Impact of a Pharmacy-Led Medication Reconciliation Program

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ABSTRACT

Objective: To determine the impact of a pharmacy-led medication reconciliation program at a large community hospital. The magnitude of the benefit of pharmacy-led medication reconciliation was evaluated based on the number of medication-related discrepancies between nursing triage notes and medication histories performed by pharmacy technicians or students. Discrepancies identified by pharmacy personnel medication histories that required pharmacist intervention on physician admission orders were further classified based on expected clinical impact if the error were to be propagated throughout hospitalization.

Methods: A retrospective chart review was performed on 200 patients who met the following inclusion criteria: adults admitted from the emergency department from October 1, 2015, to November 17, 2015, with a medication history collected by medication reconciliation personnel (MRP) containing at least three home medications or one high-risk home medication that was reviewed and reconciled by one of the investigators. The primary endpoint was the number of discrepancies between nursing triage notes and pharmacy personnel medication histories. The secondary endpoint was the percentage of pharmacy interventions categorized as “significant,” “serious,” or “life threatening” on a medication error severity scale. Additional data points included: number and type of clinical interventions; percent of interventions involving high-risk medications; amount of time spent obtaining medication histories and comparing them to admission orders; number and type of sources used; number of home medications; and percent of admitted patients interviewed by the MRP within 24 hours of admission.

Results: In a population of 200 patients, 1,762 medication history discrepancies were identified. MRP-collected histories identified issues involving 46 patients that required pharmacist intervention for a total of 235 interventions, of which 68% were related to errors categorized as significant, serious, or life threatening.

Conclusion: Utilization of a pharmacy-led medication reconciliation program decreased the number of significant, serious, and life-threatening medication reconciliation errors upon hospital admission.

Keywords: medication reconciliation, pharmacy medication history, medication safety

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INTRODUCTION

Obtaining accurate medication histories and performing medication reconciliation are keys to three main transitions of care in the hospital setting: hospital admission, transitions between hospital units, and hospital discharge.1 Medication reconciliation at hospital admission, the first step in the process, can affect hospital admission orders and medication reconciliation at future transitions of care. Admission medication reconciliation is the process of comparing a patient’s inpatient medication orders with the medications in use prior to admission and intervening to ensure that the correct medications are ordered.7 Medication errors can occur as a result of inaccurate medication histories and reconciliation. More than 25% of errors can be attributed to incorrect medication histories, demonstrating that this is an error-prone process.2 Gleason and colleagues found that more than 33% of patients had at least one medication discrepancy at admission, and 85% of these originated from the medication history.3 Obtaining an accurate medication history during transitions of care has been shown to reduce errors that could lead to patient harm and is the foundation of the medication reconciliation process.1,3 In addition, Cooper and colleagues found that a program led by pharmacy technicians ensured that a standardized medication history was obtained to enhance reconciliation efforts.4 Pharmacy personnel can play a key role in medication safety and prevention of discrepancies upon hospital admission. Al-Hashar and colleagues found a lack of clarity among professions regarding responsibility for medication reconciliation; however, several studies have demonstrated the benefit of utilizing pharmacy personnel for the medication reconciliation process.5 Buckley and colleagues discovered that greater than 97% of medication histories documented by health care providers other than pharmacists were associated with at least one medication discrepancy.2 Multiple studies have shown that in terms of obtaining accurate medication histories, pharmacy technicians provide results similar to pharmacists.6,7 Johnston and colleagues observed the mean number of discrepancies per patient did not differ significantly between pharmacists and technicians.6 Hart and colleagues found that pharmacy technicians’ medication histories were accurate without any identifiable errors 88% of the time compared with 57% of medication histories collected by nurses.8 At one teaching facility, pharmacy technicians performing medication histories identified 1,748 discrepancies from 1,797 encounters.9 Another recent study that focused on a pharmacy-technician–centered medication reconciliation program found more than half of patients had a least one discrepancy.10 Use of a pharmacy technician may provide the benefits of pharmacist-based medication history

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collection while being financially advantageous. Cooper and colleagues discussed the advantages of a standardized pharmacy technician medication history program that helped improve provider compliance with discharge medication reconciliation.5

Despite evidence of the value of pharmacy personnel in identifying discrepancies that may lead to medication errors, there is a lack of published literature classifying the severity of subsequently avoided errors. However, there have been studies looking at the severity of errors with pharmacist-collected medication histories. Cornish and colleagues found that when pharmacists collected medication histories, half of patients had one or more medication discrepancies upon hospital admission and one-third of errors had the potential to cause moderate to severe harm.12 A study in Colombia found that when pharmacists collected medication histories, 42.7% of discrepancies could cause moderate discomfort or clinical deterioration and 23.9% could potentially result in severe discomfort or clinical deterioration.13 There is limited literature looking at the clinical impact of histories collected by pharmacy technicians and further classification of errors during medication reconciliation within a community hospital.

The primary objective of the present study was to assess the clinical impact of a pharmacy-led medication reconciliation program at hospital admission. The secondary objective was to evaluate the severity of errors prevented by pharmacist intervention. In addition, we evaluated resources required to support the medication history and reconciliation process at our institution.

**METHODS**

**Setting and Population**

This study was conducted at Sarasota Memorial Hospital, an 819-bed community hospital in Sarasota, Florida, with 100,000 annual emergency department (ED) visits and an average ED admission rate of 25%. Sarasota Memorial Hospital has a robust medication reconciliation program that includes pharmacy-obtained medication histories. This retrospective study, approved by the Institutional Review Board, examined ED medication histories performed between October 1, 2015, and November 17, 2015.

**Inclusion and Exclusion Criteria**

During this period, 2,791 patients were admitted from the ED. Of these patients, 704 had a medication history performed by medication reconciliation personnel (MRP) according to the institution’s standard of practice. Two hundred patients met the inclusion criteria. Patients with a pharmacy-led medication history were included for review if the medication list prior to admission contained at least three outpatient prescription medications or one high-risk medication that was verified and compared with admission orders by one of the study investigators. The list of high-risk medications was adapted from the Institute for Safe Medication Practices outpatient high-risk medications list.13 The list of high-risk medications included antiarrhythmics, anticoagulants, antiretrovirals, chemotherapy, insulin, opioids, immunosuppressants, carbamazepine, and methotrexate. Patients who were unable to communicate verbally, were intubated, or had an unknown identity for the first 24 hours of admission were excluded due to the inability to obtain a medication history in the ED.

**Hospital Medication Reconciliation Procedures**

Medication histories were obtained by a certified pharmacy technician, pharmacy student, or pharmacy intern, collectively referred to as MRP. This program currently has two full-time pharmacy medication reconciliation technicians (Monday through Friday coverage) and 12 part-time medication reconciliation interns (weekend coverage). One MRP shift covers 8:30 A.M. to noon in the ED and then transitions onto the floor units from 12:30 P.M. to 5 P.M. The second MRP works from noon to 9 P.M. in the ED. There is pharmacist coverage in the ED 24 hours a day, seven days a week.

Advanced pharmacy practice experience (APPE) students are also utilized to provide support for the medication reconciliation program. Training on the medication reconciliation process occurs during student orientation. Students are expected to complete at least one medication history per week during the advanced hospital rotation and at least one medication history per day during internal medicine and elective rotations, depending upon the needs of assigned units.

The program coordinator provides didactic training (two hours in duration) to all pharmacy personnel involved in obtaining medication histories. Medication reconciliation technicians provide hands-on training to hired medication reconciliation interns and students through five eight-hour shifts. The medication reconciliation students and interns first shadow the medication reconciliation technician and then spend time obtaining medication histories under the observation of the medication reconciliation technician. The final step involves medication reconciliation technicians training interns and APPE students by coaching and observing while the student obtains medication histories during a four-hour training period.

Although the MRP do not use a standardized question form, they have been trained extensively to ask patients or family members about their medications, specifically to collect medication name, frequency, strength, route, directions, and when the last dose was taken. The MRP are also responsible for collecting information on the patient’s drug allergies and reaction to those agents. For anticoagulants, the MRP are expected to document the indication and, in the case of patients on warfarin, the last known international normalized ratio if it can be obtained. Antibiotics are documented with indication and duration.

The current practice of the institution is detailed below and outlined in Figure 1.

As patients arrive in the ED, triage nurses obtain an initial medication history and document it in the “ED Triage Note.” Triage nurses have had extensive education from nursing management on obtaining medication histories and entering them into the home medication section of the electronic chart and the “ED Triage Note.” The medication, frequency, strength, route, directions, and when the last dose was taken should be documented. If the patient is to be admitted to an inpatient or observation unit, an automatic consult for medication history is created for pharmacy personnel. The MRP find the medication history consults in their queues. The MRP may receive communications from pharmacists asking for specific patient medication reconciliations to be completed to help with prioritization of the consult list. The MRP may use several sources to obtain a comprehensive medication history.
The following data were collected into a standardized electronic data collection form: baseline characteristics, number and type of errors on triage and MRP history, time spent by MRP obtaining history, amount of time for the pharmacist to verify the history, and amount of time pharmacist spent on interventions. The medication history discrepancies were then classified into the following types: drug omission (exclusion of a drug that the patient was taking), commission (inclusion of a drug that the patient was not currently taking), wrong drug (incorrect drug or formulation), dose (missing or incorrect), frequency (missing or incorrect), and other (e.g., missing PRN [“as needed”] indication).

Data were also collected on the severity of errors prevented by pharmacist intervention. Two emergency medicine pharmacists and a PGY-1 pharmacy resident categorized the errors. After each pharmacist categorized the errors, they discussed them as a group to reach a consensus.

Study Tools

Medication discrepancies identified during pharmacist intervention were classified using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) criteria.\textsuperscript{14} The medication discrepancies were further categorized using a clinical severity scoring tool previously described by Buckley and colleagues (Table 1).\textsuperscript{2} Data were analyzed by descriptive statistics using Excel 2010 (Microsoft, Redmond, Washington). Median and interquartile range (IQR) were used if data were skewed.

<table>
<thead>
<tr>
<th>Classification</th>
<th>n (%)</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Life threatening</td>
<td>4 (1.7)</td>
<td>Error having the potential to cause death or likely lead to death without the use of life-sustaining interventions</td>
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<tr>
<td>Serious</td>
<td>67 (28.5)</td>
<td>Error that has potential to cause harm and 1) may require additional intervention, or 2) could result in prolonged length of stay</td>
</tr>
<tr>
<td>Significant</td>
<td>89 (37.9)</td>
<td>Error that has potential to cause harm; may need increased monitoring</td>
</tr>
<tr>
<td>Clinically insignificant</td>
<td>75 (31.9)</td>
<td>Error that would not likely cause harm</td>
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Outcome Parameters

The primary outcome was the number of medication-related discrepancies between nursing triage notes and medication histories performed by pharmacy personnel. The secondary outcome was the percentage of interventions classified as significant, serious, or life threatening using the clinical severity scoring tool. Three pharmacists classified interventions as clinically insignificant, significant, serious, or life threatening by consensus. Resources required to support the medication history and reconciliation process at this institution were also evaluated.

RESULTS

From October 1, 2015, to November 17, 2015, 2,791 patients were admitted through the ED, with 704 medication histories obtained by pharmacy staff (25.2%). Of the 704 medication histories, 504 were excluded because they had been verified by a pharmacist who was not an investigator or they contained an inadequate number of medications in use prior to admission. The full study enrollment is outlined in Figure 2. The mean age of the study population was 71 ± 17 years. The median number of medications per patient was nine (IQR, 7–13). Baseline demographics are depicted in Table 2. Of the 200 medication histories obtained, 98.5% (n = 197) contained at least one medication discrepancy. A total of 1,762 discrepancies were found, with a median of eight (IQR, 5–12) per patient. The most common discrepancy was omission (43%), followed by dose (19%) and frequency (19%). The breakdown by type of discrepancy is detailed in Figure 3. Less than 1% (n = 6) of discrepancies were found by the pharmacist on the MRP medication history. Of the total discrepancies, 162 (9.2%) were found to involve high-risk medications. While obtaining medication histories, several sources were used, with most histories requiring two or more sources. Patient interviews and outpatient pharmacies were the most commonly used sources (Figure 4). Sources used less frequently included the patient’s family or friend, outside facilities, medication lists or bottles, prescriber offices, the Florida PDMP, prior admissions, and the anticoagulation clinic associated with the health care system. Admission orders were placed prior to the completion of the pharmacy medication history note for 106 patients (53%). Of those 106 cases, 46 patients required at least one pharmacist intervention.

Pharmacists made a total of 235 interventions, with 180 (77%) in category B and 55 (23%) in category C using the NCC MERP classification scale. Under this scale, a category B error “occurred but the error did not reach the patient (an ‘error of omission’ does reach the patient),” while a category C error “reached the patient but did not cause patient harm.”14 Thirty-two interventions (13.6%) involved high-risk medications. One hundred sixty errors (68%) were found to be significant, serious, or life threatening. Specifically, four interventions (1.7%) were made for life-threatening errors. Of the total interventions, 41 involved over-the-counter medications, and all were classified as clinically insignificant.

The median time for obtaining a medication history by the MRP was 35 minutes. The median times for pharmacist verification and intervention were 10 minutes and five minutes, respectively, per patient. Of the 46 patients who required pharmacist intervention, the median time for the entire process was 60 minutes.

DISCUSSION

Many discrepancies were found on the ED triage note, and pharmacy personnel prevented medication errors from occurring through comprehensive medication history documentation and active intervention. Based on the high rate of discrepancies found (98.5% of medication histories contained at least one discrepancy), this study further supports the role of pharmacy technicians and interns for obtaining medication histories. The results indicated omission as the most common type of discrepancy, which supports previous literature.15,16 The identification of these omissions by pharmacy technicians and interns created opportunities for clinically significant interventions.
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Omission of a patient’s home medication can lead to two concerning situations. First, a patient is failing to receive therapy that was deemed necessary by a health care expert. Second, a medication in use prior to admission may contribute to the patient’s cause for hospitalization. Providers may be unable to treat the underlying cause if they are unaware of the home medication. For example, one of the potential life-threatening medication errors identified in our study was a patient presenting with a gastrointestinal bleed in which the patient’s home use of rivaroxaban (Xarelto, Janssen) was omitted from the ED triage note. The accuracy of the medication history is crucial in providing optimal care throughout the patient’s hospital stay and through final disposition.

For this study, nearly 25% of patients required at least one clinical intervention as a result of a discrepancy on the ED triage medication history. This finding is similar to previously published results.\textsuperscript{2} MRP collection of medication histories was instrumental in prevention of clinically significant errors, with 68% of errors being labeled significant, serious, or life threatening. Although this and previous studies have shown a high rate of discrepancies on medication histories, this is among the first to determine the potential clinical impact of such discrepancies found by MRP.\textsuperscript{2,8,11,12} The high rate of significant errors found in this study highlights errors that may go unnoticed in health care facilities that do not have structured medication history processes in place. This supports the use of a comprehensive pharmacy medication history reconciliation program to prevent clinically significant errors.

This research also analyzed the time needed to complete each part of the process and found the complete process of obtaining a medication history and comparing it with the admission orders to be time intensive. More resources were needed to reach patients with admission orders entered prior to the medication history. Ideally, the pharmacy medication history should be completed prior to admission orders being entered to improve workflow. The results show the use of pharmacy personnel for obtaining medication histories provided more accuracy and thus enabled pharmacists to intervene to prevent potentially harmful errors.

This study had several limitations. It was a single-center, retrospective review lacking external generalizability. Due to the large number of elderly patients seen at this hospital, it might be expected that this population would be using a higher number of medications. Furthermore, the MRP obtaining the medication history and making interventions were unblinded to the study, which may have introduced bias through a Hawthorne effect. In addition, a potential selection bias may exist based on inclusion criteria. The study included patients who were on three or more prescription medications or one high-risk medication. Although these criteria were based on those used in previous literature, this study population represents patients more susceptible to medication errors who warrant intensive investigation of medication histories. There was also a potential review bias by investigators in determining medication history discrepancies. Finally, the severity scale tool has not been validated. Rather, it was adapted from previous literature.

CONCLUSION

Many medication discrepancies were identified by pharmacists between the ED nurse triage notes and MRP medication histories at our institution. The most common discrepancy was omission, which can be difficult to identify. Although requiring additional resources in terms of staff and time, pharmacy involvement in the medication reconciliation process was instrumental in decreasing potential errors of clinical significance.
Pharmacy-Led Medication Reconciliation

The results of this study support the use of a pharmacy-led medication reconciliation program for improved continuity of care for the patient.

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REFERENCES