhibitors such as clopidogrel as well as dual antiplatelet therapy.

The results of this research project will add to an area of literature where there is currently very little data and may reconfirm the lack of benefit that platelet infusions have for those who experience a tICH while on aspirin monotherapy. Furthermore, this data may provide much needed insight into reversal strategies for clopidogrel and dual antiplatelet therapy. The current practice at Rhode Island Hospital has already trended towards less platelet utilization, especially for those on aspirin monotherapy. This study will provide additional data to help providers make more informed decisions regarding treatment of tICH and optimize outcomes for patients at Rhode Island Hospital and elsewhere.

Effect of pharmacist services on utilization of sacubitril/valsartan in patients with heart failure

Author: Sabrina Marie Silveira, PharmD

Sacubitril/valsartan, an angiotensin receptor-neprilysin inhibitor (ARNI), received United States Food and Drug Administration (FDA)-approval for treatment of heart failure with reduced ejection fraction (HFrEF) in 2015.1 In 2016, the heart failure guidelines recommended switching from angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) to an ARNi in patients with chronic symptomatic HFrEF New York Heart Association (NYHA) class II or II to further reduce morbidity and mortality.2 This recommendation was reinforced in the 2022 guideline updates.3 Beneficial results of trials, including PARADIGM-HF which showed that sacubitril/valsartan was superior to enalapril in terms of reducing the risk of death and hospitalization for heart failure, are the basis of these recommendations.4 Despite the benefits of ARNIs, sacubitril/valsartan is often underutilized.5 Pharmacists play an important role in the initiation of ARNIs due to their knowledge about medication appropriateness, insurance coverage, and dosing recommendations, including the washout period from an ACE inhibitor to an ARNI and the different starting doses depending on each patient's treatment history. Previous studies indicate the benefits of pharmacists on the titration of ARNI doses and hospital admissions, but there is a lack of information available on the impact of pharmacist management on the initiation of ARNIs.6-7

A retrospective cohort study measuring the rates of utilization of sacubitril/valsartan was conducted. Patients ages 18 and older with a diagnosis HFrEF who were seen by a pharmacist, physician, or advanced practice provider as an outpatient at the Lifespan Cardiovascular Institute between January 1, 2020 and December 31, 2021 were included. The primary outcome is a comparison of the utilization of sacubitril/valsartan between patients seen by a pharmacist within the Lifespan Cardiovascular Institute with a collaborative practice agreement (CPA) for heart failure management and those who were not seen by a pharmacist. Secondary outcomes will be the percentage of patients at target dose (97 mg/103 mg) for sacubitril/valsartan and the number of admissions/readmissions for heart failure.

This project is still in the process of data collection, and preliminary results are pending. The investigators hypothesize that the results of this study will conclude that pharmacist management will be associated with an increased utilization of sacubitril/valsartan. The results of this research project will add to an area of literature where there is currently little data and will provide data regarding the benefit of pharmacist managed sacubitril/valsartan for patients with HFrEF.

Medication-Related Falls: Development of a Prospective Pharmacy Intervention

Authors: Olivia Spence, PharmD; Emalee Collins, PharmD, BCGP; Christopher Flores, PharmD, BCPS, BCSCP; Darren Luon, PharmD, BCOP; Kendall Szulimowski, PharmD; Jessica Vital Corona, PharmD

Background:

In patients 65 years and older, many medications can increase risk of falls. These medications include benzodiazepines, opioids, sedative-hypnotics, and antidepressants. It was shown through a previous medication use evaluation at a large healthcare system, that pharmacists have a low impact in preventing inpatient falls through the utilization of a post-fall medication review, however, high-risk medications were identified. There were also minimal interventions made through use of a

deprescribing tool. As a result of this evaluation, a team of pharmacists aimed to identify prospective and more impactful interventions to prevent medication-related falls.

Methods:

An interdisciplinary approach was taken to identify sustainable, proactive interventions to prevent medication related falls. This was conducted by evaluating the entire fall process from screening at admission to the occurrence of a fall. Fall process screening was evaluated by shadowing front-line nursing staff. Prescribing practice was evaluated through meeting with geriatrics stakeholders. A survey was created to poll nurse managers to evaluate day-to-day management of patients with high fall risk and determine how to incorporate pharmacy services.

Simultaneously, data was collected on patients who fell on units with the highest number of falls at each delivery network of the healthcare system. Retrospective chart review was performed on patients who fell to ascertain if they had been given a high-risk medication within 24 hours of their fall, and track any trends in these falls.

Results:

Through engagement with stakeholders and data collection, high risk medications that may have contributed to fall risk were quantified. Nurses use the Morse Fall Scale to determine a patients fall risk and determine what nursing interventions are deployed. Geriatrics prescribers suggested removal of oxybutynin from the formulary due to its tendency to increase fall risk in older adults. Geriatrics providers also expressed interest in adding alerts to bed-time administrations to sedative/hypnotics. Lastly, through the survey, nurse managers expressed that pharmacists should have a role in educating patients about their high-risk medications and falls.

Of the 80 falls analyzed, 68% of falls occurred in a patient on a high-risk medication. All but one patient was age 50 or older, and 51 patients were age 65 or older. One or more high risk medications were involved in 33% of falls. Trends in falls were also seen in benzodiazepine-naïve patients as well as timing of sedative/hypnotic medications. Lastly, there was a high amount of patients who did not have a fall risk score at the time of their fall. Additional analyses are still being conducted.

Conclusion:

Patients fall in the institutional setting due to a multitude of factors. A multidisciplinary approach will be necessary. At this institution, pharmacy-led interventions such as implementing a comprehensive medication review consult, targeting bedtime administration times and first doses of high-risk medications, optimizing admission prescribing of high-risk medications, and proposing the removal of oxybutynin from our formulary are anticipated to be of highest impact. Assessment of these interventions for resource allocation and impact will become part of continuous quality improvement of patient falls.

The Impact of Utilizing Alternate Selection (AS) Alert Messages in the Computerized Provider Order Entry (CPOE) System to Optimize Opioid Prescribing

Author: Jasmine Irene Ssentongo, PharmD

Background/Purpose: Throughout the years, opioids have been more commonly prescribed for patients with chronic, non-cancer pain and are well-known for their addictive potential and consequently, overdose risk. Prior studies have shown that dosages greater than or equal to 50 Morphine Milligram Equivalents (MME) per day increase the risk of overdose in patients by at least 2 times the risk than at <20 MME/day. One way that healthcare providers can combat this is through utilizing Electronic Health Record (EHR) alerts which can improve patient safety and pain management outcomes and mitigate the risk of overdose. This project aims to help guide prescribers at the order entry level by utilizing the EHR's "Alternate Selection" (AS) alert messages on patients with MME's greater than 50 to reconsider a dose increase due to evidence of increased adverse effects or to consider maximizing a non-opioid medication if not already prescribed.

Methods: This project is a retrospective study design evaluating opioid usage from January 2023 to April 2023. Patient's 18 years of age or older, patients started on opioids in the hospital and continuing opioid use from home, and post surgical patients were included in this study. Patients who are less than 18 years of age, pregnant women, patients on CMO, palliative care or hospice, ICU patients who are ventilated, or patients on detoxification medications were excluded. For MME's greater than or equal to 50, an "AS" message flagged physicians to justify the utilization of higher doses and provided non-opioid alternatives on a scheduled basis. The primary endpoint of this study is the proportion of orders which exceeded an MME of greater than 50 before admission (outpatient) and after admission (inpatient) of "AS" alert messages to providers. Secondary endpoints include the number of alerts that were bypassed, % acknowledged and acted, % acknowledged but not acted upon, number of patients on bowel regimens, and the duration of opioids prescribed throughout the length of hospital stay. Results were presented as descriptive statistics. This project was approved by the Institutional Review Board.

Results: A total of 1153 orders were generated in the Alternative Selection report. Of these orders, 559 (48%) orders met the predefined inclusion criteria with a total of 261 patients included in this study. The average age of the patients was 56 years old. For the primary endpoint, the report only generated MME's/Day for 19 orders, with 78.9% exceeding 90 MME's/Day. When compared to outpatient MME's/Day, 84% of orders had an increase in MME's from their home prescription. For the secondary endpoints, 13 (2.3%)/559 orders had accepted alternatives. The remaining orders had no alternatives accepted based on a specific reason selected by the prescriber. All patients were ordered non-opioid analgesics on an as needed basis. Additionally, a total of 176 patients had bowel regimens ordered. Lastly, for the duration of inpatient opioid orders, 340 were ordered for 1 day or less, 195 were ordered for 2-7 days and 5 were ordered for more than 7 days.

Conclusion: Utilization of alternative selection alert messages presented important data for aiding in the optimization of opioid prescribing. While very few alternative non-opioid medications were selected compared to the amount of orders, providers were still triggered to reconsider their initial option and utilize a multimodal approach on a scheduled basis. We can further work with providers to help increase the amount of non-opioids prescribed provided that the patient has adequate pain control and understands the risks associated with opioid use. Additionally, an area that pharmacists can intervene on is ensuring that bowel regimens are put in place for all patients that are on opioids. Overall, this

project may help lead to policy updates and changes in the way pharmacists monitor for opioid stewardship within the hospital.

Implementation of pharmacist-run discharge medication reconciliation in a Community Hospital and its impact on 30-day readmission rates

Richard Tang, PharmD; Randy Hollins, PharmD, BCCCP

Background

Pharmacist-run medication reconciliation upon hospital discharge has not been explored at MWH and is currently hospitalist-run with nurse assistance. Pharmacist-run discharge medication reconciliation (PDMR) can help to avoid medication discrepancies such as therapeutic class duplications, omissions in treatment of a disease, drug-drug or drug-allergy interactions, prescriptions sent to incorrect pharmacies, incorrect dose, frequency adjustments, or unnecessary therapy for the patient. Although hospitalists often perform discharge medication reconciliations, studies have shown discrepancies continue to occur at other institutions, sometimes as often as 2 out of 5 patients(1). One systematic review and meta-analysis showed that pharmacist-led medication reconciliation interventions at either admission or discharge were effective in reducing medication discrepancies in patients by 66% compared to usual care. The medication discrepancies with higher clinical impact, preventing serious adverse events or medication errors, were also more easily identified through PDMR compared to usual care(2). Through a PDMR, pharmacists are able prevent medication related adverse events and reduce readmission rates as well as avoid unnecessary costs (3). The objective of this study is to implement a pharmacist-run discharge medication reconciliation pilot program and study its impact on readmission rates in patients discharged home without additional services.

Methods

This study protocol was reviewed by the Tufts Health Sciences Institutional Review Board and deemed to be not human research. Patients were excluded if they were less than 18 years old, were discharged from the hospital's psychiatric floor, intensive care unit, progressive unit, maternity, or surgical floors. Once patients were identified to be discharged within 24 hours, the pharmacist reviewed the patients' admission medication reconciliation, their inpatient ordered medications, and the discharge medication list to determine the best possible discharge medication list. If there were any discrepancies or recommendations to improve patient outcomes identified, the pharmacist would contact the attending provider to discuss changes to the discharge medication list. Utilizing data from MelroseWakefield Hospital's electronic health record, we compared pre-implementation patients discharged and readmitted from 9/1/2022 to 12/31/2022 to post-implementation patients with a PDMR discharged and readmitted from 1/1/2023 to 3/31/2023. The primary endpoint was readmission rates in patients with a pharmacist involved in the medication reconciliation versus patients without a pharmacist involved in the medication reconciliation process. Secondary endpoints included number and types of discrepancies identified and resolved, number of pharmacist-initiated medication reconciliations, and number of medication reconciliations completed before or after patient was discharged.

Results

A total of 981 patients were included in the study. Pre-implementation, there were 944 patients discharged, 34 (3.6%) of those patients were readmitted within 30 days of discharge. In the post-implementation, 37 patients were discharged with a PDMR, and 1 (2.7%) patient was readmitted within

30 days. The results were not statistically significant with an odds ratio of 0.744 (95% CI 0.099 - 5.584). nine medication discrepancies were identified, three of which were dose changes required. Three medication reconciliations were pharmacist initiated and 4 medication reconciliations were completed after patient was discharged.

Conclusion
Pharmacist-run discharge medication reconciliations at MWH did not show a statistically significant impact on readmission rates for those discharged home without additional services. The pilot study did however successfully develop the process for a PDMR and laid the groundwork for future pharmacy involvement in the discharge process. This study can be expanded and a similar PDMR system can be applied to high-risk patient populations at MWH targeting patients with chronic obstructive pulmonary disease, congestive heart failure, acute coronary syndrome, pneumonia, or total knee or hip replacement surgeries. It may be beneficial to also explore the impact of additional pharmacy interventions on readmission rates such as direct pharmacist to patient discharge counseling.

Outpatient prescribing trends of diuretics upon initiation of empagliflozin at a Veterans Affairs Healthcare System

Author: Jenessa Teta, PharmD

Background/Purpose:

FDA approvals have expanded the use of sodium-glucose cotransporter-2 (SGLT2) inhibitors in heart failure and chronic kidney disease, therefore the likelihood of a patient being on concomitant SGLT2 inhibitor and diuretic therapy has increased. The combination of SGLT2 inhibitors and diuretic therapy, however, may increase the risk for volume depletion. At VA Connecticut Healthcare System (VACHS), the preferred SGLT2 inhibitor is empagliflozin. There is currently no protocol for diuretic medication adjustments or monitoring at VACHS in patients on concomitant therapy. The aim of this evaluation was to determine best practices in medication management by assessing current prescribing trends and patient outcomes upon initiation of empagliflozin in patients prescribed diuretics at VACHS.

Methods:

This was a single-center quality improvement project deemed exempt from review by the Institutional Review Board. Patients 18 years and older who were newly prescribed empagliflozin and already receiving a diuretic between January 1, 2021 and June 30, 2021 were queried. Patients were excluded if they were on hospice or if the empagliflozin or baseline diuretic was initially prescribed by a provider outside of the VA. Patient demographic information, past medical history, weight, blood pressure, and laboratory results were collected at baseline, three months following initiation of empagliflozin, and six months following initiation of empagliflozin. Analysis was completed to assess the prescribing trends of diuretic therapy upon initiation of empagliflozin. Descriptive statistics were also utilized to determine changes in glycated hemoglobin, renal function, potassium, body weight, blood pressure, incidence of adverse effects and rate of discontinuation of empagliflozin due to adverse effects.

Results:

A total of 116 patients were screened and 30 patients met exclusion criteria. Among the 86 patients who met the inclusion criteria, the mean age was 71 years and 97.7% were male. Seventy-eight (90.7%) patients had a diagnosis of type 2 diabetes mellitus, 41 (47.7%) patients had a diagnosis of heart failure, and 29 (33.7%) had a diagnosis of chronic kidney disease. Most patients were on a single diuretic at baseline, with 35 (40.7%) on a loop diuretic and 29 (33.7%) on a thiazide-type diuretic. Out of the 86 patients, 22 (25.6%) had an adjustment to their diuretic regimen made upon initiation of empagliflozin or in the six months following initiation of empagliflozin. Adjustments to diuretic therapy were most often implemented by the primary care provider. Following initiation of empagliflozin, 19 patients (22.1%) reported adverse effects. The most common adverse effect of increased urination was reported by 11 (12.8%) patients. Three (3.5%) patients experienced an increase in serum creatinine or acute kidney injury. A total of 16 (18.6%) patients' empagliflozin prescription was discontinued in the evaluation timeframe. Of these 16 patients, empagliflozin was discontinued in 10 (62.5%) due to adverse effects. Follow-up bloodwork was obtained 70 days following initiation of empagliflozin. During the evaluation timeframe, patients' serum creatinine, estimated glomerular filtration rate, potassium, and A1C remained similar to baseline. Comparably, patients' weight and blood pressure remained similar over the six months following initiation of empagliflozin.

Conclusion:

As most patients did not require an adjustment to their diuretic therapy following initiation of empagliflozin and labs and vital signs remained similar to baseline, there is not an apparent need for a protocol to adjust diuretics for patients at VACHS upon the initiation of empagliflozin. Based on these results, patients at VACHS should be evaluated on an individual basis to determine if they are at increased risk for adverse effects associated with volume depletion. Adjustments should be made to diuretics on a case-by-case basis.

Effect of switching norepinephrine to phenylephrine on rate control after development of atrial fibrillation in ICU patients with septic shock

Author: Nick Tran, PharmD

Background/Purpose:
New onset atrial fibrillation is common in sepsis and is associated with increased mortality and hemodynamic deterioration. Norepinephrine, the first-line vasopressor for septic shock, can cause tachyarrhythmias, including atrial fibrillation. Phenylephrine is periodically used as an alternative vasopressor in patients who develop atrial fibrillation while on norepinephrine. Limited data suggests that switching to phenylephrine may be associated with decreased heart rate and improved time to rate control, with no effect on mortality. This study aimed to compare the effect of switching vasopressor therapy to phenylephrine on clinical interventions required for rate control in ICU patients with septic shock that develop atrial fibrillation while on norepinephrine.

Methods:
A single-center, retrospective chart review of septic shock patients admitted to the medical and surgical intensive care units at UMass Memorial Medical Center from January 1st, 2018, to September 1st, 2022, was performed. This study received IRB approval. Patients were identified through electronic medical

record review and included if atrial fibrillation with rapid ventricular response developed while on norepinephrine for septic shock. Major exclusion criteria included receiving inotropes or vasopressors other than norepinephrine, vasopressin, and phenylephrine, diagnosis of other shock syndromes besides septic shock, or undergoing cardiac/cardiothoracic surgery. Patients switched to phenylephrine were compared to those who remained on norepinephrine. The primary outcome was a composite of initiation of a new rate/rhythm control agent, increased dose of a home rate/rhythm control agent, or direct cardioversion. Secondary outcomes included individual components of the primary outcome, 28-day mortality, ICU and hospital length of stay, total duration of vasopressor therapy following development of atrial fibrillation, time to achievement of rate control, and proportion of time within rate control at 24 and 48 hours. Adverse events of vasopressors and rate/rhythm control agents were also collected as safety outcomes. Categorical data were compared using the Chi-squared and Fisher's exact test. Continuous data were compared using the Student's t-test and Wilcoxon rank-sum test. All analyses were conducted using SAS software.

Results:
A total of 1329 patients were screened, with 75 patients being included in each group. Baseline characteristics were mostly similar between groups, with differences likely being clinically insignificant. The primary outcome occurred in 61% of phenylephrine patients compared to 87% of norepinephrine patients ($p = 0.001$). Rate/rhythm control agents were initiated less often for phenylephrine patients compared to norepinephrine patients (60% vs. 79%; $p = 0.01$), with beta-blockers and non-dihydropyridine calcium channel blockers being the most common agents initiated. There was no difference between groups in patients requiring an increased dose of a home rate/rhythm control agent or direct cardioversion. No significant differences were found in 28-day mortality, ICU and hospital length of stay, time to achievement of rate control, proportion of time within rate control, and all safety outcomes. Phenylephrine patients had a longer total duration of vasopressor therapy (108 hours vs. 51 hours; $p = 0.001$).

Conclusion:
In ICU patients with septic shock that develop atrial fibrillation on norepinephrine, switching vasopressor therapy to phenylephrine reduced rates of clinical interventions required for rate control, but did not improve mortality and ICU length of stay. Transitioning from norepinephrine to phenylephrine can be considered as an alternative therapy for rate control. It is unknown whether switching to phenylephrine impacts overall patient outcomes compared to remaining on norepinephrine and potentially requiring more interventions for atrial fibrillation. Future studies should assess the impact of timing and dosing of vasopressors and rate/rhythm control agents on the effectiveness of this practice.

Combination of a rapid diagnostic assay and active intervention by an antimicrobial stewardship team in managing gram-negative bacteremia

Author: Julian James Ventres, PharmD

Background/Purpose: Gram-negative bloodstream infections are a major source of morbidity and mortality worldwide. Our current gold standard diagnostic test, traditional blood cultures, can take up to 24 hours to identify, and up to 48 hours to provide susceptibilities of a given pathogen following a positive Gram stain. The Accelerate PhenoTM provides identification and susceptibilities for a set panel of common causative organisms within 8 hours of a positive Gram stain. We aimed to assess the impact

of the Accelerate PhenoTM platform in conjunction with intervention by an antimicrobial stewardship team on the management and outcomes of gram-negative bloodstream infections.

Methods: We performed a retrospective, IRB-approved, pre- and post-intervention chart review. Data was collected from the electronic medical records (EMR) of a 719 and a 247 bed hospital, contained within a larger academic health system, for patients who had blood cultures positive for gram-negative bacteria. We excluded patients <18 years of age, microbes not on the Accelerate Pheno panel, polymicrobial infections, patients discharged <24 hours from ID and AST results, patients with an infectious disease consult, and patients who were deceased or made comfort-measures-only prior to finishing antibiotic therapy. Wilcoxon rank sum, chi square, and Fisher's exact tests were used for statistical analysis. In the pre-intervention group, identification and antimicrobial susceptibilities were run using traditional cultures and reported via the EMR. Following implementation of the Accelerate PhenoTM system for gram-negative bloodstream infections, a patient's first blood culture positive for gram-negative organisms was tested on the Accelerate PhenoTM system, and results were paged to the antimicrobial stewardship (AMS) team. The team reviewed patients for opportunities to de-escalate, recommend durations of therapy, and convert antibiotics from intravenous (IV) to oral during the hours of 9 AM to 5 PM. Data collected corresponded to pre-implementation alone compared to post-implementation of the Accelerate PhenoTM system in conjunction with intervention by the AMS team. Data was collected from December 1, 2017, to September 1, 2018, for the pre-intervention group, and November 1, 2019, to September 15, 2020, for the post-intervention group. The primary outcome was duration of IV antibiotics. Secondary outcomes included time to optimized antibiotic, duration of inpatient antibiotics, total duration of antibiotics, whether any IV to oral antibiotic conversions occurred, and hospital length of stay (LOS). Safety outcomes measured were readmission within 30 days and development of *Clostridioides difficile* infection within 90 days.

Results: A total of 616 blood cultures were collected during the study periods. After exclusions, 264 cultures were included for analysis, with 102 in the pre-intervention group and 162 in the post-intervention group. In the post-intervention group, the AMS team made 364 recommendations on 152 out of the total 164 patients. The most common interventions were duration of therapy (29.7%), IV to oral conversion (28.6%), and de-escalation of therapy (28.6%).
Duration of intravenous therapy specifically was shorter in the post-intervention group (4.0 days) compared to the pre-intervention group (7.5 days) ($P<0.001$). This was paired with a higher rate of conversion from IV to oral therapy at 77.8% in the post group and 60.8% in the pre group ($P=0.003$). Median LOS was reduced to 5.09 days in the post-intervention group compared to 7.01 days in the pre-intervention group ($P<0.001$).

Conclusion: The combination of the Accelerate PhenoTM rapid diagnostic system with intervention by an antimicrobial stewardship team reduced length of hospital stay and duration of intravenous antibiotics, while also improving rates of conversion from intravenous to oral antibiotic therapy. Improving these metrics is likely to confer significant cost-savings to the healthcare system and patients alike, but further studies are needed to confirm this. Overall, our results support the utility of the Accelerate PhenoTM system, particularly when used alongside active intervention from an antimicrobial stewardship team, in the management of gram-negative bloodstream infections.

Impact of implementing education and electronic medical record tools on pneumococcal vaccination rates in a primary care clinic

Author: Domenic Vita, PharmD

Purpose: Pneumococcal infection is a significant cause of illness and mortality. Vaccination reduces morbidity and mortality associated with pneumococcal disease. However, vaccine uptake remains a challenge given potential confusion over vaccine types/schedules and multiple paths to patient vaccine access. The United States Centers for Disease Control and Prevention's Advisory Committee of Immunization Practices (ACIP) currently recommends PCV20 alone or PCV15 in series with PPSV23 for eligible patients. This study was conducted to determine if screening tools, standard workflows, and physician/patient education increases pneumococcal vaccination rates in a hospital-based internal medicine clinic setting.

Methods: The Institutional Review Board at Trinity Health of New England approved this retrospective chart review study. Adult patients receiving primary care at the Gengras Adult Medical Clinic who were eligible for pneumococcal vaccination were included. Vaccine eligibility was determined based on age, comorbidities, and lack of completion of the recommended vaccination series during the 10-week intervention period. Baseline pneumococcal vaccination rates and vaccine-eligible patient lists were generated from the health record using standard reporting features. Physicians received individualized vaccine-eligible patient lists and educational materials including a podcast summarizing the ACIP vaccination updates, vaccine ordering workflows, links to ACIP mobile vaccine applications, and standardized health record documentation for patients when vaccinations were declined. Handouts on pneumococcal disease and vaccinations were provided to patients and displayed in office examination rooms. A chart review was completed for patients encountered in the office during the study period. The primary outcome was percent of eligible patients who received pneumococcal vaccination during the intervention period. The secondary outcomes were percent change in vaccination rates and percent of vaccines that were ordered correctly. Descriptive statistics were used to analyze the data collected.

Results: One hundred and thirty-seven patients were considered vaccine-eligible. Forty patients (29%) were ordered a pneumococcal vaccination during the intervention period, and 38 patients (28%) received the vaccine. Thirty-four patients (89%) received the correct pneumococcal vaccine type. The percent increase in vaccination rates post-intervention was 2%.

Conclusion: Screening tools, standard workflows, and physician/patient education increased pneumococcal vaccination rates in this setting modestly by 2% during the 10-week intervention period. One-third of vaccine-eligible patients were vaccinated during the intervention period. Nearly 90% of pneumococcal vaccination orders were deemed to be appropriate. The most common reason that vaccine-eligible patients were not vaccinated during the study was vaccinations not being addressed by providers during visits.

Enhancing Pharmacist Review and Approval of Non-Formulary Medications: Putting the EMR to Work

Authors: Brenda Wong, PharmD; Phu Huynh, PharmD, Gregory Jaszczur, PharmD; Tyler Finocchio, PharmD, BCPS, BCCCP; James Sarigianis, BS Pharm; Monica Chandwani. PharmD, BCPS; Joseph Rosano, PharmD

Background/Objective:

A hospital formulary is a continuously managed listing of medications approved to encourage safe, effective, and affordable medication utilization. While nonformulary medications may be viewed as less cost-effective, the need for hospitals to provide them, in a restricted manner, is unavoidable in some cases. Within the health system, drug use guidelines exist to assist the pharmacist in determining whether to grant approval. The purpose of this project was to evaluate and develop a model in the electronic medical record (EMR) with the intent to streamline evaluation and approval of certain restricted/non-formulary medications such as immune globulin (IVIG), chlorothiazide, and albumin.

Methods:
To assist in developing new EMR tools to guide approval of restricted/non-formulary medications, an initial review of existing drug use guidelines occurred. Next, relevant pieces of data that a clinician would need to assess in order to approve such nonformulary requests were identified and extracted from the guidelines. The data was identified as subjective or objective, and the location in the EMR from where the data point would be found was determined. After data collection, the health system IT team was engaged to assist in building the EMR model.

Results:
Based off the identified data points provided for each restricted/non-formulary drug, the IT team created a tool that collated relevant EMR data on the sidebar of the order when in the pharmacist verification module. The information that the pharmacist is presented with in the sidebar report is tailored to the specific drug being reviewed. For example, when reviewing an order for albumin, pharmacists will automatically be presented with data such as a PMN calculator, RBCs, nucleated cells, granulocytes, etc. Across all medications included in the project, the pharmacist will also have immediate access to progress notes from the last 24 hours and any previous pharmacist notes from the last year directly in the sidebar report. The EMR model was presented to pharmacy stakeholders for feedback and approval.

Conclusions:
The implementation of an enhanced pharmacist verification sidebar report may increase guideline adherence and promote pharmacist efficiencies in the evaluation of restricted or non-formulary requests. Furthermore, it may allow for expansion of pharmacy services by decreasing the time it takes for pharmacists to assess requests and increase time allotted for other patient care services. The EMR model can also serve as the framework for other protocolized non-formulary medications in the future outside of albumin, IVIG, and chlorothiazide. Future directions include implementing the tool amongst all pharmacists who assess non-formulary requests to facilitate faster evaluation and increase adherence to institution guidelines.

Comparative safety of iron sucrose and iron dextran to treat pediatric iron deficiency anemia

Author: Jenna Jashin Wu, PharmD

Background/Purpose:
Iron deficiency anemia is common among the pediatric population as neonates and adolescents utilize iron supplies for rapid growth. The two major intravenous treatments are iron sucrose and iron dextran. Iron dextran may be dosed as a one-time infusion which reduces the cost associated with infusion and time for the patient to achieve therapeutic response. However, there have been concerns regarding the potential increased risk for significant adverse reactions with iron dextran administration compared to

that of iron sucrose. The data within the adult population remains controversial and there is little to no pharmacoepidemiologic data comparing adverse event rates within the pediatric population. The purpose of this retrospective chart review is to compare the rate of adverse events in pediatric patients receiving iron dextran and iron sucrose for iron deficiency anemia to determine if there is a greater risk of adverse events with administration of either agent.

Methods:

We retrospectively reviewed pediatric patients for this IRB-approved study through a tertiary, academic medical center's electronic medical record. Patients 18 years old or younger diagnosed with iron deficiency anemia with the diagnosis code D50.x were included in this study. Patients who were older than 18 years old, received an iron infusion for a reason other than iron deficiency anemia, or received both iron sucrose and iron dextran within five half-lives of one another were excluded. Patients receiving iron sucrose were matched 1:1 to patients receiving iron dextran based on age, infusion location (inpatient, outpatient), and gender. The primary outcome was the rate of adverse reactions between iron dextran and iron sucrose in a matched pediatric patient population. An adverse reaction was defined as administration of any anaphylactic rescue medications (diphenhydramine, steroids, epinephrine) or documented reaction within the electronic medical record. Secondary outcomes included the rate of serious or major adverse reaction rates between iron dextran and iron sucrose and the rate of reaction between standard iron dextran infusion time of 4-6 hours as compared to the rapid iron dextran infusion over one hour. Statistical analysis was completed utilizing chi-squared tests.

Results:

Between June 1, 2017 and June 1, 2022, 156 pediatric patients received an intravenous iron infusion (iron dextran = 78, iron sucrose = 78) and were matched in a 1:1 ratio, stratified based on age, infusion location (inpatient, outpatient), and gender, ultimately resulting in balanced groups. Approximately 14% of patients were male (n = 22/156). The median age for patients in the iron dextran group was 15.1 years old and was 15.4 years in the iron sucrose group. The age groups were stratified into brackets: neonates, day 30 to 1 year old, 1-3 years old, 3-5 years old, 5-8 years old, 8-12 years old, and 12-18 years old. Approximately 85% of patients were in the 12-18 years old bracket (n = 132/156). Based on location, about 71% (n = 110/156) of intravenous iron infusions were completed outpatient. Overall, there were 3.85% (n = 3/78) significant adverse events in the iron dextran arm compared to 1.28%) (n = 1/78) events in iron sucrose group (p = 0.3234).

Conclusion:

In pediatric patients who are diagnosed with iron deficiency anemia, iron dextran infusion was found to have similar rates of adverse events to iron sucrose infusion. No patients in the study experienced a severe reaction to either iron infusion. Iron dextran is a potential alternative to iron sucrose infusion given its relatively similar safety profile, potential reduced length of hospital stay, and direct cost savings to the healthcare system.

Evaluating a vancomycin protocol for efficacy in pediatrics and correlating two-level versus one-level AUC pharmacokinetics, a retrospective chart review

Primary (Resident) Author: Adele Ye, PharmD
Non-Resident Authors: Alexandra Sharpe, PharmD, BCPS, BCPPS; Iman Moawad, PharmD, BCPPS

Background/Purpose:
In 2018, Massachusetts General Hospital for Children implemented a pediatric vancomycin protocol of 20 mg/kg/dose every 6 hours to achieve therapeutic drug concentrations. The Infectious Diseases Society of America recommend monitoring vancomycin with area-under-the-curve to minimum inhibitory concentration (AUC/MIC) as the better predictive pharmacokinetic marker compared to troughs for therapeutic monitoring in Staphylococcus aureus infections. This retrospective chart review was conducted to evaluate efficacy and safety outcomes of the pediatric protocol. Secondary analyses were performed to correlate therapeutic AUCs pediatric patients and determine if two-level AUC calculations can be accurately extrapolated from one-level using population kinetics.

Methods:
This was a single-center retrospective chart review from October 2019 to January 2022. Inclusion criteria were patients 1-18 years of age that received intravenous vancomycin per protocol 20 mg/kg/dose (maximum of 750 mg per dose) every 6 hours. Exclusion criteria were patients who did not receive pharmacy-led AUC monitoring (e.g., empiric 48-hour rule-outs, antibiotic de-escalation, dosed by level due to compromised renal function). From the initial 162 patients, a total of 105 patients were included for review. Primary outcomes were efficacy and safety of the protocol in achieving goal AUC of 400-600 mg-hr/L by steady-state. Data was stratified by predefined age groups (1-6, 7-9, 10-18 years) to account for difference in volume of distribution (Vd). Secondary outcomes were to identify trough values (mean, range) associated with therapeutic AUCs and correlate 1-level (trough only) AUC extrapolations versus 2-level (peak and trough) calculations. A subgroup analysis was conducted for patients weighing more than 40 kg. The institutional electronic medical record (EMR) pharmacokinetic navigator was used to calculate 2-level AUCs. A statistician-generated calculator was utilized to extrapolate 1-level AUCs from troughs. Descriptive statistics and SPSS software were utilized for data analysis and generating a correlation coefficient. Since this was a retrospective chart review and a quality improvement project, investigation review board (IRB) approval was not needed.

Results:
A total of 105 pediatric patients were included in the final data analysis. Baseline characteristics included average age of 8 years (range: 1-18), average weight of 34.2 kg (range: 9.8-124 kg), and normal renal function at therapy initiation. Patients were stratified by age groups (1-6, 7-9, 10-18 years), each with an assigned volume of distribution for use in 1-level AUC calculations (0.6 L/kg, 0.47 L/kg, 0.49 L/kg, respectively). For efficacy outcomes, 38 patients (36.2%) achieved a therapeutic AUC of 400-600 mg-hr/L by adhering to the dosing protocol. 43 patients (40.9%) had a subtherapeutic AUC of less than 400 mg-hr/L and 24 patients (22.7%) had supratherapeutic AUC of greater than 600 mg-hr/L. 6 of these supratherapeutic patients had AUCs greater than 800 mg-hr/L, with noted serum creatinine elevations greater than 0.3 mg/dL, but none incurred clinically significant acute kidney injury. The overall average trough was 10.48 mg/L (SD: 5.9, range: 6.6-15) for AUCs of 400-600 mg-hr/L. A subgroup analysis for 33 patients weighing more than 40 kg revealed a greater likelihood of incurring subtherapeutic AUC. 1-level AUC extrapolations poorly estimated 2-level AUC values (correlation coefficient of 0.589).

Conclusion:
The institutional pediatric vancomycin dosing protocol of 20mg/kg/dose every 6 hours achieves therapeutic AUCs for the majority of patients with minimal nephrotoxic sequelae. However, this protocol should be reevaluated for pediatric patients that weigh greater than 40 kg. Therapeutic AUCs aligned to an average trough of 10.48 mg/L. 1-level AUCs underestimated actual AUC values and may not be an accurate substitution for 2-level calculations. These findings suggest that additional

vancomycin pharmacokinetic studies are needed in the pediatric population for determining optimal dosing protocols.