Prospective Medication Order Review in the Emergency Department: An Evaluation of Pharmacist Impact on the Medication-Use Process

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Disclosure Statement

- IRB Status: Approved
- Co-investigators:
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- Conflicts of Interest: None
- Project Sponsorship: None

IRB: Institutional Review Board

Learning Objectives

- Compare time from order entry to medication administration before and after requirement of prospective review among medication orders placed by emergency department physicians
- Identify strengths and weaknesses of the prospective medication order review process for the emergency department

Background

- Prospective medication order review is the verification of a medication order prior to dispensing and administration of the medication
- Previously, prospective order review was not a requirement in the emergency department (ED) of Billings Clinic (BC)
  - 36 beds
  - Pharmacist present in the ED from 1000 to 0100

1. Sin B, et al. *J Pharm Pract.* 2018;31:22-28.
2. Hospital Accreditation Requirements Medication Management Standard: MM.05.01.01. The Joint Commission Web site.
3. ASHP guidelines on emergency medicine pharmacist services. *Am J Health-Syst Pharm.* 2011;68:e81-95.

Background

- Implementation of prospective medication order review in the ED is considered best practice by organizations such as Joint Commission, but few health systems have implemented this process
- Main concern with prospective order review in the ED is the potential for a delay in patient care

1. Sin B, et al. *J Pharm Pract.* 2018;31:22-28.
2. Hospital Accreditation Requirements Medication Management Standard: MM.05.01.01. The Joint Commission Web site.
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Background

- Feasibility of prospective medication order review by pharmacists in the ED has not been extensively studied
- One previous investigation found order verification accounted for a small part of the overall medication-use process timeframe

1. Sin B, et al. *J Pharm Pract.* 2018;31:22-28.
2. Hospital Accreditation Requirements Medication Management Standard: MM.05.01.01. The Joint Commission Web site.
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Purpose

- Determine the impact of pharmacist prospective order review on the medication-use process in the emergency department

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Methods: Study Design

- Prospective, single-center, observational study

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Methods: Eligibility Criteria

Inclusion Criteria	Exclusion Criteria
Medications	**Medications**
Ordered by an ED provider	Administered >5 hours after order verification
Dispensed from: • ED ADC • Inpatient pharmacy via a pneumatic tube	Dispensed from: • ED ADC prior to order verification • Inpatient pharmacy without a trackable delivery date and time
	Orders
	Automatically placed by the computer system
	Order actions other than the initial verification
	Missing any pertinent data points

ADC: automated dispensing cabinet

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Methods: Study Group

- Pre-implementation group (retrospective):
  - Prior to the implementation of prospective order review by pharmacists in the ED
  - August 1 – September 30, 2017
- Post-implementation group (prospective):
  - After the go-live of prospective order review by pharmacists in the ED
  - December 1, 2017 – January 31, 2018

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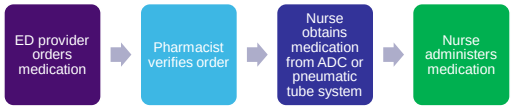
Methods: Primary Outcome

- Overall time from order entry to medication administration among eligible medications



ADC: automated dispensing cabinet

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Methods: Secondary Outcomes

- Time from order entry by a provider to order verification by a pharmacist
- Time from order verification by a pharmacist to medication dispensing from either the ADC or inpatient pharmacy
- Time from medication dispensing from the ADC or inpatient pharmacy to medication administration to the study subject

ADC: automated dispensing cabinet

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Methods: Statistics

- Sample Size
  - 16,000 medication orders
  - 1,500 study subjects
  - 30 pharmacists
  - Convenience sample
- Statistical Tests
  - Descriptive statistics
  - Chi-square test
  - T-test

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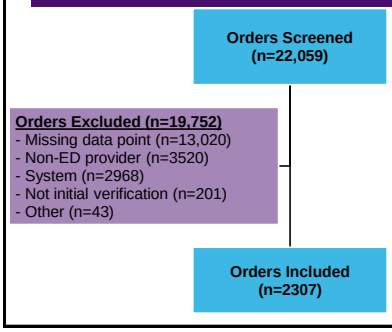
Results: Patient Selection



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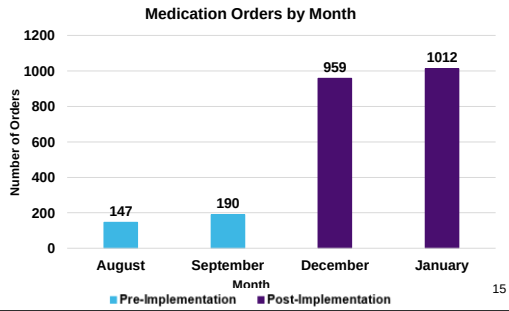
Results: Medication Orders



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Results: Medication Orders

Results, n (%)	Pre (n=337)	Post (n=1971)	P Value
Pharmacist Shift			
Pharmacist in ED	205 (60.8%)	1334 (67.7%)	0.014
No Pharmacist in ED	132 (39.2%)	637 (32.3%)	
Dispense Location			
ED ADC	120 (35.6%)	1763 (89.4%)	<0.001
Main Inpatient Pharmacy	217 (64.4%)	208 (10.6%)	

ADC: automated dispensing cabinet

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Results: Medication Orders

Results, n (%)	Pre (n=337)	Post (n=1971)	P Value
Medication Category			
Anti-infective	42 (12.5%)	197 (10%)	0.169
Other	295 (87.5%)	1774 (90%)	
Medication Urgency			
Non-emergent	216 (64.1%)	740 (37.5%)	<0.001
Emergent	121 (35.9%)	1231 (62.5%)	

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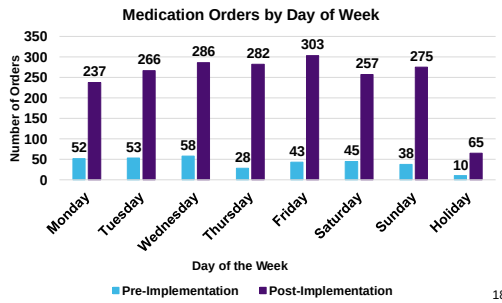
Results: Medication Orders



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Results: Medication-Use Process Time

Result, (minutes) mean ± SD	Pre (n=337)	Post (n=1971)	P Value
Order entry to verification (pharmacist role)	11.7 ± 11.4	8 ± 10.5	<0.001
Verification to dispensing	6.7 ± 16.7	13.5 ± 19.7	<0.001
Dispensing to administration	22.4 ± 34.4	8.8 ± 16.6	<0.001
Order entry to administration (total time)*	**40.7 ± 37**	**30.3 ± 28.1**	<0.001

* Primary Outcome

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Results: Process Time Anti-Infective Agents

Result, (minutes) mean ± SD	Other (n=2069)	Anti-infective (n=239)	P Value
Order entry to verification (pharmacist role)	8.2 ± 10.5	11.5 ± 11.6	<0.001
Verification to dispensing	12.8 ± 19.4	10.3 ± 19.3	0.055
Dispensing to administration	9.7 ± 18.7	20.5 ± 32.1	<0.001
Order entry to administration (total time)	**30.7 ± 28.7**	**42.2 ± 36.2**	<0.001

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Results: Process Time Weekday vs. Weekend/Holiday

Result, (minutes) mean ± SD	Weekday (n=1618)	Weekend /Holiday (n=690)	P Value
Order entry to verification (pharmacist role)	8.7 ± 11.1	8 ± 9.7	0.134
Verification to dispensing	12.9 ± 19.9	11.7 ± 18.1	0.179
Dispensing to administration	11.3 ± 22.7	9.5 ± 15.1	0.054
Order entry to administration (total time)	**33 ± 32**	**29.2 ± 23.7**	0.006

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Results: Process Time Dispensing Location

Result, (minutes) mean ± SD	Main Inpatient Pharmacy (n=425)	ED ADC (n=1883)	P Value
Order entry to verification (pharmacist role)	11.9 ± 11.5	7.8 ± 10.3	<0.001
Verification to dispensing	1.5 ± 9.9	15 ± 20.2	<0.001
Dispensing to administration	31.3 ± 33.1	6.2 ± 12.8	<0.001
Order entry to administration (total time)	**44.7 ± 35.3**	**29 ± 27.6**	<0.001

ADC: automated dispensing cabinet

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Discussion

- Significant decrease in overall process time after implementation of prospective order review
  - Change not clinically significant
  - Overall process time similar to previous investigation
- Uneven characteristics between groups
  - Fewer medications dispensed from the ED in the pre-implementation group
    - May have biased the increased overall time in the pre-implementation group

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Discussion

- Majority of orders verified by an ED pharmacist
  - Expected due to their presence in the ED
- Significantly longer process for anti-infectives vs. other medications following implementation
  - Difference not clinically significant
  - May be due to delay with intervention on these orders
  - Not separated by pre- and post- groupings
- No significant difference in medication-use process time between weekdays and weekends/holidays

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Limitations

- Exclusion criteria eliminated majority of the orders
  - Dispensed before verification
- Unable to track pharmacist interventions

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Conclusion

- Statistically significant overall decrease in the medication-use process time following implementation of pharmacist prospective order review in the emergency department
  - Decreased time from order entry to verification (pharmacist role)
  - Increased time from verification to dispensing (~90% of medications dispensed from ED ADC)
  - Decreased time from dispensing to administration

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Future Directions

- Share results with ED physicians and nursing staff
- Implement further phases of prospective review requirements
- Post-hoc analysis of those orders excluded due to different order of events

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Acknowledgements

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  - Kelsie Ophus, PharmD, BCPS
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  - Melanie Townsend, PharmD, BCPS
  - Kyle Townsend, PharmD, BCPS, MBA
- Statistical Analysis
  - Ya-Huei Li, PhD
- Study Coordinator
  - Melanie Townsend, PharmD, BCPS

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Questions?

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References

1. Sin B, Lau K, Tong R, et al. The feasibility and impact of prospective medication review in the emergency department. *J Pharm Pract.* 2018;31:22-28.
2. Hospital Accreditation Requirements Medication Management Standard: MM.05.01.01. The Joint Commission Web site. Available at: https://e-dition.jcrinc.com/MainContent.aspx. Accessed October 23, 2017.
3. American Society of Health-System Pharmacists. ASHP guidelines on emergency medicine pharmacist services. *Am J Health-Syst Pharm.* 2011;68:e81-95.

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Supplementary Slides

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Emergent vs. Non-Emergent Medication Examples

Emergent	Non-Emergent
Adenosine IV	Metoprolol PO
--	Amoxicillin/clavulanate PO
--	Apixaban PO
Fentanyl IV	Oxycodone PO
Ketamine IV/IM	
Ondansetron IV	Ondansetron PO
Methylprednisolone IV	Prednisone PO

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ED Pharmacist Coverage

- Weekdays
  - Main Inpatient Shift: 0700 – 1000
  - ED/ICU Shift: 1000 – 2030
  - ED Shift: 1430 – 0100
  - Night Shift: 0100 – 0700
- Weekends/Holidays
  - Main Inpatient Shift: 0700 – 1430
  - ED Shift: 1430 – 0100
  - Night Shift: 0100 – 0700

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Post Hoc Analysis

- Includes an additional 7227 medication orders
  - Originally excluded due to dispensing before verification
  - Actions do not follow the ideal sequence
    - Order entry
    - Order verification
    - Medication dispensing
    - Medication administration

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Post Hoc Analysis

Result, (minutes) mean ± SD	Pre (n=3919)	Post (n=3308)	P Value
Order entry to administration (total time)	**37 ± 38.9**	**33 ± 38.4**	**<0.001**

Result, (minutes) mean ± SD	Other (n=7103)	Anti-infective (n=124)	P Value
Order entry to administration (total time)	**35.1 ± 38.8**	**40.4 ± 36.7**	0.125

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