

# Emergency Department Discharge Prescription Interventions by Emergency Medicine Pharmacists

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**Study objective:** We determine the rate and details of interventions associated with emergency medicine pharmacist review of discharge prescriptions for patients discharged from the emergency department (ED). Additionally, we evaluate care providers' satisfaction with such services provided by emergency medicine 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 emergency medicine pharmacist interventions on discharge prescriptions were compiled with a standardized form. Interventions were categorized as error prevention or optimization of therapy. The staff of the ED was surveyed related to the influence and satisfaction of this new emergency medicine pharmacist-provided service.

**Results:** The 674 discharge prescriptions reviewed by emergency medicine pharmacists during the study period included 602 (89.3%) for adult patients and 72 (10.7%) for pediatric patients. Emergency medicine 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 23.6% for pediatric prescriptions (95% CI 14.7% to 35.3%) (difference 15.1%; 95% CI 5.1% to 25.2%). There were a similar number of interventions categorized as error prevention and optimization of medication therapy, 37 (54%) and 31 (46%), respectively. More than 95% of survey respondents believed that the new pharmacist services improved patient safety, optimized medication regimens, and improved patient satisfaction.

**Conclusion:** Emergency medicine 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. [Ann Emerg Med. 2013;61:209-214.]

Please see page 210 for the Editor's Capsule Summary of this article.

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0196-0644/\$-see front matter

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<http://dx.doi.org/10.1016/j.annemergmed.2012.04.011>

## INTRODUCTION

### Background

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

Pharmacist involvement in patient care processes has demonstrated improvements in quality of care, along with decreased health care costs, in both the inpatient and

ambulatory setting.<sup>7-10</sup> The value of emergency medicine pharmacist services has been previously documented; however, to our knowledge this is the first study evaluating the effect on ED discharge prescriptions.<sup>11</sup>

Although ED discharge prescriptions are reviewed by the community pharmacist during the prescription-filling process, medication errors may be unrecoverable because of a lack of direct access to patient- and case-specific information (eg, 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 that for an emergency medicine pharmacist known to the provider. As a result, the initiation of therapy may at best be delayed while the ED is contacted and the prescriber clarifies information. More often, the community pharmacist may not reach the prescribing physician (eg, 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, emergency medicine pharmacists are in a unique position to significantly improve

### Editor's Capsule Summary

#### *What is already known on this topic*

Emergency department (ED) pharmacists are believed to be useful in improving drug treatment for patients in the ED.

#### *What question this study addressed*

This article examines the effect of ED pharmacist review of 674 prescriptions written for patients discharged from the ED.

#### *What this study adds to our knowledge*

Pharmacist interventions were accepted by the treating physician for 10% of prescriptions reviewed (8% adult and 24% pediatric), despite the presence of computerized provider order entry and decision support. Interventions were roughly equally divided between preventing errors and optimizing therapy.

#### *How this is relevant to clinical practice*

Review of patient prescriptions by ED pharmacists before discharge can improve outpatient drug therapy.

patient care during the transition from the ED to the community.

Dedicated emergency medicine 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 emergency medicine pharmacists would review electronic prescriptions generated by the emergency physicians to prevent medication errors and optimize medication therapy on patient discharge from the ED. To reduce significant delays in patient discharge, emergency medicine pharmacist review could be bypassed when an emergency medicine pharmacist was performing time-sensitive medication-related services.

### Importance

To our knowledge, this is the first study investigating the effect of emergency medicine 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 emergency medicine

pharmacist review of prescriptions for patients being discharged from the ED. The secondary purpose was to evaluate the perceived usefulness of this emergency medicine pharmacist service to ED health care providers.

## MATERIALS AND METHODS

### Study Design

This was a prospective observational study conducted at an academic tertiary care ED. Standardized forms were developed and used to track the rate of intervention associated with emergency medicine 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 before 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. Order entry includes decision support for drug-drug and drug-allergy interactions. Pharmacy services within the ED are provided by emergency medicine pharmacists from 7 AM to 11 PM on weekdays (1 morning shift from 7 AM to 3:30 PM and 1 evening shift from 2:30 PM to 11 PM) and 1:30 PM to 10 PM on weekends. Before and during the study, the focus of emergency medicine 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 4 emergency medicine pharmacists participated in the study, with none excluded. Education was provided to emergency medicine pharmacists on study procedures and documentation, including guidance on how to discriminate between medication error and optimization of therapy. Emergency medicine pharmacists and prescribers were informed that all data collected would remain anonymous. All emergency medicine pharmacists, attending physicians, residents, and nurses were invited to participate in the survey involving the new pharmacy service. Survey responses were anonymous.

### Data Collection and Processing

Data were collected during a continuous 3-week period in 2010 during emergency medicine pharmacist staffing hours, as previously described. Emergency medicine pharmacists documented the total number of prescriptions reviewed,

including 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.<sup>12</sup> 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 emergency medicine pharmacist determined a need for a possible intervention, it was reviewed with the ordering physician, who made the final decision to either change the prescription according to emergency medicine 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 emergency medicine pharmacist time spent on the intervention (Figure). Data were maintained and analyzed in a secured Microsoft Access (Microsoft, Seattle, WA) database.

To determine the perceived value of this service, a satisfaction survey was conducted through an online vendor (Survey Monkey) 4 months after implementation. Each potential respondent was assigned a randomized number through which results were handled anonymously. The survey was composed of multiple-choice, response-rated, and open-ended questions (Appendix E1, available online at <http://www.annemergmed.com>).

**Outcome Measures**

The intervention rate was calculated by dividing the number of emergency medicine 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 with a 2-sample test for equality of proportions.  $\alpha$  Was set at .05 for all tests.

After an emergency medicine 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  $\kappa$  statistic was used to determine level of agreement for classification.

**RESULTS**

A total of 674 discharge prescriptions were reviewed by emergency medicine pharmacists during the study period, with an average of 32 prescriptions reviewed per day. Inclusive of the times the emergency medicine pharmacist was not on duty, the total number of discharge prescriptions during the study period was 1,263. Thus, 53.4% of all prescriptions were captured in

**EM Pharmacist Intervention Documentation Form**

Date: 12/\_\_\_/10                      Time of Intervention: \_\_\_\_\_

Medication Involved: \_\_\_\_\_

<input type="checkbox"/> Adult ( $\geq$ 18 years old)	<input type="checkbox"/> Peds (< 18 years old)
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Reason for Intervention (may select more than one)

<input type="checkbox"/> Wrong Patient	<input type="checkbox"/> Underdose
<input type="checkbox"/> Drug	<input type="checkbox"/> Overdose
<input type="checkbox"/> Drug Omission	<input type="checkbox"/> Frequency
<input type="checkbox"/> Drug/Class Duplication	<input type="checkbox"/> Duration
<input type="checkbox"/> Contraindication	<input type="checkbox"/> Monitoring/Lab Results
<input type="checkbox"/> Allergy	<input type="checkbox"/> Quantity
<input type="checkbox"/> Drug-Drug Interaction	<input type="checkbox"/> Refills
<input type="checkbox"/> Dosage Form	<input type="checkbox"/> Non-Formulary
<input type="checkbox"/> Strength	<input type="checkbox"/> Reduce Cost to Patient
<input type="checkbox"/> Route	<input type="checkbox"/> Other _____

This intervention was made to (select one):

<input type="checkbox"/> Optimize Medication Therapy	<input type="checkbox"/> Prevent a Medication Error
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Intervention Details (select one)

<input type="checkbox"/> Medication order corrected/adjusted (e.g. dose, frequency, quantity, refills, etc.)
<input type="checkbox"/> Change to Different Therapy <input type="checkbox"/> New Medication: _____
<input type="checkbox"/> Discontinue Therapy
<input type="checkbox"/> Initiate New Order
<input type="checkbox"/> Recommend Monitoring
<input type="checkbox"/> Other: _____

Time Spent on Intervention (minutes)

<input type="checkbox"/> 0-2	<input type="checkbox"/> 5-10	<input type="checkbox"/> >20
<input type="checkbox"/> 2-5	<input type="checkbox"/> 10-20	

Please document any additional information that may provide further insight into the above intervention on the reverse side of this form. Thank you.

**Figure.** Emergency medicine pharmacist intervention documentation form.

**Table 1.** Interventions by emergency medicine pharmacists.

Type of Intervention	No. (%)	Adult (%)	Pediatric (%)
Medication error prevention	37 (54)	29 (57)	8 (47)
Medication optimization	31 (46)	22 (43)	9 (53)
<b>Total</b>	<b>68</b>	<b>51</b>	<b>17</b>

this 3-week study period. Adults received 602 prescriptions (89.3% of total prescriptions); pediatric patients, 72 (10.7%). A total of 68 prescription interventions made by emergency medicine 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% to 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% to 7.5%).

**Table 2.** Examples of types of interventions by emergency medicine 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; emergency medicine 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 emergency medicine pharmacist on the prescription. Amlodipine prescribed daily to be initiated for hypertension; emergency medicine 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; emergency medicine 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; emergency medicine pharmacist discussed with prescriber and therapy was changed to oxcarbazepine solution. Patient was prescribed pantoprazole, which the emergency medicine pharmacist recognized as being non-formulary for patient's insurance; emergency medicine pharmacist recommended change to formulary proton pump inhibitor to which the prescriber agreed.

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% ( $\kappa=0.88$ ).

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 majority (83.8%) of the interventions completed by emergency medicine pharmacists during the study period took fewer 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 about 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 believed 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 computerized provider order entry is mitigated by the expectation that an increasing number of EDs have or will soon acquire such technology. The decision support tools built into computerized provider order entry will

underestimate the benefits of emergency medicine pharmacists in settings without this technology. Similarly, the study focus was on intercepted interventions only after the discharge prescription was generated. However, previous discussions between an emergency medicine pharmacist and prescriber may underestimate the benefits of emergency medicine pharmacist involvement in the discharge prescription process.

Because the interventions captured during this study were limited to hours of emergency medicine pharmacist staffing and this study collected data only during a 3-week period, it is possible that significant differences exist during the overnight hours and other times of the year. This study captured only the time required of the emergency medicine pharmacist to make accepted interventions on discharge prescriptions. The amount of emergency medicine 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  $\kappa$  statistic demonstrated very good agreement with regard 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 be interpreted and applied only assuming true-positive interventions.

The clinical significance of the documented emergency medicine pharmacist interventions was outside of the scope of this study. Therefore, the overall effect of this service remains unknown. We believe that these data should be collected and reported in future research related to this service.

Finally, the emergency medicine 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 emergency medicine pharmacist review of prescriptions for discharged ED patients. If the results of this study were annualized for the study site, emergency medicine 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.<sup>3,4</sup>

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.<sup>13</sup> As a setting with a very robust electronic medical record and computerized decision support (Healthcare Information and Management Systems Society Stage 7 Award), the added usefulness of emergency medicine pharmacist review of discharge prescriptions was questioned. Providers are prompted through the electronic medical record whenever a drug-drug and drug-allergy interaction occurs during the prescription writing process. Because of the lack of any drug-allergy interventions documented within our study, the ability of computerized provider order entry 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 the presence of a severity rating. 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 about knowing when to incorporate such computerized provider order entry prompts into clinical practice.

Moreover, the range of clinically meaningful drug optimization interventions included in the study showed the limitations of current computerized provider order entry 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 noncompliance may be no better or worse than under- or overdosing (medication error). As such, this study suggests that computerized provider order entry does not replace the need for prescription review and intervention on discharge prescriptions from the ED and demonstrates the value provided by emergency medicine pharmacists in this area.

There was a significant difference between the number of interventions in adult and pediatric patients, which is in agreement with previous studies.<sup>14</sup> Prescribing errors are much more common, and more dangerous, in children compared with adults, likely because of 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 repeatedly demonstrated their abilities to improve patient safety.<sup>15,16</sup> These benefits can be translated to the ED through prospective medication order review, involvement in trauma and medical resuscitations, providing patient-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.<sup>17</sup>

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 emergency medicine 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-effectiveness. These types of emergency medicine pharmacist services will be imperative as the ED patient care delivery model continues to evolve.<sup>18</sup>

In conclusion, we have shown that emergency medicine pharmacists improve suboptimal discharge prescriptions at a surprisingly high rate, despite the support of computerized provider order entry. Such a process provides significant value to patients, the health care team, and those mindful of costs associated with medication errors.

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*Author contributions:* JLC, ALS, and AGH were responsible for study conception and trial design. JLC was responsible for data collection and primary data analysis. All authors were responsible for article development. ALS takes responsibility for the paper as a whole.

*Funding and support:* By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see [www.icmje.org](http://www.icmje.org)). The authors have stated that no such relationships exist. This project was supported in part by the University of Wisconsin Institute for Clinical and Translational Research, funded through a National Institutes of Health Clinical and Translational Science Award, grant 1 UL1 RR025011.

*Publication dates:* Received for publication December 8, 2011. Revisions received March 10, 2012, and March 27, 2012. Accepted for publication April 10, 2012. Available online May 24, 2012.

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**APPENDIX E1.**

Care provider satisfaction survey.

1. What is your role in the UW Health ED?
  - 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 ED
    - improves patient safety
    - increases patient satisfaction
    - optimizes patients' medication regimens
  - decreases the number of callbacks that the ED receives from local pharmacies or patients about 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 affect the overall efficiency of the ED discharge process?
  - a. increases efficiency
  - b. no change
  - c. decreases efficiency
4. Should pharmacists continue to review patient prescriptions before discharge from the ED?
  - a. Yes
  - b. No
5. Please provide any additional comments related to pharmacist review of ED discharge prescriptions: