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Original Research

Prospective Medication Order Review in an Emergency Department Serving a Rural Population: Impact on the Medication-Use Process

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Background

Prospective pharmacist review of medication orders mitigates prescribing errors and improves patient safety, yet adoption in emergency departments (EDs) remains limited by staffing and care delay concerns.

Objectives

The objective of this study was to evaluate the impact of prospective medication order review in a Level I trauma center ED serving rural populations across a geographically expansive service area.

Methods

A retrospective chart review of ED admissions compared medication-use process times before and after implementation of prospective pharmacist review for 101 non-urgent medications stocked in ED automated dispensing cabinets (ADCs). The primary outcome was time (minutes) of each step of the medication-use process. Secondary outcomes included ED length of stay (LOS) and ADC override rate. Descriptive statistics were used to summarize the data and group differences were assessed using univariate analyses and multivariate regression.

Results

A total of 2,405 orders were analyzed (pre-intervention n=1,431; post-intervention n=974). Median time from order entry to verification increased (p=0.018) from 3 to 4 minutes pre- to post-intervention; however, variance decreased from 60.2 to 37.4 minutes^2 (p=0.001). Multivariate analysis identified intervention group (p=0.0001) and ED pharmacist presence (p<0.001) as significant factors associated with verification time, with significant interactions between intervention group and pharmacist presence (p=0.0017) and intervention group and order date (p=0.0095). No differences were identified in median time for any other step of the medication-use process with total time from order entry to medication administration of 24 and 25 minutes in the pre- and post-intervention groups, respectively. Override rates declined from 6.98% to 4.55% (p<0.001) from pre- to post-intervention, and ED LOS did not change significantly (p=0.516) with median times of 4.24 and 4.13 hours, respectively.

Conclusion

Requiring prospective pharmacist review for non-urgent medications was successfully implemented with minimal impact on the medication-use process, supporting the feasibility of broader implementation in similar healthcare settings. Our findings further highlight the importance of ED pharmacist presence in supporting efficient medication verification during prospective review implementation.

INTRODUCTION

Globally, medication-related errors are responsible for 5% to 41.3% of all hospital admissions and 22% of readmissions after discharge.[1] Prospective medication order review, in which pharmacists assess medication orders prior to dispensing or administration, is a well-established standard in inpatient practice and serves as a critical intervention point within the medication-use process. Nationally, more than 90% of hospitals have implemented methods for pharmacists to prospectively review medication orders.[2] This approach reduces adverse drug events by facilitating early identification of prescribing errors including incorrect dosing, inappropriate drug selection, and potential drug interactions.[3]

While benefits of prospective order review are well-documented, its implementation in emergency departments (EDs) remains limited. A survey of 562 hospitals found that only 20.2% of hospitals had pharmacists review medication orders before the first dose is administered in the ED.[4] This limited adoption is supported by a 2007 Joint Commission clarification, which permits exceptions to prospective review in emergency situations or when delays in administration could result in patient harm. Nonetheless, the estimated national rate of medication errors in the ED ranges from 3% to 14%, many of which are considered preventable, with an associated annual cost exceeding $3.5 billion.[5-7] Although not mandated, prospective review in the ED is recognized as best practice by the Joint Commission as well as other accrediting bodies including the American Society of Health-System Pharmacists and the National Integrated Accreditation for Healthcare Organizations (Det Norske Veritas). Despite recognition as best practice, broader implementation of prospective order verification in EDs is often hindered by concerns over potential delays in time-sensitive care and constraints related to dedicated ED pharmacy staffing.[8]

Although concerns about potential delays have limited adoption of prospective review in the ED, few studies have directly evaluated its impact on medication-use process times in this setting, leaving the extent of these concerns largely unsubstantiated. Available evidence, though extremely limited, indicates that prospective review can be implemented in the ED without causing significant delays in patient care. A 2017 retrospective study[9] evaluated the feasibility of pharmacist prospective order review in the ED by analyzing 834 medication orders over one year. The median time from order entry to pharmacist verification was 3 minutes, with slightly longer times observed during overnight shifts. Notably, order verification was the shortest step in the medication-use process. Similarly, another single-center retrospective study[10] reported that the median time from order entry to pharmacist verification in the ED of a Level I Trauma Center was 4 minutes. During this period, 94% of medication orders were reviewed by a pharmacist prior to administration. While these studies demonstrate the feasibility of prospective order review, there is a critical need for more comprehensive research across diverse clinical settings, patient populations, and healthcare systems to fully understand the impact of prospective review on workflow efficiency, patient outcomes, and safety. Such evidence is essential to address concerns about potential delays and to facilitate wider implementation of prospective order review in ED and acute care settings.

Rural- and frontier-serving EDs face unique challenges in delivering timely trauma and acute care due to geographic isolation, limited access to higher levels of care, and constrained emergency medical services.[11] Delays in transport and treatment are compounded by workforce shortages, reliance on volunteer emergency medical services (EMS) personnel, and seasonal or geographic barriers that can hinder patient transfer.[12] These factors not only contribute to higher rates of preventable injury-related mortality, but also place added pressure on EDs to optimize care coordination, streamline discharges, and maximize the efficient use of limited staff and resources.[13] In such settings, aligning clinical workflows with timely patient care is essential to balancing safety with feasibility and ensuring equitable outcomes in resource-scarce environments. In this context, evaluating the feasibility of prospective order review in these settings is particularly important to ensure that safety gains can be achieved without adding delays or straining already limited resources.

The objective of this study was to evaluate the impact of pharmacist prospective order review on the ED medication-use process in a Level I Trauma healthcare system that services both a metropolitan area as well as high-commuting and rural service tracts. A secondary objective was to assess the impact of prospective order review on ED length of stay to further investigate impact of implementation. Completing this work is essential to evaluate whether pharmacist prospective order review can be implemented while maintaining timely medication administration in the emergency care setting. This study holds further practicality for rural- and frontier-serving healthcare systems, where unique operational constraints and staffing limitations pose distinct challenges to implementing prospective order review.

METHODS

SETTING

This study was conducted at a 336-bed community teaching hospital and Level I emergency and trauma center in the Rocky Mountain region of the western United States that serves both metropolitan and rural populations without an affiliated academic medical center. The primary surrounding 3-county area is within a metropolitan core of ~170,000 residents but includes 9 (23.6%) high commuting tracts to include 7 rural and 2 small town cores.[14] Total land area for the area is 3,724 square miles with an average population density of 2,272 (standard deviation 1,852, minimum 3.4, maximum 5,789).[14] Accordingly, this facility services a uniquely large geographic coverage area from extremely rural and sparsely populated to a densely populated city core. The facility's ED includes 36 beds averaging 137 ED patient visits per day.

During the study period, dedicated ED pharmacist coverage was provided from 0930 to 0200 on weekdays and 1530 to 0200 on weekends and holidays. During these hours, ED pharmacists reviewed and verified medication orders requiring prospective review. Outside these hours, verification was performed by centralized pharmacy staff. ED medication orders could not be automatically verified.

STUDY DESIGN

This prospective, single-center, observational study included patient visits from December 1, 2023 through February 28, 2025. A retrospective chart review of ED admissions was conducted to collect data for pre- (December 1, 2023 through March 31, 2024) and post-intervention (December 16, 2024 through February 28, 2025) groups. A comparative analysis of outcome measures between these study groups was conducted. The institutional Privacy and Exemption committee approved the study protocol prior to initiation, including a waiver of HIPAA authorization (Protocol #24.012-PR).

INTERVENTION

At the time of study initiation, required prospective order review in the ED was limited to 30 anti-infective agents, accounting for only a small proportion of the approximately 4,000 medication orders placed by ED providers each month. Except for the 30 anti-infective agents, most orders during the pre-intervention were prospectively reviewed by the pharmacy team but dispense overrides were allowed. In December of 2024, an additional 101 non-urgent medications stocked in ED automated dispensing cabinets (ADCs) were selected for required prospective order verification and made non-overridable. Medication selection was informed by a review of the ED ADC inventory, the institutional ADC Override Decision Tree (**Supplemental Figure 1**), and consultation with ED nursing staff. These additional 101 medications, excluding the 30 anti-infective agents already under prospective order review, comprise the medications included in the study (**Supplemental Table 1**). The 30 anti-infectives comprised 9.3% of non-overridable medications in the ADC. Adding the additional 101 (31.2%) study medications for the intervention, brought the total non-overridable ADC medications to 131 (40.7%). While the anti-infectives remained non-overridable, only the new non-overridable study medications (101) were included in this analysis.

INCLUSION AND EXCLUSION CRITERIA

Study groups consist of ED patients who received a qualifying medication order during respective pre- and post-intervention periods. Medication orders were included in this study if they were issued by ED providers and matched selected medications available in the ED ADCs. Orders were excluded if the medication was administered outside of the ED, the medication was administered more than 5 hours after order entry, the medication was documented as administered before dispensing, or the order was discontinued before administration. Subsequent doses for the same order were also excluded.

OUTCOME MEASURES

Primary study outcomes included the total medication-use time (in minutes), defined as the interval from order entry to medication administration, as well as the time between sequential process steps: (1) order entry to pharmacist verification, (2) pharmacist verification to medication dispensing, and (3) medication dispensing to medication administration. Secondary outcomes included the emergency department (ED) automated dispensing cabinet (ADC) override rate (expressed as relative frequency) and ED length of stay (measured in hours).

DATA COLLECTION AND PROCESSING

Patients were identified using inclusion and exclusion criteria and relevant data points were extracted from a report generated by the Cerner™ Clinical Information System (Oracle Corporation; Austin, TX). Collected medication order details included medication name and time of order entry, order verification, medication dispensing, and administration. ADC override rates were obtained from the Medication Order Override Report in Omnicell™ (Omnicell Inc.; Fort Worth, TX). Data for eligible patients were organized in a standardized format using Microsoft™ Excel™ (V2511, Microsoft Corporation; Redmond, WA). After initial data collection, participant information was de-identified using coded identifiers to ensure confidentiality.

STATISTICAL ANALYSIS

Statistical analyses were performed using SAS software (V9.4, SAS Institute, Inc.; Cary, NC). Descriptive statistics were calculated for categorical and continuous variables, and between-group differences were assessed using Kruskal–Wallis tests, χ^2 tests of association, and one-way ANOVA. Medication process times and length of stay were further analyzed using a linear mixed model analysis with repeated measures. A separate model was constructed for each outcome measure. Each model contained fixed effects terms by group (pre- vs. post-intervention), pharmacist presence, order entry day of the week, override status, and the interaction effects of group x pharmacist presence, and group x order entry day of the week. Least square (LS) means (adjusted treatment means and differences of fixed effects) were estimated as part of the mixed regression model, respectively, to interpret the intervention effect. Maximum likelihood estimators allow efficient parameter estimation using only available data under an assumption of missing at random. The level of significance was set at α=0.05 (two-tailed) and the Bonferroni method was implemented to control false positives over the multiple tests.

Table 1. Patient demographics at time of encounter by intervention group (n=2009).

Outcome	Measure[f]	Study Group		Significance
		Pre-Intervention (n=1200)	Post-Intervention (n=809)	P-Value
Age (years)	Median (IQR, Q_1 - Q_3)	49 (34, 1-98)	49 (35, 0-98)	0.857
Patients ≥65 years	Count (%)	352 (29.3%)	230 (28.4%)	0.662
Sex (Female)	Count (%)	661 (55.1%)	446 (55.1%)	0.984
Race[a]				
White or Caucasian	Count (%)	925 (77.7%)	628 (78.1%)	0.187
American Indian or Alaskan Native	Count (%)	212 (17.8%)	132 (16.4%)	
Black or African American	Count (%)	24 (2.02%)	11 (1.37%)	
Other, including multiple races	Count (%)	30 (2.52%)	33 (4.10%)	
Ethnicity[b]				
Hispanic or Latino/a	Count (%)	65 (5.50%)	38 (4.80%)	0.172
ED Length of Stay, (hrs)[c]	Median (IQR, Q_1 - Q_3)	4.24 (3.21, 0.48-94.7)	4.13 (4.03, 0.43-29.8)	0.516
Order Entry Date[d]				
Monday-Friday	Count (%)	843 (70.3%)	546 (67.5%)	0.203
Saturday-Sunday	Count (%)	336 (28.0%)	241 (29.8%)	
Federal Holiday	Count (%)	21 (1.7%)	22 (2.7%)	
ED Pharmacist Present[e]	Count (%)	934 (77.8%)	561 (69.3%)	0.01

a. Other included multiple races, Native Hawaiian or Pacific Islander and Asian. n*=14 declined or did not provide their race.
b. n*=35 declined or did not provide their ethnicity.
c. Length of stay was non-normal (Anderson-Darling tests p<0.05). Skewness/Kurtosis 9.163/154.1 and 2.23/5.39 for each group, respectively.
d. Order entry date included the 11 federally recognized holidays in the United States.
e. Dedicated pharmacist present in the ED.
f. Skewed measures were reported as median, interquartile range (IQR) and range (minimum, maximum). Sample counts and relative frequency (%) were reported for non-continuous demographics.

RESULTS

ENCOUNTER CHARACTERISTICS

The pre-intervention group included 1,070 patients admitted to the ED. Of these patients, 163 were admitted to the ED more than once (two admissions n=118, 3 admissions n=29, 4 or more n=16). Only 179 patients had more than one medication order, which ranged from 2 to 5 orders. The post-intervention group included 735 patients admitted to the ED, 74 of which were admitted to the ED more than once (two admissions n=59, 3 admissions n=11, 4 or more n=4). Only 127 patients had more than one medication order, which ranged from 2 to 7 orders. There was no significant difference in patient demographics by encounter between groups including race, ethnicity, age, and sex (Table 1).

In the pre-intervention group, 1,507 of the 26,718 orders screened met inclusion criteria (**Supplemental Figure 2**). Seventy-six were excluded, resulting in 1,431 included in the statistical analysis. In the post-intervention group, 1,025 of the 20,357 orders screened met inclusion criteria and fifty-one were excluded. A total of 2,405 orders were included in study analysis (pre-intervention n=1,431; post-intervention n=974). Orders analyzed were primarily entered on a weekday (67.5-70.3%), followed by orders placed on the weekends (28-29.8%) and federal holidays (1.7-2.7%). The proportion of orders placed when a dedicated pharmacist was present in the ED declined from 77.8% pre-intervention to 69.3% post-intervention (p=0.01) (Table 1). Median length of stay in the ED in pre- and post-intervention was not significantly different (p=0.516) at 4.24 and 4.13 hours, respectively.

MEDICATION-USE PROCESS

There was no significant difference between the pre- and post-intervention groups in time from order entry to medication administration (24 ± 31 (median ± IQR) minutes vs 25 ± 31 minutes; p=0.220), order verification to medication dispensing (11 ± 22 minutes vs 11 ± 23 minutes; p=0.372), or medication dispensing to administration (4 ± 6 minutes vs 4 ± 7 minutes; p=0.697) (Table 2). Median time from order entry to verification increased (p=0.018) from 3 ± 7 (median ± IQR) minutes to 4 ± 7 minutes from pre- to post-intervention. However, variance for this time in-

Table 2. Medication administration process time intervals by intervention group (n=2405).

Outcome	Measure[f]	Study Group		Significance
		Pre-Intervention (n=1431)	Post-Intervention (n=974)	P-Value
Order Entry to Order Verification (minutes)[a]				
	Mean (SD)	5.99 (7.76)	5.69 (6.12)	0.32
	Median (IQR, Q_1 - Q_3)	3.0 (7.0, 1-8)	4.0 (5.0, 2-7)	0.01
	Variance (SD)	60.2 (7.76)	37.4 (6.12)	<0.01
Order Verification to Medication Dispense (minutes)[b,c]				
	Mean (SD)	21.4 (30.4)	23.7 (34.2)	0.09
	Median (IQR, Q_1 - Q_3)	11.0 (22.0, 4-26)	11.0 (23.0, 4-27)	0.37
	Variance (SD)	922.9 (30.4)	1169.4 (34.2)	0.08
Medication Dispensed to Medication Administration (minutes)[d]				
	Mean (SD)	10.8 (19.1)	10.4 (18.3)	0.63
	Median (IQR, Q_1 - Q_3)	4.0 (6.0, 2-8)	4.0 (7.0, 2-9)	0.69
	Variance (SD)	364.5 (19.1)	335.1 (18.3)	0.61
Total: Order Entry to Medication Administration (minutes)[e]				
	Mean (SD)	37.0 (37.8)	39.7 (41.0)	0.09
	Median (IQR, Q_1 - Q_3)	24.0 (31.0, 14-45)	25.0 (31.0, 15-46)	0.22
	Variance (SD)	1431.9 (37.8)	1681.9 (41.0)	0.17

a. Duration (minutes) from order entry in ED to verification by pharmacist was non-normal (Anderson-Darling tests p<0.05). Skewness/Kurtosis 3.12/2.76 and 14.80/10.62 for each group, respectively.
b. n*=26 orders were dispensed via override at the ADC and thus were not verified.
c. Duration (minutes) from order verification to medication dispense was non-normal (Anderson-Darling tests p<0.05). Skewness/Kurtosis 3.63/2.94 and 19.05/9.79 for each group, respectively.
d. Duration (minutes) from medication dispense to administration was non-normal (Anderson-Darling tests p<0.05). Skewness/Kurtosis 3.27/3.45 and 10.53/11.90 for each group, respectively.
e. Total duration (minutes) from order entry to medication administration was non-normal (Anderson-Darling tests p<0.05). Skewness/Kurtosis 2.81/2.38 and 10.80/6.20 for each group, respectively.
f. Skewed measures were reported as median, interquartile range (IQR) and range (minimum, maximum). Sample counts and relative frequency (%) were reported for non-continuous demographics.

Table 3. Automated dispensing cabinet override rates by intervention group (N=47,076).[a]

Outcome	Study Group		Intervention Change	Significance
	Pre-Intervention (n=26,718)	Post-Intervention (n=20,358)	Post - Pre	P-Value
Override Rate	6.98%	4.55%	- 2.43%	<0.001
Override Dispenses	1,866	927	- 939	<0.001
Non-Override Dispenses	24,852	19,431	- 5,421	

a. All dispenses during the control and intervention period, N = 47,076.

terval decreased significantly (p=0.001) from 60.2 (SD 7.76) to 37.4 (6.12). No significant differences were identified in mean times for any step of the medication-use process between pre- and post-intervention groups (Table 2). Override rates for all medications dispensed from ADCs decreased (p<0.001) from 6.98% to 4.55% from pre- to post-intervention (Table 3).

Time from order entry to verification was the only interval of the medication-use process to demonstrate a statistically significant change in median value following implementation of mandatory prospective order review. To explore this finding, a multivariate regression analysis was conducted to assess the influence of order entry factors including pharmacist presence in the ED, day of the week, override status, and intervention group on verification times (Table 4). Significant main effects were observed for intervention group (F = 14.76, p = 0.0001) and pharmacist presence in the ED (F = 66.52, p < 0.001). A significant interaction between intervention group and ED pharmacist presence (F = 9.84, p = 0.0017) indicated that the effect of the intervention on verification time varied according to pharmacist presence. A significant interaction was also ob-

Table 4. Order Entry to Verification Multivariate Regression Model (n=2405).

(a) Type III Tests of Fixed Effects

Effect	Numerator df	Denominator df	F-value	Bonferroni Adjusted Significance
Intervention Group	1	1946	14.76	**p=0.0001**
ED Pharmacist Present	1	2360	66.52	**p=<0.001**
Order Date	1	2340	3.06	p=0.0806
Dispensed via Override	1	2039	2.3	p=0.1295
Group x ED Pharmacist Present	1	2360	9.84	**p=0.0017**
Group x Order Date	1	2329	6.73	**p=0.0095**

(b) Estimated Least Squares Mean

Treatments	Estimate	95% CI Lower Estimate	95% CI Upper Estimate
Pre-Intervention Group	8.1163	6.7987	9.4339
Post-Intervention Group	6.7069	5.3187	8.0951
Pharmacist Present	5.9719	4.6476	7.2961
Pharmacist Not Present	8.8513	7.4763	10.226
Monday-Friday	7.7083	6.3778	9.0387
Saturday, Sunday or Holiday	7.1149	5.7526	8.4773
Order Dispensed via Override	8.4036	5.8416	10.966
Order Dispensed Not via Override	6.4195	6.0589	6.7802

served between intervention group and order date (F = 6.73, p = 0.0095); however, order date was not independently associated with verification time (p = 0.0806). Override status was also not independently associated with verification time (p = 0.1295).

Given the significant main effect and interaction involving ED pharmacist presence, this factor was considered important for interpreting verification time. After adjustment for the order entry variables included in the model, the estimated verification time was 5.97 minutes (95% CI, 4.64–7.29) when an ED pharmacist was present, compared with 8.85 minutes (95% CI, 7.47–10.22) when an ED pharmacist was not present. These model-estimated least squares means differ from the unadjusted verification times calculated directly from the observed data because they account for the other variables included in the model. Identical multivariate analyses were conducted for total time of the medication-use process as well as ED LOS; results are presented in **Supplemental Tables 2–3.**

Figure 1 summarizes the impact of the significant main effects of intervention group and pharmacist presence on average order verification time. Across all time periods, pharmacist presence was consistently associated with shorter verification times, with the largest differences observed during weekends and holidays. The magnitude of this effect was greater in the pre-intervention period, where pharmacist presence was associated with more substantial reductions in mean times compared to the post-intervention period. The intervention was also associated with decreased variability in verification times, particularly in the absence of pharmacist coverage. Pre-intervention distributions without pharmacist presence demonstrated wide dispersion and frequent high-duration outliers, most notably during weekends and holidays, which were substantially attenuated following implementation. In contrast, verification times with pharmacist presence were consistently less variable across all time periods, with relatively narrow interquartile ranges both before and after the intervention.

DISCUSSION

This study evaluated the feasibility of mandatory prospective pharmacist order review for non-urgent medications in a Level I trauma center ED serving a rural population. Although few studies have examined the operational impact of prospective pharmacist review in the ED, there is concern that such interventions could delay medication administration in such a fast-paced, time-sensitive environment. Our study results indicate that implementation did not meaningfully alter medication-use process times or ED length of stay. These findings support the feasibility of prospective pharmacist review in the ED and underscore the critical role of ED pharmacists in maintaining safe and efficient medication workflows.

Univariate analysis demonstrated no significant difference in overall time to medication administration following implementation of mandatory prospective review of study medications. The primary change in the medication-use process was a 1-minute increase in median order entry-to-verification time, from 3 to 4 minutes. Although statistically significant, the 1-minute increase in verification time was small in absolute terms, and overall verification times

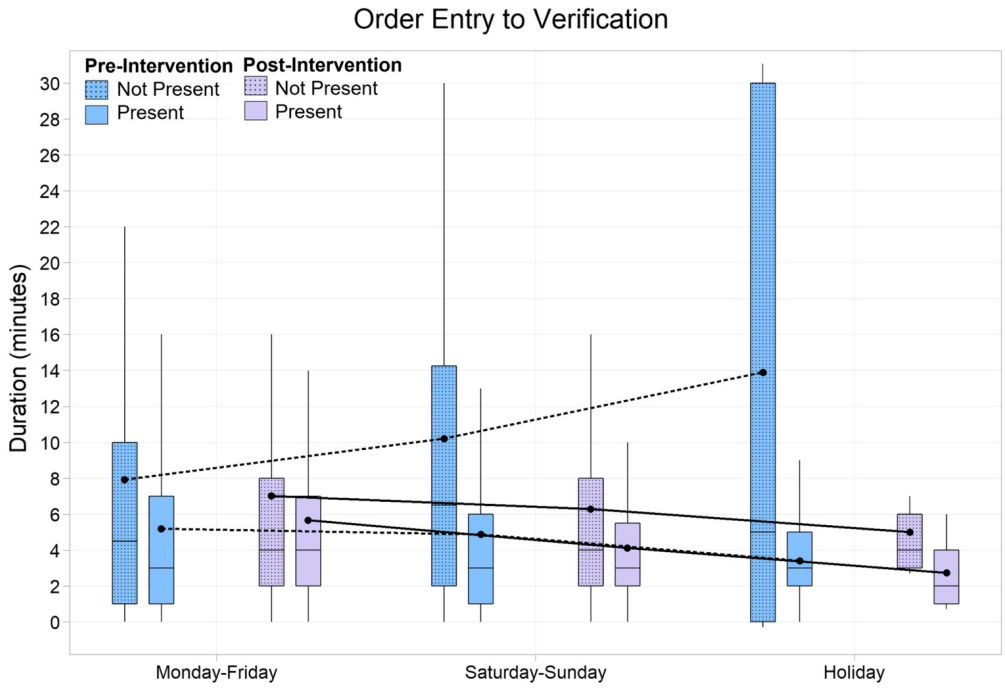


Figure 1. Average Duration of Order Entry to Verification Time (minutes) by Pharmacist Presence and Intervention Group.

remained low in both groups, suggesting limited clinical impact. Importantly, verification times became more consistent following implementation, with reductions of 1.64 minutes in standard deviation and 2 minutes in interquartile range. Thus, implementation of prospective review was associated with a small increase in verification time but a more consistent verification process. These study findings are consistent with the limited existing literature evaluating prospective pharmacist review in the ED.[5,9] Prior work has shown that order entry to verification is typically the shortest step in the medication-use process and that verification to dispensing remains the longest interval in ED medication workflows.[9,10] Reported verification times of 3-4 minutes align closely with those observed in our study and further support the feasibility of timely pharmacist review even in the high-acuity ED setting.

We conducted multivariate modeling to gain additional insight into factors associated with verification time. Verification times were shorter when an ED pharmacist was present, and the significant interaction between intervention group and pharmacist presence indicated that the effect of the intervention differed according to pharmacist coverage. This finding highlights the importance of pharmacist staffing and workflow design when implementing prospective review, as ED pharmacists can prioritize and manage medication orders within the context of the ED workflow more effectively than centralized pharmacists. This analysis also identified that verification time did not differ significantly by order date or by dispensing via override, suggesting that these factors did not independently influence verification time. From an implementation perspective, hospitals aiming to reduce medication verification delays should consider ED pharmacist coverage as a key factor when introducing mandatory prospective review.

The intervention was also associated with a significant reduction in ADC override rate, from 6.98% before implementation to 4.55% after. A reduction in override use was expected because the intervention increased the number of medications for which override dispensing was prohibited. Although the magnitude of the reduction was not an outcome of primary interest, its expected direction provided an internal consistency check for the intervention. Because override status was directly affected by the intervention, it was included in the multivariate model to determine whether this change contributed to differences in verification time between study periods. Model results indicate that override status was not independently associated with verification time, suggesting that changes in override use did not account for differences in verification time between study periods. ED length of stay also did not significantly change following implementation, supporting the feasibility of prospective review without adversely affecting overall ED throughput.

This study was conducted at a Level I trauma center serving both metropolitan and rural populations across a geographically expansive service area. This setting differs from large academic medical centers that primarily serve urban populations, where staffing models, resources, and medication-use workflows may differ substantially. These contextual differences motivated our interest in evaluating the impact of prospective medication order review and contribute to the value of this study within the limited literature on prospective pharmacist review in emergency departments. The rural and frontier populations served by our institution face unique operational challenges, including

long transport distances, weather-related barriers, reliance on volunteer EMS, limited access to higher-level trauma services, fluctuating staffing, variable patient acuity, and limited specialist availability. These operational challenges, combined with well-documented disparities in trauma outcomes and access to high-quality emergency care, highlight the need for safety processes that are both reliable and feasible.[15] Our findings demonstrate that prospective pharmacist medication order review can be achieved in a geographically expansive, rural-serving Level I trauma center, supporting the feasibility of implementing this patient-safety strategy in settings with these operational challenges.

Several limitations should be considered when interpreting these findings. First, this quality assurance study was conducted at a single institution. As pharmacy staffing, resources, and workflows may differ substantially across healthcare settings, particularly in rural critical access hospitals, future research should evaluate prospective medication review in these settings to determine how these differences influence the feasibility and impact of prospective review. Second, retrospective chart extraction introduces the potential for unmeasured confounding, including variation in patient volume, acuity, and staffing. Third, the electronic medical record did not reliably capture pharmacist clarification events. Consequently, the frequency of clarification requests and their specific contribution to verification time could not be quantified. Finally, although the intervention was limited to non-urgent medications, the included medications varied in clinical urgency. Future research should evaluate the operational impact of prospective review across the full range of medication urgency, including more time-sensitive therapies.

CONCLUSION

This study demonstrates that prospective pharmacist order review in a rural-serving ED can be implemented without delaying medication administration or affecting ED throughput. These results provide practical evidence supporting broader adoption of pharmacist-led prospective medication order review to enhance medication safety without compromising timeliness of care in rural and frontier emergency care environments where operational efficiency is critical and staffing variability is common. For hospitals considering adoption of similar models, these findings underscore the value of aligning pharmacist staffing with prospective review implementation to support rapid and reliable medication verification.

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CONFLICTS OF INTEREST

No conflicts of interest are declared.

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ETHICAL APPROVAL

Approved by the Billings Clinic Institutional Review Board, Privacy & Exemption Committee, Project #24.012-PR.

CONSENT TO PARTICIPATE

This study was deemed exempt by the Billings Clinic Privacy and Exemption Committee and was granted a Waiver of HIPAA Authorization to permit use and/or disclosure of protected health information for research purposes.

ABBREVIATIONS

ED: Emergency Department
EMS: Emergency Medical Services
LOS: Length of Stay
ADC: Automated Dispensing Cabinet
HIPAA: Health Insurance Portability and Accountability Act
LS: Least Squares

CREDIT AUTHOR STATEMENT

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SUPPLEMENTARY MATERIALS

Supplementary

Download: https://jacp.scholasticahq.com/article/171017-prospective-medication-order-review-in-an-emergency-department-serving-a-rural-population-impact-on-the-medication-use-process/attachment/367999.docx