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Emergency Department Discharge Prescription Interventions by Emergency Medicine Pharmacists

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Abstract

Study objective—To determine the rate and details of interventions associated with emergency medicine (EM) pharmacist review of discharge prescriptions for patients discharged from the emergency department (ED). Additionally, to evaluate care providers' satisfaction with such services provided by EM pharmacists.

Methods—This was a prospective observational study in the ED of an academic medical center that serves both adult and pediatric patients. Details of EM pharmacist interventions on discharge prescriptions were compiled using a standardized form. Interventions were categorized as error prevention or optimization of therapy. The staff of the ED was surveyed related to the impact and satisfaction of this new EM pharmacist provided service.

Results—The 674 discharge prescriptions reviewed by EM pharmacists during the study period included 602 (89.3%) for adult patients and 72 (10.7%) for pediatric patients. EM pharmacists intervened on 68 prescriptions, resulting in an intervention rate of 10.1% [95% confidence interval (CI), 8.0% to 12.7%]. The intervention rate was 8.5% (95% CI, 6.4% to 11.1%) for adult prescriptions, and was 23.6% for pediatric prescriptions (95% CI, 14.7% to 35.3%) (difference 15.1%, 95% CI 5.1–25.2%). There were a similar number of interventions categorized as error prevention and optimization of medication therapy, 37 (54%) and 31 (46%) respectively. Over 95% of survey respondents felt the new pharmacist services improved patient safety, optimized medication regimens, and improved patient satisfaction.

Conclusions—EM pharmacist review of discharge prescriptions for discharged ED patients has the potential to significantly improve patient care associated with suboptimal prescriptions, and is highly valued by ED care providers.

INTRODUCTION

Background

Every year, nearly 1.5 million preventable adverse drug events (ADEs) occur in the United States, costing hospitals at least \$2 billion and contributing to over 7,000 deaths.^{1,2,3} Previous research has shown that medication-related errors have been implicated in nearly 11% of emergency department (ED).⁴ Furthermore, there is growing national concern focused on providing safe and effective care during patient transitions between various healthcare settings. Poor communication at transitions in care accounts for 56% of all hospital medication errors, with nearly 66% of adverse events following hospital discharge being associated with medication therapy.^{5,6}

Pharmacist involvement in patient care processes has demonstrated improvements in quality of care, along with decreased healthcare costs, in both the inpatient and ambulatory setting.⁷⁻¹⁰ The value of emergency medicine (EM) pharmacist services have been previously documented, however, this is the first study evaluating the impact on ED discharge prescriptions.¹¹

While ED discharge prescriptions are reviewed by the community pharmacist during the prescription filling process, medication errors may be unrecoverable due to a lack of direct access to patient- and case-specific information (e.g., drug indication, laboratory values, microbiological sensitivities, patient weight, complete medication profile). Furthermore, the process for contacting an ED prescriber has enhanced difficulties from the community pharmacy setting as opposed to a pharmacist in the ED known to the provider. As a result, the initiation of therapy may at best be delayed while contacting the ED and clarifying with the prescriber. More often, the community pharmacist may not reach the prescribing physician (e.g. change of shift), leading to decreased patient satisfaction and quality of care. With direct access to the prescriber and patient-specific clinical information through the electronic medical record, EM pharmacists are in a unique position to significantly improve patient care during the transition from the ED to the community.

Dedicated EM pharmacists at a single academic, tertiary care center have provided pharmacy services to patients and staff in the ED since 2003. Quality improvement efforts at the study ED highlighted the need to improve the discharge prescription process for patients. In 2010, a collaborative effort between physicians, nurses, pharmacists, and administrative staff in the ED led to the initiation of a new pharmacist service. Wherein EM pharmacists would review electronic prescriptions generated by the EM physicians to prevent medication errors and optimize medication therapy upon discharge from the ED. To reduce significant delays in patient discharge, EM pharmacist review could be bypassed when an EM pharmacist was performing emergent or other time-sensitive medication-related services.

Importance

To our knowledge, this is the first study documenting the impact of EM pharmacists' review of discharge prescriptions for all discharged ED patients. Given the large number of prescriptions written in this setting, any reduction in error rate could result in improved patient care for a large number of patients.

Goals of This Investigation

The purpose of this study was to determine the rate and types of intervention associated with EM pharmacist review of prescriptions for patients being discharged from the ED. The secondary purpose was to evaluate the perceived usefulness of this EM pharmacist service to ED healthcare providers.

MATERIALS AND METHODS

Study Design

This was a prospective observational study conducted at an academic, tertiary care ED. Standardized forms were developed and utilized to track the rate of intervention associated with EM pharmacist review of prescriptions for patients being discharged from the ED. A satisfaction survey was conducted to determine the perceived value of this service to ED staff. This study received approval from the Institutional Review Board prior to initiation.

Setting

The study was conducted in a 32-bed ED that serves both adult and pediatric patients with an annual census of approximately 45,000 patients. The ED is a level I burn and trauma center for both pediatric and adult patients. It is also the primary teaching site of an Emergency Medicine residency training program. All discharge prescriptions are ordered by physicians using computerized provider order entry (CPOE). Order entry includes decision support for drug-drug and drug-allergy interactions. Pharmacy services within the ED are provided by EM pharmacists from 07:00 to 23:00 on weekdays (one morning shift from 07:00 to 15:30, one evening shift from 14:30 to 23:00) and 13:30 to 22:00 on weekends. Prior to and during the time of the study, the focus of EM pharmacist services included prospective order review for ED medication orders, patient-specific clinical consultations with physicians and nursing staff, participation in trauma and medical resuscitations, medication histories for hospital patient admissions from the ED, and teaching of pharmacy residents and students.

Selection of Participants

All four EM pharmacists participated in the study with none excluded. Education was provided to EM pharmacists on study procedures and documentation, including guidance on how to discriminate between medication error and optimization of therapy. EM pharmacists and prescribers were informed that all data collected would remain anonymous. All EM pharmacists, attending physicians, residents, and nurses were invited to participate in the survey involving the new pharmacy service. Survey responses were anonymous.

Data Collection & Analysis

Data were collected over a continuous 3-week period in 2010, during EM pharmacist staffing hours as previously described. EM pharmacists documented the total number of prescriptions reviewed, included detailed data pertaining to interventions, through the use of a standardized form. An intervention was defined as any change to the prescription after completion by the prescriber. A medication error was defined as any preventable event that

may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer.¹² Optimization of therapy was defined as an intervention that resulted in a change to the prescription that did not meet the criteria for a medication error.

Once the EM pharmacist determined a need for a possible intervention, it was reviewed with the ordering physician. The ordering physician made the final decision to either change the prescription based on EM pharmacist recommendation or continue with original prescription.

For each intervention, the following data were documented: date, time, medication, patient type (adult or pediatric), reason for intervention, categorization as medication error or optimize medication therapy, outcome of the intervention, and amount of EM pharmacist time spent on the intervention (see Figure 1). Data were maintained and analyzed in a secured Microsoft Access (Microsoft Corporation, Seattle, WA) database.

To determine the perceived value of this service, a satisfaction survey was conducted through an online vendor (Survey Monkey®) four months after implementation. Each potential respondent was assigned a randomized number through which results were handled anonymously. The survey was comprised of multiple choice, response-rated, and open-ended questions (Appendix 1).

Outcome Measures

The intervention rate was calculated by dividing the number of EM pharmacist interventions by the total number of discharge prescriptions reviewed. Data analysis consisted of summarizing intervention rate in total, by shift time, and by adult versus pediatric patients. For each intervention rate, a 95% confidence interval (CI) was calculated. Interventions by shift time and age group were compared using a 2-sample test for equality of proportions. Alpha was set at 0.05 for all tests.

After an EM pharmacist intervention was accepted by a physician and documented, a pharmacist (J.L.C.) completed an independent review to classify as error prevention or optimization of therapy. The κ statistic was used to determine level of agreement for classification.

RESULTS

A total of 674 discharge prescriptions were reviewed by EM pharmacists during the study period, with an average of 32 prescriptions reviewed per day. Inclusive of the times the EM pharmacist was not on duty, the total number of discharge prescriptions during the study period was 1263. Thus, 53.4% of all prescriptions were captured in this 3-week study period. Adults received 602 prescriptions (89.3% of total prescriptions) and pediatric patients 72 (10.7%). A total of 68 prescription interventions made by EM pharmacists were accepted by ordering physicians, which resulted in an overall intervention rate of 10.1% (95% CI, 8.0% to 12.7%) (Table 1). The intervention rate was 8.5% (95% CI, 6.4% to 11.1%) for adult prescriptions, and was higher for pediatric prescriptions at 23.6%

(difference 15.1%, 95% CI 5.1–25.2%) during the study period. There was no difference observed between the intervention rate during morning shifts (9.0%; 95% CI, 5.2% to 15.0%) and evening shifts (9.4%; 95% CI, 7.1% to 12.4%; difference 0.4%, 95% CI –3.7%–7.5%).

There were a similar number of interventions made to prevent a medication error and optimize medication therapy, 37 (54%) and 31 (46%) respectively. Examples of medication errors and optimization of therapy are provided in Table 2. The interrater reliability with the classification of “Prevent a Medication Error” versus “Optimize Medication Therapy” was found to be 90% ($\kappa = 0.88$, 0.77–0.99).

Interventions occurred most frequently for central nervous system agents (n=20; 29.4%), anti-infective agents (n=18; 26.5%), gastrointestinal agents (n=13; 19.2%), and autonomic drugs (n=5; 7.4%). A large majority (83.8%) of the interventions completed by EM pharmacists during the study period took less than 5 minutes to perform.

Of 82 potential respondents, 74 (90%) replied to the satisfaction survey. A survey response of “strongly agree” or “agree” was considered a positive response. Overall, ED care providers answered positively that this service improved patient safety (99%), optimized patients’ medication regimens (96%), and improved patient satisfaction (95%). A majority (73%) believed that the service decreased the number of callbacks to the ED from local pharmacies regarding discharge prescriptions. A majority (76%) thought that adding pharmacist review of discharge medications to their other duties did not decrease the level of other pharmacist services provided in the ED. Finally, 96% of respondents agreed or strongly agreed that discharge efficiency was not impaired by adding the pharmacist review to the discharge process. Four months after implementation, 99% of respondents felt that this service should be continued.

LIMITATIONS

Our study was conducted in a single academic tertiary care center which inherently may limit generalizability. The potential limitation of conducting our study in an ED with CPOE is mitigated by the expectation that an increasing number of EDs have, or will soon acquire such technology. It should be noted that the decision support tools built into CPOE will underestimate the benefits of EM pharmacists in settings without this technology. Similarly, the study focus was on intercepted interventions only after the discharge prescription was generated. However, prior discussions between an EM pharmacist and prescriber may underestimate the benefits of EM pharmacist involvement in the discharge prescription process.

Since the interventions captured during this study were limited to hours of EM pharmacist staffing, and this study collected data only over a 3-week period, it is possible that significant differences exist during the overnight hours and other times of the year. It should also be noted that this study only captured the time required of the EM pharmacist to make accepted interventions on discharge prescriptions. The amount of EM pharmacist time associated with review of prescriptions that did not result in an intervention was beyond the scope of this study.

Another limitation is the subjectivity inherent in defining a medication error or optimization of therapy. However, our κ statistic demonstrated very good agreement with regards to these classifications. Additionally, the medication error definition that was provided to pharmacists was based on a subjective assessment of preventability, which may have been inherently different between providers. Furthermore, the study was not designed to capture situations wherein a pharmacist recommended an intervention that was not adopted by the ordering provider (a false positive intervention). Therefore, the results of the study should only be interpreted and applied assuming true positive interventions.

With regards to the clinical significance of the documented EM pharmacist interventions, it should be noted that this was outside of the scope of this study. Therefore, the overall impact of this service remains unknown. The authors believe that this data should be collected and reported in future research related to this service.

Finally, the EM pharmacists were not blinded to the study and may have been biased toward achieving a higher intervention rate during the study.

DISCUSSION

This study demonstrates the improvements that can be realized in the medication use process through the implementation of EM pharmacist review of prescriptions for discharged ED patients. If the results of this study were annualized for the study site, EM pharmacists would review almost 11,700 prescriptions per year and make approximately 1,180 prescription interventions. Given the number of visits made to EDs each year associated with medication-related effects, this intervention could be significantly beneficial to improving patient care.^{3,4}

An intervention rate of 10.1% overall (23.6% for pediatrics) was higher than expected, given many reports of decreased medication errors with electronic prescribing.¹³ As a setting with a very robust electronic medical record (EMR) and computerized decision support (Healthcare Information and Management Systems Society Stage 7 Award), the added usefulness of EM pharmacist review of discharge prescriptions was questioned. Providers are prompted through the EMR whenever a drug-drug and drug-allergy interaction occurs during the prescription writing process. Due to the lack of any drug-allergy interventions documented within our study, the ability of CPOE systems to reduce drug-allergy interactions appears to be effective. On the other hand, physicians have commented that it is difficult for them to gauge the clinical significance of drug-drug interactions, despite a severity rating being provided. This may be due to the deviation of clinical practice from these severity ratings. For example, from the physician perspective, sometimes drug-drug interactions with high severity are easily overridden by the pharmacist, and other times they are not, leaving the physician less confident to know when to incorporate such CPOE prompts into clinical practice.

Moreover, the range of clinically meaningful drug optimization interventions included in the study showed the limitations of current CPOE to fully address all opportunities for suboptimal prescriptions for patients. If a medication is not on an insurance company's

formulary, or if less expensive alternatives are not offered, the patient may not fill the prescription. Medication non-compliance may be no better or worse than under or overdosing (medication error). As such, this study suggests that CPOE does not replace the need for prescription review and intervention on discharge prescriptions from the ED and demonstrates the value provided by EM pharmacists in this area.

There was a significant difference between the number of interventions in adult and pediatric patients, which is in alignment with previous studies.¹⁴ Prescribing errors are much more common, and more dangerous, in children compared to the adult population. This is likely due to the need for weight-based dosing and additional calculations in the majority of medications prescribed for children. Pharmacists are an integral member of the interdisciplinary patient care team, and have demonstrated time and time again their abilities to improve patient safety.^{15,16} These benefits can be translated to the ED through prospective medication order review, involvement in trauma and medical resuscitations, providing patients-specific clinical consultations, and now reviewing discharge prescriptions for patients in the ED. With physicians increasingly being pulled in multiple directions, this prescription review also has the potential for reducing interruptions to workflow.¹⁷

Given the immense and immediate success of the pilot program, the decision was made by administration to move this service into permanent practice as part of the EM pharmacists' scope of responsibilities without a gap in coverage after the pilot. Future opportunities that were realized through performing this service included patient teaching, improving patient compliance and cost efficiencies. These types of EM pharmacist services will be imperative as the ED patient care delivery model continues to evolve.¹⁸

In conclusion, we have shown that EM pharmacists improve suboptimal discharge prescriptions at a surprisingly high rate, despite the support of CPOE. Such a process provides significant value to patients, the health care team, as well as those mindful of costs associated with medication errors.

Acknowledgments

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Appendix 1. Care Provider Satisfaction Survey

1. What is your role in the UW Health emergency department?

- a. Attending physician
- b. Emergency Medicine resident
- c. Registered nurse
- d. Pharmacist

2. Please indicate your level of agreement with the following statements:

Possible Answers (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

Pharmacist prospective review of discharge prescriptions in the emergency department...

- Improves patient safety

- Increases patient satisfaction
 - Optimizes patients' medication regimens
 - Decreases the number of callbacks that the ED receives from local pharmacies and/or patients regarding prescriptions
 - Does NOT decrease the level of other clinical pharmacist services provided in the ED
3. With the pharmacist reviewing of discharge prescriptions, how does this service impact the overall efficiency of the emergency department discharge process?
 - a. Increases efficiency
 - b. No change
 - c. Decreases efficiency
 4. Should pharmacists continue to review patient prescriptions prior to discharge from the emergency department?
 - a. Yes
 - b. No
 5. Please provide any additional comments related to pharmacist review of emergency department discharge prescriptions:

ED Pharmacist Intervention Documentation Form																						
Date: 12/____/10 Time of Intervention: _____																						
Medication Involved: _____																						
☐ Adult ($\geq$ 18 years old) ☐ Peds (< 18 years old)																						
Reason for Intervention (may select more than one)																						
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This intervention was made to (select one):																						
☐ Optimize Medication Therapy ☐ Prevent a Medication Error																						
Intervention Details (select one)																						
☐ Medication order corrected/adjusted (e.g. dose, frequency, quantity, refills, etc.) ☐ Change to Different Therapy ☐ New Medication: _____ ☐ Discontinue Therapy ☐ Initiate New Order ☐ Recommend Monitoring ☐ Other: _____																						
Time Spent on Intervention (minutes)																						
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Please document any additional information that may provide further insight into the above intervention on the reverse side of this form. Thank you.																						

Figure 1.
EM pharmacist intervention documentation form.

Table 1

Interventions by EM pharmacists.

Type of Intervention	No. (%)	Adult (%)	Pediatric (%)
Medication Error Prevention	37 (54%)	29 (57%)	8 (47%)
Medication Optimization	31 (46%)	22 (43%)	9 (53%)
Total	68	51	17

Table 2

Examples of types of interventions by EM pharmacists.

Type of Intervention	Narrative
Medication Error Prevention	Prescribed quetiapine for a patient that was currently on phenytoin, which would significantly decrease quetiapine levels 5-fold; EM pharmacist clarified with prescriber and an alternative agent was selected.
	Pseudoephedrine prescribed with directions to take up to eight 60 mg tablets daily (480mg/day); maximum recommended dose is 240 mg which was clarified by EM pharmacist on the prescription.
	Amlodipine prescribed daily to be initiated for hypertension; EM pharmacist clarified with prescriber as patient was already taking amlodipine.
Medication Optimization	Valacyclovir was prescribed for a patient without prescription coverage, which would cost the patient \$130 for a 7-day course; EM pharmacist discussed with prescriber and changed to acyclovir, decreasing the patient cost to \$22 for a 7-day course which the patient stated to be able to afford.
	Oxcarbazepine tablets prescribed to a patient who was unable to swallow pills; EM pharmacist discussed with prescriber and therapy was changed to oxcarbazepine solution.
	Patient was prescribed pantoprazole, which the EM pharmacist recognized as being non-formulary for patient's insurance; EM pharmacist recommended change to formulary proton pump inhibitor to which the prescriber agreed.