Section Advisory Group on Emergency Care

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Poster Summary

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The Role of Clinical Pharmacist in Emergency Medicine Department of an Academic Hospital in the Kingdom of Saudi Arabia

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Introduction

The Emergency department has a high risk environment duo to its unique and complex workflow.

At the emergency and high-stress situations such as Cardiopulmonary resuscitation, Trauma and Rapid sequence intubation procedures; many high risk medication is ordered and administered at bed-side without being checked by pharmacist which may lead to increase the incident of medication error and adverse drug reaction

Purpose

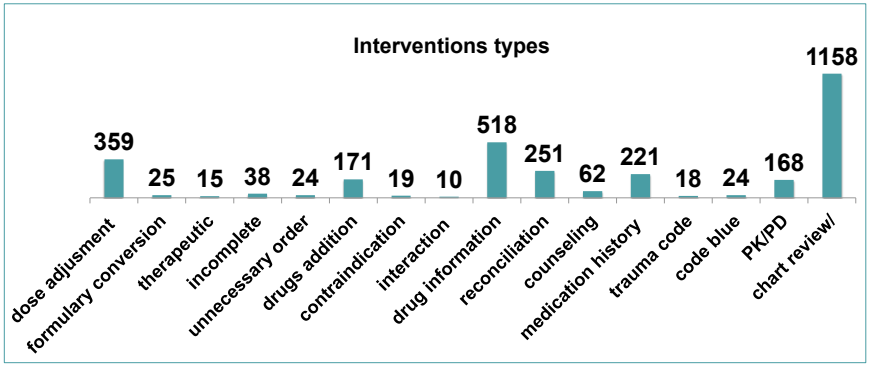
To assess the need of clinical pharmacy service in the emergency department at King Saud University Medical City, Saudi Arabia

Methods

A retrospective one-year study conducted between January 1st and December 31, 2016 at Adult Emergency Department of King Saud University Medical City, Riyadh, Saudi Arabia. The documentation of Emergency Medicine clinical pharmacist interventions was extracted from Esihi database. Including the period of morning shift (07:30-15:30) from Sunday to Thursday.

Results

A total of 3081 interventions were documented. The rate of acceptance was 88%. Antibiotics were the common drugs.



Conclusions

This study shows the important role of clinical pharmacy service in the Emergency department.

Disclosure

Authors of this presentation have the following to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

1: Waad Alkathiri: Nothing to disclose.
2: Hosam Abdulraziq: Nothing to disclose.

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Elevated international normalized ratio (INR) in patient treated with apixaban and amiodarone

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BACKGROUND

Apixaban is a factor Xa inhibitor, indicated to reduce the risk of stroke and systemic embolism in patients with nonvalvular atrial fibrillation. Apixaban does not require any routine INR monitoring. The package insert recommends dose reduction for patients receiving concomitant therapy with strong dual CYP3A4 and P-gp inhibitors. Apixaban does not reliably and/or predictably affect INR, but according to the manufacturer, there is a concentration dependent effect on INR.

This case report illustrates the potential drug interaction between amiodarone and apixaban in a 68 year old Caucasian male patient.

PATIENT CASE

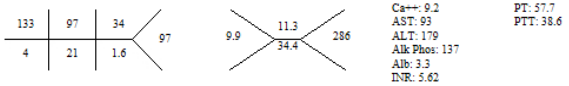
68 year old Caucasian male presented to the ED with tachypnea and swollen legs during the past two days.

PMH: atrial fibrillation, coronary artery disease, congestive heart failure (CHF), and coronary artery bypass graft (CABG)

Home Medications: amiodarone 200mg oral twice daily, apixaban 5mg oral twice daily, aspirin 81mg oral daily, cholecalciferol 2,000 international unit oral daily, furosemide 40mg daily, multivitamin oral daily, omega-3-polyunsaturated fatty acids 1,000mg oral daily, pantoprazole 40mg oral daily, potassium chloride 20mEq oral daily, and simvastatin 20mg oral at bedtime

Ht: 167cm **Wt**:72kg

Initial Labs:



Patient was admitted for CHF exacerbation. Elevated INR of 5.62 was noted. Attending physician ordered phytonadione 10mg orally. When questioned by the pharmacist, the attending explained that he did not realize the patient wasn't on warfarin.

Upon further chart review, it was discovered that the patient was started on amiodarone two weeks prior during an admission for ventricular tachycardia.

PATIENT CASE

Figure 1: INR Trend

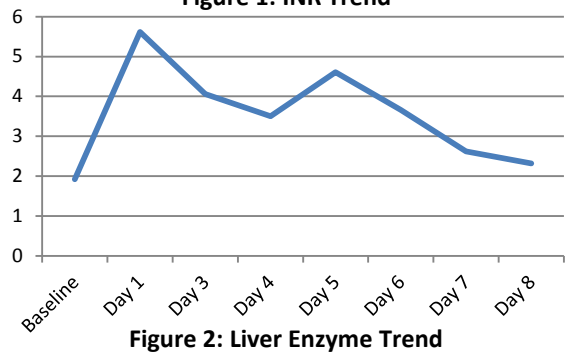


Figure 2: Liver Enzyme Trend

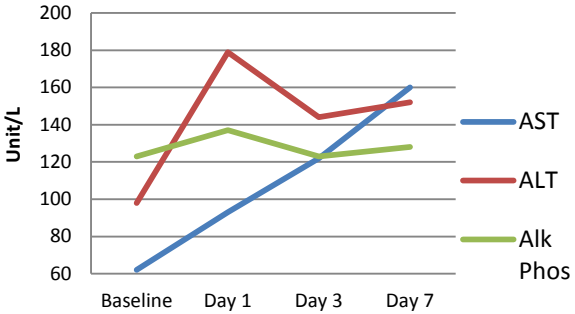
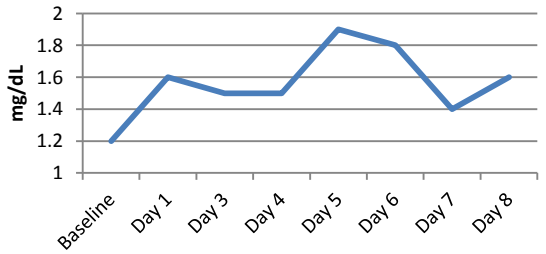


Figure 3: Serum Creatinine Trend



PATIENT CASE

At this point, it was suspected that this rise in INR might be due to a drug interaction between amiodarone and apixaban. The manufacturer was contacted, and while they had no data to support any specific INR changes, they did state that apixaban could cause an increase in INR in a concentration dependent manner. The pharmacist recommended holding apixaban and restarting at a reduced dose (2.5mg twice daily) once INR decreased. This recommendation was accepted.

The patient received two doses of 5mg on day 2. On day 4, apixaban was restarted at 2.5mg oral twice daily. On days 5 through 9, apixaban was held. On day 9, the patient expired.

DISCUSSION

The package insert for apixaban recommends a dose reduction to 2.5mg oral twice daily for patients receiving concomitant therapy with strong dual CYP3A4 and P-gp inhibitors. Amiodarone is an inhibitor of P-gp and CYP3A4, but is not specifically named in the package insert.

The timing of the addition of amiodarone does seem to indicate a drug interaction, but the patient did have elevations in liver enzymes that could have contributed to the elevated INR. Using the standardized Naranjo scale, the event's score is 6, which indicated the adverse drug reaction is probable.

While apixaban and other direct oral anticoagulants (DOACs) are often viewed as easier to manage than warfarin due to the lack of monitoring requirements, this case illustrates that potential drug interactions need to be evaluated prior to initiation and during DOAC therapy. Despite the relative safety of these drugs, DOAC therapy still needs to be closely monitored.

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Disclosures

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Effectiveness and safety of four-factor prothrombin complex concentrate for the emergent reversal of factor Xa inhibitors in patients with traumatic intracranial hemorrhage

OhioHealth Grant Medical Center

Daniel Dybdahl, PharmD; Grant Walliser, PharmD; Chance Spalding, DO, PhD; Michelle Kincaid, MD

BACKGROUND

- Four-factor prothrombin complex concentrate (PCC) is commonly utilized for the reversal of factor Xa inhibitors (apixaban, rivaroxaban, and edoxaban) in the setting of severe hemorrhage.
- This off-label indication is based on animal studies[1-5] and pharmacodynamics studies in healthy volunteers.[6-9]
- Three retrospective studies assessed the outcomes associated with four-factor PCC for the reversal of factor Xa inhibitors and dabigatran, but were limited by small sample size.[10-12]
- No study has compared effectiveness and safety in patients who did and did not receive four-factor PCC for the reversal of factor Xa inhibitors.
- At OhioHealth, prescribers utilize an anticoagulation reversal guideline that previously required an INR ≥ 1.5 to give four-factor PCC for the reversal of factor Xa inhibitors due to traumatic intracranial hemorrhage (ICH). As a result, some patients did not receive four-factor PCC due to a low INR despite taking factor Xa inhibitors.
- Four-factor PCC is dosed 50 units/kg (maximum of 5,000 units/dose) for the reversal of factor Xa inhibitors at OhioHealth.

OBJECTIVES

- The objective of this study is to determine the effectiveness and safety of four-factor PCC for the reversal of factor Xa inhibitors in patients with traumatic ICH.

Figure 1. Study Aims.

Aim 1

- Compare effectiveness outcomes in patients who did and did not receive four-factor PCC for the reversal of factor Xa inhibitors for traumatic ICH.

Aim 2

- Compare safety outcomes in patients who did and did not receive four-factor PCC for the reversal of factor Xa inhibitors for traumatic ICH.

METHODS

Research Design & Study Population

- This study is a retrospective review of patients at OhioHealth Grant Medical Center and OhioHealth Riverside Methodist Hospital between March 1, 2015 and August 31, 2017 who were taking a factor Xa inhibitor prior to admission and had a traumatic ICH.

Figure 2. Study Population.

Inclusion Criteria
- Taking a factor Xa inhibitor (apixaban, rivaroxaban, or edoxaban) prior to admission.
- Traumatic ICH (epidural hematoma, subdural hematoma, subarachnoid hemorrhage, or intracerebral hemorrhage) on head CT scan.

Exclusion Criteria
- None

- Anticoagulation prior to admission is routinely recorded for all trauma patients in the OhioHealth trauma databases.
- Based on review of the data, approximately 70 patients will be included in the study.
- Approximately 50% of the patients included in the study received four-factor PCC and 50% of patients did not receive four-factor PCC on the basis of INR, in accordance with the OhioHealth anticoagulation reversal guideline.

Figure 3. Patient Identification and Inclusion.

Queried trauma databases at OhioHealth Grant Medical Center and Riverside Methodist Hospital → Created list of patients meeting inclusion criteria → Manually reviewed patient charts to ensure that they met all inclusion criteria

Outcomes of Interest

Figure 4. Outcomes of Interest.

Primary Effectiveness Outcome	• In-hospital mortality
Primary Safety Outcomes	• Venous thromboembolism (pulmonary embolism or deep venous thrombosis) • Stroke or transient ischemic attack (TIA) • Myocardial infarction (MI)
Secondary Outcomes	• Timing of in-hospital mortality • Hematoma expansion • Neurosurgical interventions required • Blood products required • Functional recovery • Hospital and ICU length of stay

Other Study Variables

- History of venous thromboembolism, thrombophilia, stroke/TIA, MI, antiplatelet use, and nonsteroidal anti-inflammatory drug use.
- Dose of four-factor PCC administered, other reversal agents administered, mechanism of injury, site of injury, INR, Glasgow Coma Score, injury severity score, serial hemoglobin, disposition, and cause of death.

RESULTS & CONCLUSIONS

- Results and conclusions will be presented at the Great Lakes Regional Conference in West Lafayette, Indiana in April, 2018.

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DISCLOSURE

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- Daniel Dybdahl has nothing to disclose.
- Grant Walliser has nothing to disclose.
- Chance Spalding has nothing to disclose.
- Michelle Kincaid has nothing to disclose.

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Effectiveness and safety of four-factor prothrombin complex concentrate for the emergent reversal of factor Xa inhibitors in patients with traumatic intracranial hemorrhage
Daniel Dybdahl, PharmD, PGY2, et al. Emergency Medicine Pharmacy Resident, OhioHealth Grant Medical Center, Daniel.Dybdahl@ohiohealth.com

Evaluation of a medication guideline for the management of acute agitation in the emergency department

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Methods

- To assess the effectiveness of a medication guideline for the management of acute agitation in the emergency department

Background

- Proper management of acute agitation in the emergency department (ED) is essential for patient care and safety. This allows clinicians to properly assess patients for their underlying problems which brought them to the emergency department[1]
- The American Association for Emergency Psychiatry (AAEP) recommends 3 main classes of medications for acute agitation based on effectiveness studies[2]: first generation antipsychotics, second generation antipsychotics, and benzodiazepines
- Recommendations are based on studies that evaluated the effectiveness of these medication classes in the following patient populations: elderly, undifferentiated agitation, schizophrenia, schizoaffective disorder, bipolar disorder, psychosis, or other psychotic disorders
- The AAEP recommends the Behavior Activity Rating Scale (BARS) score to assess the effectiveness of these medications for acutely agitated patients
- Preval et al (2005)[2] investigated ziprasidone 20 mg intramuscular (IM) versus standard of care in a psychiatric ED for undifferentiated acute agitation in populations that included psychiatric agitation alone, a positive toxicology screen, or an alcohol level greater than 50 mg/dL (N = 119)

Ziprasidone	Standard of Care
○ BARS score was lower at 15 minutes (p<0.05), 30 and 120 minutes (p<0.01) versus baseline	○ BARS score was lower at 30 and 120 minutes (p<0.01) versus baseline

- Huang et al (2015)[3] investigated olanzapine 10 mg (IM) versus haloperidol 5 mg (IM) plus lorazepam 2 mg (IM) in agitated patients with schizophrenia or schizoaffective disorder (N = 67)
  - ○ No significant differences between the Positive and Negative Syndrome Scale-Excited Component (PANSS-EC) score at 2 hours leading to the conclusion of non-inferiority between the two regimens
- Hackensack University Medical Center utilizes the BARS score to assess agitated patients in the Adult ED. Currently, there is no medication guideline in place to assist physicians in selecting a medication for acute agitation based on individual patient characteristics.
- Using data provided from studies and the Psychopharmacology of Agitation: Consensus Statement of the AAEP Project BETA Psychopharmacology Workgroup Guideline, a medication guideline will be implemented for the treatment of acute agitated patients in this setting[4]

Study Population

Inclusion Criteria	Exclusion Criteria
• Patients ≥ 18 years of age in the Adult ED • Documented BARS score • Received a medication for acute agitation	• Patients with no BARS score documented • Patients who did not receive a medication or medication received was not part of study guideline

Methods

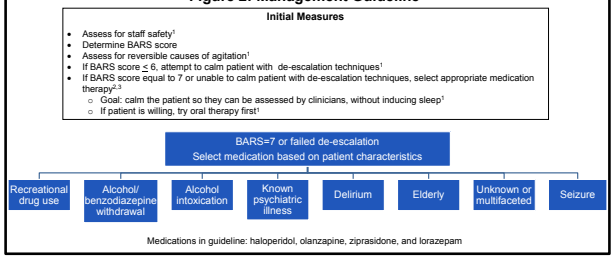
Study Design
- Single center chart review
- Historical standard of care (no medication guideline) versus intervention (medication guideline)

Procedure
- Patients will be identified using an EPIC - generated report for patients whom nurses initiated the BARS score monitoring tool

Figure 1: BARS Score[5]

1	• Difficult or unable to rouse
2	• Asleep but responds normally to verbal or physical contact
3	• Drowsy, appears sedated
4	• Quiet and awake (normal level of activity)
5	• Signs of overt (physical or verbal) activity, calms down with instructions
6	• Extremely or continuously active, not requiring restraint
7	• Violent, requires restraint

Figure 2: Management Guideline



Methods Continued

Primary Outcome
- Percent of patients that achieved a BARS score of 3 or 4 within 60 minutes of sedative administration

Secondary Outcomes
- Percent of patients with a BARS score < 3 or > 4
- Percent of patients who required additional sedatives
- Percent of patients who required rescue medication for medication side effects
- Percent of patients who developed cardiac dysrhythmias and/or QTc prolongation

Potential Benefits

- Information gained from this study may help to determine the effectiveness of the medication guideline implemented in the Adult Emergency Department for the treatment of acutely agitated patients and may minimize use of medications

Results

- Final results are pending

Limitations

- Single center study
- Interrater variability for BARS score assessment
- Inability to determine if provider used medication guideline to select medication administered

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Evaluation of transition-of-care pharmacist contribution for patients admitted through the Emergency Room

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Background

- A complete and accurate medication list during a patient's transition of care is known to reduce medication errors and adverse drug events.
- When a patient is admitted to a hospital through the Emergency Room (ER), completing an admission medication reconciliation can be a challenging task due to factors such as a patient's disease acuity, time constraints, and poly-pharmacy.
- According to a study by the Agency for Healthcare Research and Quality in 2015, over half of admitted patients' medication lists contain at least one discrepancy, of which 40% had the potential for patient harm.[1]
- Traditionally, physicians and nurses complete medication reconciliation, however, their workflow has not included using the Best Possible Medication History (BPMH) method.
- The BPMH is a history created by utilizing a systematic process of interviewing the patient/family and a review of at least one other reliable source of information to confirm all of a patient's medications (both prescription and over the counter). Complete documentation includes drug name, dosage, route and frequency.[2]
- Errors in obtaining an accurate preadmission medication history have great potential for harm, as they can propagate throughout a patient's hospitalization and after discharge.[3]
- Pharmacists have extensive training in obtaining medication histories. It has been proven that the BPMH obtained by pharmacists are more accurate and more complete than those obtained by other health care professionals.[4]

Purpose

- The goal of this project was to evaluate the incidence of admission medication reconciliation discrepancies for patients admitted through the ER.

Methods

- A prospective chart review was completed on 418 patients admitted through the ER at The George Washington University Hospital (GWUH) from October 2015 through July 2017.
- In the ER, an admission medication reconciliation was completed by non-pharmacy medical personnel.
- The Transition-of-Care (TOC) pharmacist and/or Advanced Pharmacy Practice Experience (APPE) students reviewed each patient's medication chart using BPMH within 24 hours of admission to the Cardiology service.
- The TOC pharmacy team also provided clinical services, such as medication education and clinical interventions, as part of daily responsibilities.
- The primary outcome was the percentage of patients with admission medication discrepancies when medication reconciliation was completed by non-pharmacy personnel in the emergency room.
- The secondary outcome was to identify the type of admission medication reconciliation discrepancies.

Results

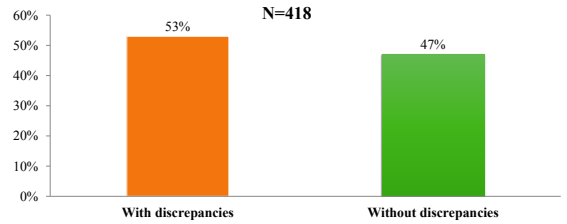


Figure 2: Type of medication discrepancies

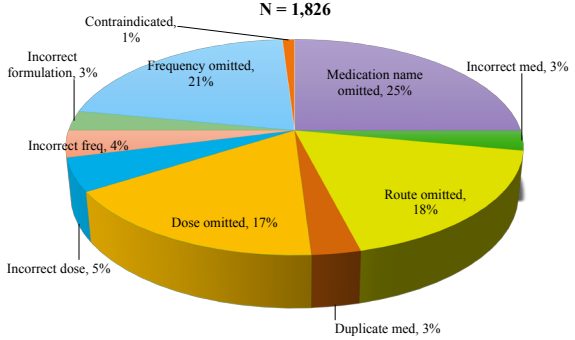
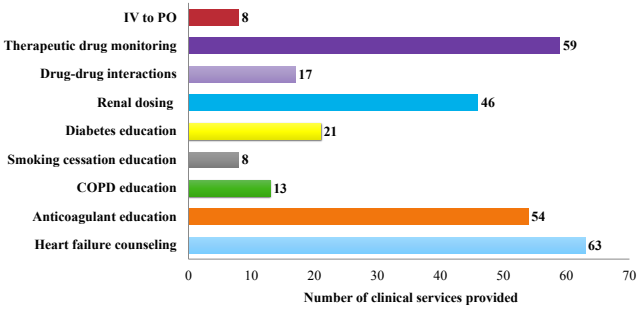


Figure 3: Clinical services provided



Discussion

- This project demonstrates the admission medication reconciliations completed in the ER by non-pharmacy personnel had a considerable number of medication discrepancies.
- The TOC pharmacy team created a comprehensive medication list within 24 hours of patient admission to the Cardiology service.
- In order to improve admission medication reconciliation and decrease medication errors, a TOC pharmacy team with knowledge of the BPMH method is warranted.
- A decreased number of admission medication reconciliation discrepancies lead to a complete and accurate discharge medication list.
- Based on this data, GWUH Department of Pharmacy is restructuring the work flow of the pharmacist to include comprehensive TOC activities to other medical services within the hospital.

Limitations

- The majority of the data was recorded by APPE students who rotated every 5 weeks, resulting in some inconsistency in data collection.
- When APPE students were not on rotation, no data was collected.
- The project design lacked a control group.

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Disclosure

- Nothing to disclose

Medication code tray redesign for improved access and faster delivery of medications in emergency situations at a Veterans Affairs medical center

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BACKGROUND

- The availability of appropriate medications in an emergency situation is crucial to improving patient outcomes
- Unorganized code cart trays which do not have easily identifiable or accessible medications can be a detriment to medication administration time and a patient's response to medications.
- Reorganizing these trays was deemed necessary by several areas in the VA Boston Healthcare System (VABHS) in order to improve:

Uniformity	Filling, checking, and verifying code trays
Utilization	Ease of access in an emergency
Updating	Removal of used or expired products

This project was implemented at VABHS as a part of "VA SHARK TANK", an initiative that aims grow and share best practices.

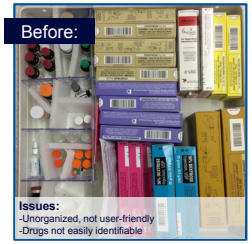
Diffusion of EXCELLENCE
Diffusing Best Practices Across VHA

SPECIFIC AIMS

1. Standardize code cart medication trays utilizing cost-effective materials to make medications easily accessible and identifiable
2. Improve time of location and time to administration of medications
3. Measure difference in time locating medications from old version to new version of medication code tray
4. Utilize medication code tray redesign as a best practice locally and nationally across VA Medical Centers

METHOD OF CODE TRAY REDESIGN

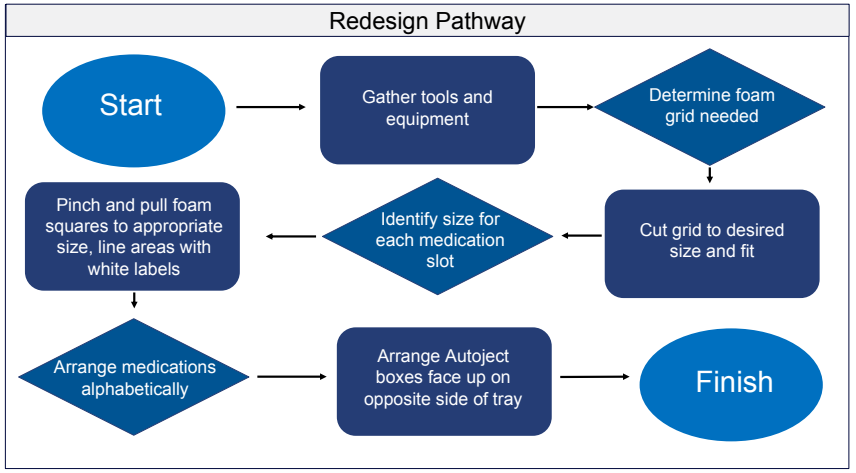
Before:



Issues:
-Unorganized, not user-friendly
-Drugs not easily identifiable

After:

Issues:
-Organized, foam custom fitted for each drug
-Drug labels easily visible, identifiable



RESULTS OF IMPLEMENTATION

83%	↓10 secs	↓20 mins	+ $10K
83% of users were able to locate medications more efficiently than the original tray design	Time trials showed that the time to locate medications in an emergency situation was reduced by up to 10 seconds	The time to refill and update the redesigned trays was reduced by up to 20 minutes per tray	Removed a high cost, infrequently used drug and saved $10K annually

DISSEMINATION AND EXPANSION

Presentation
Recognized at the VA Diffusion of Excellence Conference as a National Gold Status Best Practice

Standardization
-Mandated for all of New England (regional level)
-Adopted by Loma Linda, CA VA system

Expansion
Can be utilized locally for stocked medication trays in other areas of the medical center

Acknowledgements: Bryan R. Wood, PharmD, Chelsea Hawley, PharmD, Andrew Krevat, PharmD, John Roefaro, PharmD, FASHP

Medication code tray redesign for improved access and faster delivery of medications in emergency situations at a Veterans Affairs medical center
Kristine Gherardi, CPhT, VA Boston Healthcare System Boston, MA, Kristine.gherardi@va.gov

Evaluation of outcomes after the implementation of an updated, emergency department-based alcohol withdrawal treatment protocol at an academic medical center.

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Background

- Alcohol use disorder affects approximately 8.5% of the adult population in the United States[1]
- Rapid recognition and symptom-triggered treatment of alcohol withdrawal syndrome (AWS) in the emergency department (ED) can prevent serious morbidity and mortality[2-9]
- The Johns Hopkins Hospital implemented an ED-specific AWS treatment protocol in December 2010, which provided a more consistent approach to treatment but offered limited clinical decision support
- A new ED-specific AWS treatment protocol will be implemented in December 2017 which provides a more comprehensive treatment algorithm with nurse titration parameters[2-11]

Study Purpose

- The purpose of this study is to evaluate outcomes after the implementation of an updated, more comprehensive acute alcohol withdrawal protocol in the emergency department.

Study Design and Patient Population

- Observational study comparing two periods
  - Prior protocol period: July 2017 – September 2017
  - Updated protocol period: December 2017 – February 2018
- Includes patients ≥ 18 years of age who are treated for AWS with at least one dose of benzodiazepine while in the ED
- Patients will be identified utilizing ICD-10 codes for the diagnosis of alcohol withdrawal or with at least one dose of benzodiazepine ordered through the ED-specific AWS order set

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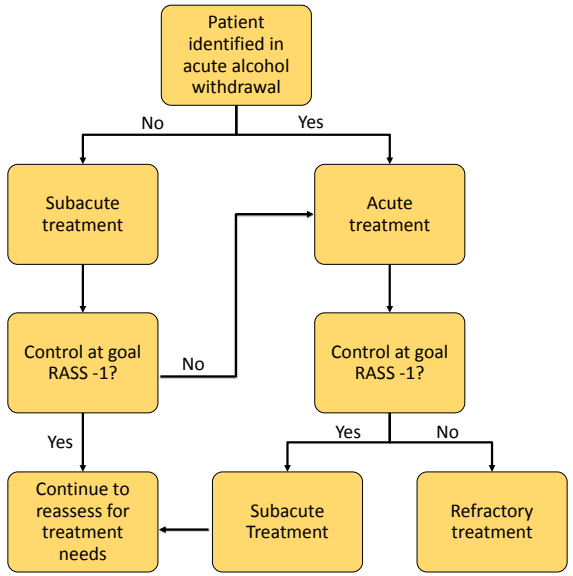
Emergency Department Alcohol Withdrawal Protocols*

Treatment Stage	Prior Protocol	Updated Protocol
Acute In active withdrawal	• Intravenous benzodiazepine doses did not escalate with subsequent administrations	• Intravenous benzodiazepine doses escalate with each subsequent administration
Subacute Potential for withdrawal or maintenance therapy after acute treatment	• Oral benzodiazepines recommended but no guidance on dosing or frequency	• Oral benzodiazepines recommended with specified dose and titration strategy
Refractory Patients not responsive to initial acute treatment	• Continuous infusion of benzodiazepine recommended with some titration guidance, but no starting dose suggestions	• Continuous infusion of benzodiazepine recommended with starting dose based on total benzodiazepine doses received in previous 60 minutes



*Assumes all patients have an alcohol abuse history

Study Objectives and Selected Endpoints

- To compare compliance with an updated ED-based alcohol withdrawal protocol to compliance with the previous protocol
  - Percent of patients treated with an order-set based order at any time while in the ED
  - Percent of patients with baseline BAWS/RASS score documented[10,11]
  - For patients treated with an order-set based order
    - Percent of patients with benzodiazepine orders administered outside of the order-set
  - For all patients treated with lorazepam infusions:
    - Percent of patients initiated at appropriate dose based on benzodiazepine requirement in prior 60 minutes
- To compare adverse events related to treatment using an updated ED-based alcohol withdrawal protocol to adverse events related to the previous protocol
  - Within 60 min of intravenous benzodiazepine administration:
    - Percent of patients requiring mechanical ventilation through endotracheal intubation
    - Percent of patients with occurrence of SBP < 90 mmHg, HR < 50 BPM, or RR < 10 breaths/min
  - At any point in time during treatment
    - Percent of patients developing seizure while in the emergency department
    - Percent of patients with occurrence of RASS ≤ -2
    - Percent of patients with occurrence RR < 10 breaths/min
    - Percent of patients with an occurrence of O_2 saturation less than 90% in whom the O_2 requirement is new
- To describe clinical outcomes for patients treated using an updated ED-based alcohol withdrawal protocol
  - Time from first benzodiazepine administration to RASS -1
  - Total benzodiazepine administered (in lorazepam equivalents)
  - Percent of patients with a continuous benzodiazepine infusion
  - Percent of patients requiring admission to intensive care unit
  - Percent of patients who received phenobarbital IV in whom this was not a home medication
  - Once goal of RASS -1 achieved, percent of patients with occurrence of HR ≥ 120 BPM or RASS ≥ +2

Evaluation of post-exposure prophylaxis administration following suspected human rabies exposure

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Background

- Rabies is a vaccine-preventable disease that is caused by RNA virus transmission from contact with saliva of infected animals.[1,2]
- Human rabies exposures and vaccine administration records are reportable events mandated by the state health department for syndromic surveillance and compliance.
- Specific post-exposure prophylaxis is outlined by the Advisory Committee on Immunization Practices (ACIP) due to the high mortality risk associated with rabies disease.[3,4]
- Inappropriate or unnecessary initiation of post-exposure prophylaxis (PEP) can contribute to financial burden to the public health sector and the patient.

Objectives

- Primary objective: evaluate initial selection of rabies PEP following animal exposure
- Secondary objectives: evaluate timing and site of administration of rabies vaccine and human rabies immunoglobulin (HRIG)

Methods

- This medication use evaluation was a quality assessment review and deemed exempt from Institutional Review Board approval.
- Retrospective chart review of all patients who received rabies vaccine, HRIG, or both for PEP from January 1, 2015 through May 31, 2017
- Inclusion: all patients administered at least one dose of any rabies biologic agent in the inpatient or ambulatory care setting
- Exclusion: any patient who presented for travel-related pre-exposure prophylaxis (PrEP), booster series, or completion of prior PEP
- Utilized ACIP recommendations to determine appropriateness of initiation, timing, and administration of PEP (Table 1)
- Descriptive statistics were utilized to evaluate the data collected.

Table 1. ACIP recommendations for PEP initiation / administration[3,4]

Animal exposure requiring PEP	Bats, domesticated mammals (i.e., dog, cat), wild carnivores (i.e., foxes, skunk), non-human primates
HRIG administration	Infiltrate full dose into wound, with any volume remaining administered intramuscularly at anatomical site distal from vaccine administration on day 0[#]
Rabies vaccine administration	Intramuscular deltoid or lateral thigh as a 4 dose series (days 0, 3, 7, 14)*

[#] This may require multiple sites.
* Patient with immunosuppression: 5 doses series should be administered (days 0, 3, 7, 14, 28).

Results

Figure 1. Patient selection criteria

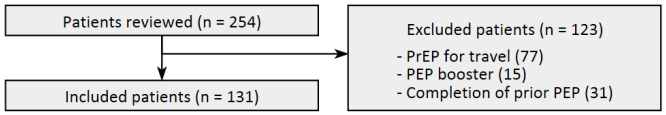


Figure 2. Type of animals for potential human rabies exposure (n = 131)

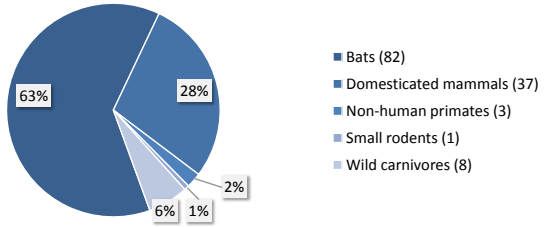
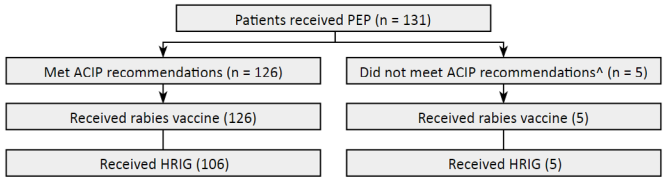
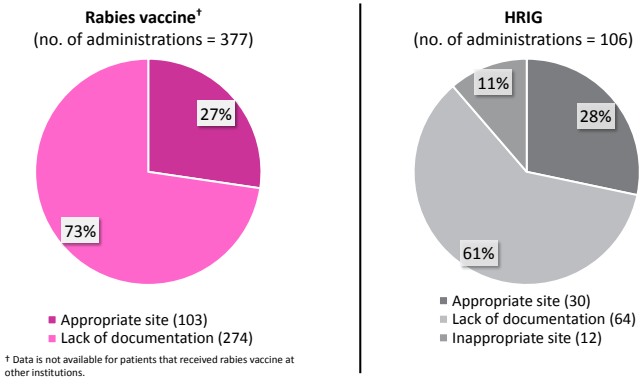


Figure 3. Biologic administration per ACIP recommendations



^ Patients did not meet ACIP recommendations due to exposure to small rodents (n = 1) or contact with bat guano (n = 4).

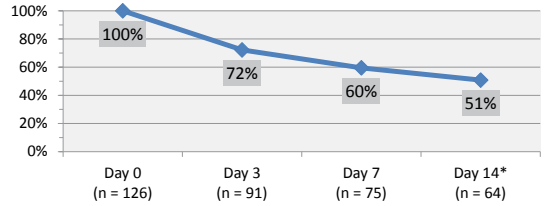
Figure 4. Rabies biologics site of administration for patients meeting ACIP recommendations



† Data is not available for patients that received rabies vaccine at other institutions.

Results (cont.)

Figure 5. Patients completing rabies vaccination series‡



‡ Data excludes patients who received vaccine doses >/=2 days off recommended schedule (n = 21).
* One patient was immunosuppressed and presented on day 14 and 28 for competition of rabies series.

Discussion

- At this health system, the majority of human rabies exposure were related to bats and domesticated mammals (dogs and cats).
- All patients who met ACIP recommendations for rabies vaccination received the first dose, with greater than 85% of patients also receiving HRIG (Figure 3).
- Majority of rabies biologics administered lacked documentation regarding site of administration within the EHR, possibly due to multiple sites used or complexity of EHR documentation.
- There was a 28% attrition rate between the first and second dose of rabies vaccine with 51% of patients completing their PEP series.
- Limitations:
  - This was a single-center, retrospective chart review.
  - Inability to evaluate completion of PEP for patients who did not return to the same health system for subsequent doses but may have presented elsewhere
  - Some patients may have been advised to not complete the rabies vaccine series by the health department because the source of animal exposure did not exhibit rabies symptoms under observation.

Conclusions

- Ensuring appropriate patient selection, site of administration, and completion of series may benefit from additional tools with the EHR.
- Education regarding rabies administration protocol will be reinforced with providers to help meet ACIP recommendations.
- These results will be shared with the Departments of Emergency Medicine and Infection Control.

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Impact of a pharmacist-driven culture follow-up program in the emergency department

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AMITA Health Adventist Medical Centers - Hinsdale and La Grange Department of Pharmacy

Background:

The purpose of this study was to assess the impact of a pharmacist-managed culture review and follow-up program in the emergency department (ED) at two community hospitals. As a result of the overuse and inappropriate prescribing of antibiotics, there is increasing antimicrobial resistance in the community. In the Emergency Department, physicians are tasked with the challenge of prescribing antibiotics prior to obtaining the finalized culture results. Therefore, empiric treatment needs to cover the likely pathogens while minimizing the collateral damage of resistance and side effects. ED pharmacists are well positioned to change therapy when needed and choose the most appropriate agent.

Methods:

A retrospective study was performed to evaluate the impact of a pharmacist-driven culture review and follow-up process in the ED at two community hospitals which are staffed by the same ED Physician group. The pharmacist-managed service was performed five days per week from Sunday through Thursday. The nursing staff was responsible for culture follow-up on the remaining two days of the week. The ED pharmacist was responsible for reviewing a report, which identified patients who left the ED with a positive culture. The pharmacist also received calls from the microbiology laboratory regarding Verigene® results for positive blood cultures, STD culture results and rapid strep test cultures. Adults and pediatric patients were included in the review. The pharmacist determined if the patient was discharged on appropriate therapy. If a change in therapy was required, the pharmacist would discuss the recommendation with the ED physician and would then call the patient and notify him or her of the change in treatment. The pharmacist would then send the new prescription electronically to the patient's pharmacy of choice. Interventions were documented in the patient's electronic medical record. ED revisits within 72 hours were recorded as well as hospital admissions within 30 days. Pharmacy interventions that were recorded included the following: antibiotic changed based on culture/sensitivities, discontinuation of unnecessary antibiotics, and calling patients to return to the ED based on positive cultures.

Results:

Evaluation period – September 2016 – March 2017 (6 months)

Patient Demographics		Type of Cultures Resulted	Cultures (n=487)
Patients, n	484	Urine	364
Age (mean ± SD) years range	45.3 ± 27 3 months – 99 years	Blood	27
		Wound	49
		Strep Culture	37
<18 years of age, n (%)	78 (16.1%)	Stool	6
		Sputum	3
Female, n (%)	375 (79.5%)	*Chlamydia trachomatis* amp probe	1

ED Revisit/Admission Data	N (%)
ED Revisit within 72hr	13 (2.7%)
Admission within 30 days	19 (3.9%)
ED Revisit within 72hr and admitted	16 (3.3%)

Pharmacist Interventions:	N (%)
Resistant culture to empiric therapy – Pharmacist changed antibiotic to appropriate therapy	83 (17%)
Positive Blood cultures/results – Pharmacist called patient to return to ED	3 (0.6%)
Positive Blood cultures/results – Pharmacist called Primary Physician or long-term care facility to notify	10 (2.1%)
De-escalation/Discontinuation based on results	3 (0.6%)
TOTAL INTERVENTIONS	**99 (20%)**

Discussion:

A total of 487 cultures were reviewed and 99 (20%) were intervened on by ED pharmacists. One notable finding was that of 60 patients who were started empirically on a fluoroquinolone for a UTI, 14 (23%) required change due to a resistance culture. This led to ED provider education of the 2016 FDA Fluoroquinolone Safety Warning. Empiric treatment recommendations based on culture sensitivity data were reviewed with providers after this study. Additionally, 27 patients who did not go home on antibiotics for a UTI were treated after cultures resulted. This led the Antimicrobial Stewardship Committee to revise the urinalysis reflex culture criteria to only reflex for WBC >10/hpf. Baseline ED revisit and admission data would have been beneficial to determine if the pharmacist culture follow-up program resulted in decreased admissions. Furthermore, pharmacists only intervened on positive cultures. In the future, obtaining a negative culture report would allow pharmacists to intervene and save antibiotic days in the community.

Conclusion:

Over a 6-month period, a pharmacist-managed culture follow-up process in the emergency department had a positive impact on patient care. Antimicrobial interventions were performed in approximately 1/5 of patients, supporting the opportunity for the expansion of antimicrobial stewardship in the ED.

Disclosure

Authors of this presentation have the following to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation:

1. PharmD 2. MBA 3. BCPS

Evaluation of a novel fixed dosing regimen of 4-factor prothrombin complex concentrate (PCC) for warfarin reversal

Clare McMahon, PharmD, Anne Rose, PharmD, Joe Halfpap, PharmD, BCPS

Background

- Current UW Health PCC dosing recommendations are weight and INR based with a maximum dose of 5000 units
- Recent literature shows that fixed and often lower doses of PCC for warfarin reversal may be equally effective as traditional weight-based dosing
- Updated dosing recommendations were created based on current literature and PCC usage data from UW Health

Updated UW Health Guideline recommendations PCC dosing in warfarin reversal

Pre-treatment INR	Dose of PCC
≤ 6.0	1000 IU
≥ 6.1	2000 IU
Any INR with CNS bleed	2000 IU
May repeat with 500 units if INR goal or clinical outcome is not achieved	
*Round doses to the nearest vial size. Vial sizes vary.	

Purpose and Objectives

To evaluate the efficacy, efficiency and cost of a novel fixed dose PCC regimen for warfarin reversal as compared to a historical weight based dosing cohort.

Objective 1: Implement and optimize utilization of updated recommendations for fixed dosing of PCC for warfarin reversal

Objective 2: Assess efficacy of fixed dosing of PCC for warfarin reversal

Objective 3: Evaluate timeliness of medication administration and laboratory availability

Objective 4: Evaluate the cost implications associated with utilization of fixed dose PCC recommendations

Methods

Objective 1
- Update UW guideline to recommend fixed dosing
- Educate hospital staff on new recommendations
- Measure compliance to updated PCC dosing recommendations
- Provide real time feedback with daily usage reports
- Evaluate need for pharmacist delegation protocol

Objective 2
- Compare case matched patients using historical weight based dosing to fixed dosing using the following measures of treatment success:
  - INR reversal to ≤1.3 for CNS bleeds and emergent surgery or ≤1.5 for all other bleeds
  - Clinical signs of continued bleeding

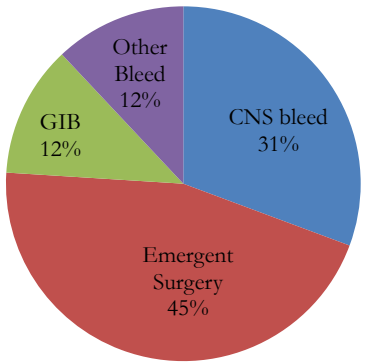
Objective 3
- Implement PCC order panel with fixed dosing and follow up INR guidance
- Calculate time to INR result pre- and post- PCC administration
- Calculate median time to PCC administration pre- and post- guideline update
- Identify barriers to more rapid PCC administration

Objective 4
- Compare the median cost per patient of PCC with weight based and with fixed dosing for warfarin reversal

Results - Baseline Data

- 99 doses of PCC administered at UW Health in 2016
  - 75 were for emergent warfarin reversal
- 27 doses of PCC for warfarin reversal utilized in the ED

2016 indications for emergent warfarin reversal with PCC (n=75)



2016 PCC utilization for warfarin reversal			
Initial INR, mean ≤ 6 ≥ 6.1 CNS bleed	3.1 45 (60%) 7 (9.3%) 23 (30.7%)		
Post PCC INR, mean	1.3		
Follow up INR ≤1.3 1.4-2 ≥2.1	**INR ≤ 6** 25 (55.6%) 18 (40%) 2 (0.04%)	**INR ≥ 6.1** 6 (85.7%) 1 (14.3%) 0	**CNS Bleed** 15 (68.2) 7 (31.8%) 0
PCC dose, mean	2403 units	2942 units	2313 units
Patient weight, mean	87.5 kg		
ED time from order entry to administration, mean	42 minutes		

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The authors of this poster have nothing to disclose.

Evaluation of a novel fixed dosing regimen of 4-factor prothrombin complex concentrate (PCC) for warfarin reversal
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Clinical pharmacist simulation training for the rapidly decompensating patient

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Background

• Clinical pharmacists have become integral members of emergency response, including rapid response teams (RRT) and cardiopulmonary arrest response teams. Pharmacist responsibilities include, but are not limited to, medication procurement and preparation; providing recommendations for medication therapy including doses, rates, and routes of administration; serving as a drug information resource; and providing compatibility information.[1]

• RRT deployment reduces rates of respiratory failure, stroke, severe sepsis, acute kidney injury, intensive care admission and in-hospital cardiopulmonary arrest.[2,3,4,5] RRTs and arrests remain relatively rare events and maintaining responder proficiency and comfort in these areas is difficult. The optimal method of maintaining pharmacist responder training has yet to be described.

• Simulation based training (SBT) allows learners to engage in clinical scenarios that are infrequently encountered in real life and to practice skills without endangering patients. It provides a safe, supportive, and realistic learning environment with an opportunity to provide real-time feedback. This project aims to utilize simulation training as a technique for improving the comfort and knowledge level of clinical pharmacists as RRT and cardiopulmonary arrest responders.

Objective(s)

Primary Objective

- To assess the impact of simulation training on clinical pharmacist self-efficacy in the management of a rapidly decompensating patient

Secondary Objectives

- To assess the impact of simulation training on clinical pharmacist knowledge while participating in management of a rapidly decompensating patient
- To assess clinical pharmacist perception towards RRT and Code Blue response
- To determine whether pharmacist characteristics affect baseline self-efficacy, knowledge, and perception in the care of a rapidly decompensating patient

Methods

Study Design
- IRB approved, single-center, observational study

Inclusion Criteria
- 69 adult clinical pharmacists solicited for participation, on a volunteer basis

Exclusion Criteria
- Non-CPCS (Clinical and Patient Care Services) staff, including residents

Materials
- A training manikin to simulate the patient
- Vital Sign Simulator (VSS) software
- Mock code cart
- Expired Abboject syringes, medications, plastic syringes with needles, and fluid bags

Simulation
- Multiple sessions available to allow for participation from all shifts
- ACPE Continuing Education credit provided
- Class sizes limited to 10 individuals
- Scenarios developed using evidence-based practice and guidelines
- A mock class schedule is as follows:
  – Case (15 minutes)
  – Debriefing (30 minutes)

Primary Endpoint

- Score of self-efficacy survey pre and post simulation

Secondary Endpoints

- Score of knowledge assessment pre and post simulation
- Score of perception survey pre and post simulation
- Effect of pharmacist characteristics on baseline self-efficacy, knowledge, and perception in the care of a rapidly decompensating patient

Data Collection & Analysis

• Summary statistics will be used to describe the outcome and demographic characteristics.

• Continuous variables will be summarized using mean and standard deviation or median and interquartile range. Depending on parametric or nonparametric distribution, a two-sample t test or Wilcoxon-Mann-Whitney test will be used to compare results among pharmacists who attended at least one simulation session compared to pharmacists who did not participate.

• Chi-squared test or Fishers exact test will be used to determine if there is a difference between the two groups.

• A mixed model will be used to assess the association between self-efficacy score and patients' characteristics to account for the correlation between the same pharmacist's pre-simulation and post-simulation scores. Significance will be assessed at alpha = 0.05.

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The authors have no financial or personal relationships to disclose with commercial entities that may have direct or indirect interest in the subject matter of this presentation.

Effect of Initial Intravenous Antihypertensive Agent on the Management of Blood Pressure During Hypertensive Emergencies

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Background

- Hypertensive emergency is defined as a systolic blood pressure (SBP) greater than 180 mmHg and/or diastolic blood pressure (DBP) greater than 120 mmHg with evidence of end organ damage[1,2]
- This life-threatening crisis requires careful blood pressure reduction, a decrease in mean arterial pressure (MAP) by 15-25% within the first hour, via titratable intravenous (IV) antihypertensives to prevent progressive organ damage[2,3]
- However, most of these patients tend to be inappropriately managed and a clear consensus on which IV antihypertensives provide the most benefit is lacking[3]. This creates a need for a comprehensive study that compares the various agents

Objective

- To compare IV antihypertensives commonly used in our emergency department (ED) as initial therapy for hypertensive emergency and determine their effect on clinical outcomes during the course of treatment

Methods

- IRB approved, single center, retrospective cohort study of patients admitted from January 1, 2012 to August 31, 2017
- Diagnostic and drug charge codes were used to identify patients with hypertensive emergency who received at least one IV antihypertensive agent
- Since labetalol comprised of 54% of the initial agents used, two comparison groups were created
  - Labetalol group: patients who received labetalol as the initial agent
  - Non labetalol group: patients who received any other IV antihypertensive as the initial agent
  - **Figure 1** summarizes the patient selection process

Methods and Results

- Primary Outcomes:
  - Proportion of patients who achieved goal MAP within the first hour of initial antihypertensive administration
  - Time to initial goal MAP
- Secondary Outcomes:
  - Percentage of MAPs at goal within the first 24 hours of hospitalization
  - Duration of IV therapy
  - Number of IV antihypertensives used to meet goal MAP
- Inclusion Criteria:
  - Patients ≥ 18 years old
  - Patients who met the definition of hypertensive emergency
  - Patients who received at least one dose of an IV antihypertensive agent in the ED
- Exclusion Criteria:
  - Pregnancy
  - Stroke
  - Aortic dissection

Figure 1.

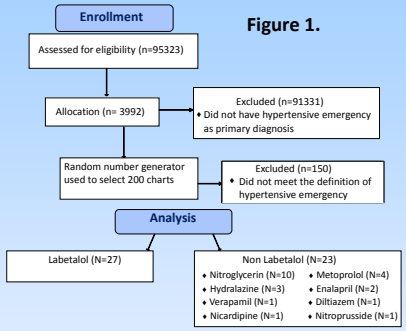

Table 1. Demographic Information

Variable	Labetalol (N=27)	Non Labetalol (N=23)	P-value
Age (years, SD)	65.2 ± 19.3	65.8 ± 19.1	0.97
Male Gender (n,%)	18 (66.7)	14 (60.9)	0.68
Race (n,%)			
Caucasian	18 (66.7)	14 (60.9)	0.68
Black or African American	7 (25.9)	7 (30.4)	0.73
Other	2 (7.4)	2 (8.7)	0.88
Prior Hypertension (n,%)	26 (96.3)	19 (82.6)	0.14
Tobacco/Stimulant Use (n,%)	10 (37.0)	7 (30.4)	0.64
End Organ Damage (n,%)			
Cardiac	8 (29.6)	10 (43.5)	0.33
Neurologic	11 (40.7)	7 (30.4)	0.47
Renal	5 (18.5)	2 (8.7)	0.36
Pulmonary	3 (11.1)	4 (17.4)	0.56

Table 2. Primary and Secondary Outcomes

Variable	Labetalol (N=27)	Non Labetalol (N=23)	P-value
Achieved Goal MAP Within the First Hour of Therapy (n,%)	12 (44.4)	12 (52.2)	0.60
Time to Initial Goal MAP (n,%)			
0-1 hours	12 (44.4)	12 (52.2)	0.60
1-6 hours	12 (44.4)	8 (34.8)	0.51
6+ hours	3 (11.1)	3 (13.0)	0.84
MAPs at Goal Within the First 24 Hours of Hospitalization (%)			
0-50%	2 (7.4)	6 (26.1)	0.092
51-75%	5 (18.5)	7 (30.4)	0.35
76-90%	13 (48.1)	3 (13.0)	<0.01
91-100%	7 (25.9)	7 (30.4)	0.73
Duration of IV Therapy (n,%)			
0-24 hours	25 (92.6)	15 (65.2)	0.021
24-48 hours	0 (0)	4 (17.4)	0.038
48+ hours	2 (7.4)	4 (17.4)	0.32

Results

Table 3. Secondary Outcomes Continued

Variable	Labetalol (N=27)	Non Labetalol (N=23)	P-value
Number of IV Antihypertensives Used to Meet Goal MAP (n,%)			
1 agent	19 (70.4)	10 (43.5)	0.064
2 agents	8 (29.6)	10 (43.5)	0.33
3+ agents	0 (0)	3 (13.0)	0.09
Requiring additional boluses of the same agent, dose titrations, and/or additional agents	13 (48.1)	19 (82.6)	0.014
Mean Hospital LOS (days, SD)	2.97 ± 3.57	6.73 ± 7.15	< 0.01
Mean Intensive Care LOS (days, SD)	0.36 ± 1.19	1.35 ± 2.6	< 0.01

Discussion

- Comparison of the labetalol and non labetalol antihypertensive groups in relation to the primary outcomes was not statistically significant
- No statistically significant difference between the two groups in terms of percentage of MAPs at goal within the first 24 hours of hospitalization
- It is notable that there was a significant difference in changes to initial antihypertensive therapy with the non labetalol group requiring more boluses, titrations, and/or additional agents to maintain goal MAP. Patients in the labetalol group had fewer changes to initial therapy
- Non labetalol group required a longer duration of IV therapy and consequently, a longer hospital and intensive care length of stay to remain at goal MAP
- Study limitations: possibility of a Type II error due to small sample size, variance in blood pressure documentation among patient charts, accuracy of ICD coding

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Disclosure
All affiliations and persons represented on this presentation have no conflicts of interests or financial interest

Evaluation of Empiric Antibiotic Prescribing for Urinary Tract Infections in Patients Discharged From the Emergency Department

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BACKGROUND

- Antibiotics compose 11% of prescriptions written for patients discharged from the emergency department (ED)
- Previous studies have shown improvement in appropriateness of antibiotics after implementation of a pharmacist driven urine culture callback program
  - 30% decrease in inadequate regimens
  - Faster callback times
  - Decrease in unplanned readmissions
- A study completed in Jackson Memorial Hospital's (JMH) ED from May to October 2014 showed that 25% of patients treated for an *Escherichia coli* urinary tract infection (UTI) received inadequate therapy

RATIONALE

- JMH ED sees approximately 100 adult patients per month who are discharged prior to the return of positive urine cultures
- Currently no structured system exists for response to these cultures
- Pharmacists are well trained in interpretation of antimicrobial resistance, dosing, duration of therapy, identification of allergies, route of administration, and drug interactions
- The ED pharmacist is in a unique position and equipped with the proper knowledge and tools to facilitate appropriate and timely modifications

METHODOLOGY

- Retrospective chart review conducted between July and September 2017 of patients discharged from JMH ED with positive urine culture and diagnosis of UTI

Inclusion Criteria
- ≥ 18 years of age
- Positive urine culture
- Diagnosed with a UTI

Exclusion Criteria
- <18 years old
- Admitted status at time of culture result
- No diagnosis of UTI

ENDPOINTS

Primary
- Describe the rate of potential pharmacist interventions for empiric antimicrobial prescribing for UTIs in patients discharged from the ED

Secondary
- Describe the rate of antimicrobial resistance to empiric treatment for UTI in patients discharged from the ED
- Describe prescribing practices for empiric regimens for UTI in patients discharged from the ED

RESULTS

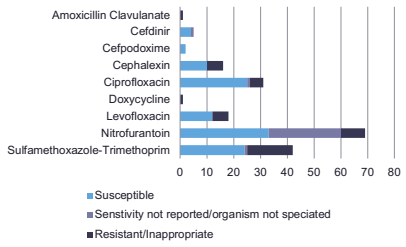
- 185 patients were included
- 194 organisms were isolated
  - *Escherichia coli* (n=121)
  - *Klebsiella pneumonia* (n=15)
  - *Proteus mirabilis* (n=14)
  - Other (n=44)
- 22 patients (12%) were readmitted to a JMH facility within 30 days with diagnosis of UTI
  - 14/22 (64%) potentially preventable

Patient Demographics (n=185)	
Average age, years	47.3
Catheter associated	33
Diagnosis of pyelonephritis	20
Female	130
Pregnant	16
Presented from skilled nursing facility	2

Potential Interventions (n=56)	
Bug-drug mismatch	43
Inadequate duration	0
Renal adjustment	6
Allergy to antibiotic	0
Drug interactions	0
Other*	7

*Includes patients with positive blood cultures, diagnosis or symptoms of pyelonephritis receiving nitrofurantoin, under dosed medications

Empiric Antibiotic Prescribing



DATA COLLECTION

- Antibiotics prescribed
- Culture data
- Demographics
- Documentation of symptoms of UTI or pyelonephritis
- Potential pharmacist intervention
- Readmission to a JMH facility within 30 days

LIMITATIONS

- Retrospective data review
- Variations in micro-lab reporting during study period
- Single center

FUTURE DIRECTION

- Implementation of a pharmacist driven urine culture callback program
- Post intervention impact analysis
- Education to providers on best practices when treating UTIs for patients discharged from the ED
- Development of an ED specific antibiogram for urine cultures at JMH

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DISCLOSURE

•No disclosures. Submitted to JMH Clinical Research Review Committee and IRB approved.

Impact of inter-hospital transfer in delaying appropriate anticoagulation reversal in patients with warfarin-associated intracranial hemorrhage

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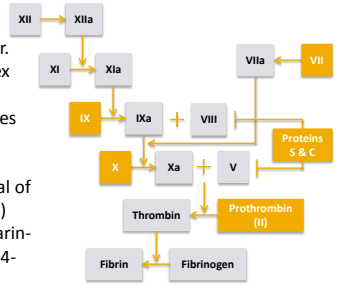
Introduction

- Millions of Americans are prescribed warfarin each year.
- 4-factor prothrombin complex concentrates (4-factor PCC) selectively and rapidly reverses anticoagulation activity of warfarin.
- Current guidelines for reversal of intracranial hemorrhage (ICH) recommend reversal of warfarin-associated hemorrhage with 4-factor PCC and intravenous phytonadione.[1]



Clotting factors inhibited by warfarin, contained in 4-factor PCC

Background

- Previous research in our region has demonstrated an absence of 4-factor PCC in rural community healthcare centers.
- It is not clear whether this disparity influences patient morbidity and mortality.

Objectives

- **Primary Objective:** to determine if patients with warfarin-associated ICH transferred from outside institutions had a delay in anticoagulation reversal compared to patients presenting directly to our institution.
- **Secondary Objectives:**
  - In-hospital mortality
  - Disposition at discharge
  - ICU and hospital length of stay
  - Change in bleed size after 4-factor PCC administration
  - Guideline concordant phytonadione administration
  - Administration of coagulation factor reversal agents prior to transfer

Methods

- This is a single-center, retrospective chart review, conducted between August 1st, 2013 and July 1st, 2017.
- **Inclusion Criteria:**
  - Traumatic or non-traumatic intracranial hemorrhage on warfarin
  - Administration of 4-factor PCC
- **Exclusion Criteria:**
  - Less than 18 years of age
  - 4-factor PCC received for indication other than warfarin reversal in the setting of ICH
  - 4-factor PCC received during subsequent encounter
  - Pregnant or incarcerated patients
  - Key data points missing from medical record

Baseline Demographics

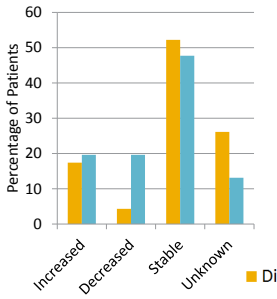
	Total N=173	Direct N=23	Transfer N=153	p-value
Age, mean (std)	76 (11.6)	76.1 (13.4)	76.3 (11.3)	0.93
Male (%)	73 (41.5)	13 (56.5)	60 (39.2)	0.02
Initial INR, mean (std)	2.9 (1.5)	4.0 (2.8)	2.7 (1.1)	0.04
FFP prior to arrival (%)	39 (22.5)	NA	39 (25.5)	NA
GCS at admission (std)	12.5 (3.8)	12.9 (3.2)	12.5 (3.9)	0.56
Traumatic ICH (%)	82 (47.2)	12 (52.2)	71 (46.4)	0.69
Indication for warfarin therapy				
Atrial fibrillation (%)	128 (72.7)	17 (73.9)	111 (72.5)	0.58
Valve replacement (%)	24 (13.6)	2 (8.7)	22 (14.4)	0.54
Thromboembolism (%)	30 (17.0)	3 (13.0)	27 (17.6)	0.58
Other indication (%)	7 (4.0)	1 (4.3)	6 (3.9)	0.99

Disclosure: The authors have nothing to disclose. This research project was approved by institutional review board.

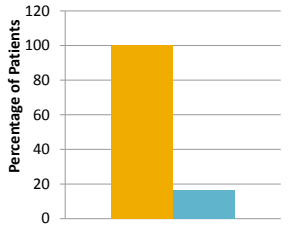
Results

	Direct N=23	Transfer N=153	p-value
Time to 4-factor PCC administration (minutes), (std)	135.7 (59.9)	339.1 (181.1)	<0.0001
In-hospital mortality (%)	7 (30.4)	37 (24.1)	0.496
Hospital length of stay (days), mean (std)	7.3 (5.2)	7.7 (6.7)	0.77
ICU length of stay (days), mean (std)	3.0 (4.2)	2.5 (3.2)	0.44

Graph 1. Change in ICH Size



Graph 2. Compliance with Guideline-Concordant Phytonadione Administration



Conclusion

- Interhospital transfer was associated with a delay in guideline concordant reversal of warfarin-associated intracranial hemorrhage
- This delay in therapy was not associated with increased in-hospital mortality, hospital length of stay or change in interval ICH size.

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