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IMPLEMENTATION OF A PHARMACY STUDENT-LED MEDICATION HISTORY PROGRAM IN A LARGE, TERTIARY PEDIATRIC EMERGENCY CENTER

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ABSTRACT

Purpose

The implementation of a pharmacy student-led medication history program in the Emergency Center to identify and prevent medication-related errors.

Methods

This was a twelve-week pilot study from October 2016 to January 2017 that evaluated the implementation of a medication history program within a large, tertiary pediatric Emergency Center. Pharmacy students were trained and process-validated by a pharmacist to complete medication histories for patients with admission status. The students compared the current medication list in the electronic medical record to the medication list obtained through the patient interview. The following discrepancies were documented on the data collection form: incorrect/missing dose, incorrect/missing route, incorrect/missing frequency, incorrect/missing drug, incorrect/missing allergy, incorrect/missing formulation, discontinued/not taking drug, and duplication. Additional information collected included: time to complete medication histories, number of outside pharmacies used, total number of home medications in the record, and total number of medications reported during the interview.

Results

Students completed 180 medication histories. Within this population, 98 (54%) were male. The mean ± S.D. age and weight reported were 6.3 ± 6.1 years and 28.7 ± 27 kilograms, respectively. There was a mean ± S.D of 3 ± 3.1 discrepancies per patient. The mean ± S.D time spent on a medication history was 8.7 ± 4.8 minutes per patient. In accordance with the Pareto Principle, approximately 80% of 522 discrepancies came from discontinued/not taking drug (34%), incorrect/missing drug (31%), and incorrect/missing dose (14%).

Conclusion

Pharmacy students, with appropriate oversight, have been beneficial in collecting medication histories and identifying medication discrepancies to prevent errors.

Keywords: medication reconciliation, medication history, student pharmacist, pediatrics, pharmacy

INTRODUCTION

An accurate medication list is an essential component of any initial patient assessment at admission to the hospital (1). The Joint Commission defines the medication reconciliation process as "obtaining and maintaining an accurate, detailed list of all medicines taken by a patient and using this list to provide correct medicines anywhere within the health care system (2)." The 2017 National Patient Safety Goals, established by The Joint Commission, specifically address the importance of medication reconciliation in Goal 3: Improve the safety of using medications (3). The body of literature regarding medication reconciliation is fairly large and growing. Without a formalized process for collecting this data, as well as a designated individual, the accuracy of the medication list can vary greatly (1). A recent meta-analysis of data relating to medication reconciliation found a substantial reduction in the rate of all cause readmissions (19%), all cause emergency center visits (28%) and adverse drug event (ADE) related hospital revisits (67%) with pharmacist-led medication reconciliation (4). However, pharmacists are not the only pharmacy trained personnel performing medication histories. Pertinent to our study includes a publication demonstrating that pharmacy technician completed medication histories resulted in a reduction of errors by 50% compared to nursing completed medication histories (relative risk reduction of errors of 77% (p <.001) (5). Lancaster and colleagues report that student-led medication histories identified significantly more medications per patient (10.2) as compared with nurses (6.8) and physicians (7.1) (p=0.006) (6). Another study reports that student-obtained medication histories led to the addition of previously undocumented medications to 175 electronic medical record charts (53.7% of the charts analyzed) (7).

The process for medication reconciliation in this large, tertiary pediatric institution is complex and inconsistently performed across the transitions of care throughout the system. Unfortunately, the lack of a consistent and reliable process has led to a variety of medication related errors which have impacted patient care. Moreover, the lack of a sound medication reconciliation process is not consistent with the quality of care that this institution aims to provide. The National Coordinating Council (NCC) for Medication Error Reporting and Prevention (MERP) classifies medication related errors based on the level of potential or realized harm and the level of intervention required to remediate said harm if the error reached the patient. Categories extend from "A" which are "Circumstances or events that have the capacity to cause error" up to "I" or "An error that may have contributed to or resulted in the patient's death" (8). Within the institution, all reported medication related events receive a MERP categorization for tracking and quality improvement purposes. A review of institutional data identified 18 medication-related safety reports associated with medication reconciliation in 2014, with 39% classified as MERP Category E or higher and a potential harm of 61%. In the following year (2015), there were 28 reports, with 14% MERP Category E or higher. A variety of interdisciplinary discussions reviewed opportunities to reduce these medication reconciliation related errors. As a result, consensus was gained for the department of pharmacy to pilot medication histories as part of a movement to redesign the overall medication reconciliation practice.

METHODS

Study Population

This was a 12 week descriptive pilot study, which we retrospectively looked at data to analyze the efficacy of pharmacy-student led medication histories to identify and prevent medication related errors at transitions of care. Patients included in the pilot program were admitted to the hospital through the Emergency Center on designated week nights from October 2016 through January 2017. Each patient had been prescribed at least one home medication. This study was approved by the appropriate Institutional Review Board.

Endpoints

The purpose of this project was to review the impact of a pharmacy student-led pilot of medication histories in the Emergency Center. The primary endpoint was to identify the errors/discrepancies between the patient interview and the previous documented home medication list in electronic medical record. The secondary endpoints include time to complete medication histories, number of outside/community pharmacies, number of medications reported in the patient interview, and number of medications previously reported on the home medication list in the electronic medical record.

Data Collection/Reconciliation

Using the four preceptor roles in practice-based teaching, a licensed pharmacist instructed and validated two pharmacy students on the process to complete an appropriate medication history (9). The training process included direct instruction, where the preceptor demonstrated the process of taking a mediation history, including how to fill out the data collection form and what probing questions to ask (Figure 1). The preceptor progressed to modeling, where the student observed the preceptor completing a medication history in the emergency center whilst "thinking out loud." The third step was coaching, where the student completed a medication history in the emergency center with the oversight of the preceptor. Facilitation was the last step, where the student completed a medication history independently, with the preceptor available if needed. After each step of training, the preceptor and student discussed the process and the preceptor provided effective feedback.

These pharmacy students (registered as interns with the state board of pharmacy) were stationed in the Emergency Center at Texas Children's Hospital on designated week nights for 12 weeks. The students received service learning hours from their respective intuition of the time spend at the hospital. The students used a physical medication history form to complete a patient/caregiver interview to obtain a complete list of accurate medications (Figure 1) for patients designated to be admitted to the hospital. The student then compared the medication list collected form the patient interview to the medication list previously documented in the electronic medical record. If the patient did not have a home medication list in the electronic medical record, the student called the patient's outside pharmacy/pharmacies and used this list for comparison. The following discrepancies identified were recorded on an additional data collection form: Incorrect/Missing Dose, Incorrect/Missing Route, Incorrect/Missing Frequency, Incorrect/Missing Drug, Incorrect/Missing Allergy, Incorrect/Missing Formulation,

Discontinued/Not Taking Medication, and Duplication. The following demographic information was collected from the patient: sex, date of birth, race/ethnicity, weight/height, admission diagnosis, primary diagnosis, and preferred language. Additional information collected included: time to complete medication history (minutes), number of outside pharmacies being utilized by the patient, number of medications reported, and number of medications on previous home medication list in the electronic medical record. All data was transferred to an electronic secure environment with designated study identification numbers. The physical information collected by the students was stored in a locked filing cabinet and destroyed upon completion of the study. A registered pharmacist reviewed the data for content, completeness, and confidentiality within 24 hours and follow-up with the physician when appropriate.

Statistical analysis
All data was summarized using descriptive statistics.

RESULTS
A total of 180 medication histories were completed by the two students. Patient characteristics, as shown in Table 1, revealed 98 (54%) male patients. The mean age and weight reported were 6.3 (range, 0-22) years and 28.7 (range, 3.2-173) kilograms, respectively. The medication histories documented resulted in a total of 522 discrepancies, for a mean 3.0 (range, 0-18) discrepancies per patient. Table 2 represents the number of discrepancies in each category. The top three discrepancies were as follows: discontinued/not taking drug (186), incorrect/missing drug (170), and incorrect/missing dose (78). The mean time spent on a medication history was 8.7 (range, 2-25) minutes per patient. The mean number of pharmacies used by each patient was 1.0 (range, 0-4) pharmacies. The mean number of medications reported via the patient interview was 3.8 (range, 0-24) and the mean number of medications previously documented in the electronic medical record was 4.1 (range, 0-26). Additionally, we looked at the data separately for each student. Student #1, a second year pharmacy student, completed 87 medication histories with a mean of 2.8 (range, 0=16) discrepancies per patient. Student #2, a fourth year pharmacy student completed 93 medications histories with a mean of 3.3 (range, 0-18) discrepancies per patient. Each student reported a mean of 8.7 (range, 2-25) minute per patient to complete the medication history.

DISCUSSION
Consistent and accurate documentation of a patient's medication list upon admission to the hospital is important to identify and prevent medication errors. As the drug experts, pharmacists and student pharmacists are well suited to own medication reconciliation. As shown in our data, student pharmacists are able to identify discrepancies and errors in the patient's documented home medication list. This can help prevent inappropriate drug therapy, drug interactions, duplications of medications, and many other discrepancies associated with medication therapy. One particular error discovered was in regards to an antiepileptic regimen. Through the patient interview, the student pharmacist discovered the patient was having issues

with the insurance covering lacosamide and zonegram. Because the patient could not get this medication filled, the patient was taking multiple doses of levetiracetam. The student pharmacist contacted the physician, and from there the physician was able to adjust the patient's medication regimen as appropriate. There were also multiple instances where the patient interview revealed the patient was not compliant with any medications on the home medication list. The patient with 18 discrepancies had 11 medications list on the medication list that the patient was not taking, 6 that were duplications, and 1 that had an incorrect dose recorded. This is important for a physician to know, as some medications may not be safe to restart at the previous dose. The student pharmacists also asked the patient or caregiver when the last dose of a medication was administered. This allowed the student pharmacist to inform the nurse or physician if the patient had received a dose just prior to admission, to prevent duplicate dosing. This process was well received by both the medical and nursing staff within the emergency center.

The findings in this study of a mean ± S.D. of 3 ± 3.1 (range, 0-18) discrepancies per patient and a mean ± S.D. of 8.7 ± 4.8 (range, 2-25) minutes per medication history are consistent with current literature. A study examining medication histories completed by technicians reported a mean ± S.D. of 8.0 ± 4.5 (range, 2-15) minutes to complete the history. They also reported a mean ± S.D of 2.9 ± 2.5 (range, 0-10) discrepancies per patient (10). Additionally, another study looking at student-led medication histories reports an average of 5 (range, 0-13) discrepancies per patient (6). In accordance with the Pareto Principle, as shown in Figure 2, approximately 80% of 522 discrepancies came from discontinued/not taking drug (34%), incorrect/missing drug (31%), and incorrect/missing dose (14%). This is also consistent with the previous studies mentioned. The first study revealed 48% of discrepancies as being omitted or incorrect medication, and 31% being omitted or incorrect dose, totaling to 79% of the total discrepancies (10). The second study reported 66% of discrepancies as medication omitted and 8% as dosage form omitted, for a total of 74% of all discrepancies (6).

Although our study, along with others show that student pharmacists are beneficial to the medication history process, this does not suggest removing the pharmacist from the process (6). The pharmacist is an essential aspect of the process, specifically in reconciling the work of the student pharmacist. A limitation of our study was the inability to validate that the student's medication history was 100% accurate because the pharmacist was not physically present for every medication history being taken. To minimize this limitation, we had a pharmacist present at all times in the emergency center, and required that a pharmacist review the medication history within 24 hours of completion. In addition, the fact that the majority of medication history information comes from the patient or caregiver allows for variability in the accuracy of information between patients. When applicable, the student pharmacist called the patient's outside pharmacy to verify medication information.

The sustainability of a program like this without allocation position by an institution poses a challenge. One option is to create a student service learning program in collaboration with a local college of pharmacy. Our study shows the benefit that it has to the medical institution, but it also poses a great benefit to the students. McLaughlin and colleagues instituted a Student Medication and Reconciliation Team (SMART) program for second-year pharmacy students. These students fulfilled three shifts 5-hour shifts in the emergency center. Their results revealed a significant increase in the following areas: student self-efficacy associated with reviewing and synthesizing information from a medical record and other sources to develop an initial medication list (p=0.002); describing the purpose of the medication history interview to a patient (p=0.048); conducting a complete medication history (p=0.012); identifying potential medication-related problems (p=0.024); and communicating the completed medication history to a pharmacist (p=0.003) (11). These results showcase the benefits that a program like this can have on student pharmacist development. With two students completing our pilot study, we were able to interview the students to get their perspective. Student #1 reported that, *"Being one-on-one with the patient taught me to think quickly on my feet and forced me to learn medications quicker."* Student #2 commented, *"At first, I saw myself trying to complete a task and unknowingly learning little about the patient and their current situation. As I grew comfortable in the position, I saw that it was important to ask more situational questions to gain a fuller picture as to why a patient may have stopped taking a medication for example."* Our program, again supports the benefits of providing pharmacy students with this opportunity. Student #1 and Student #2 collected a similar number of mean discrepancies per patient (2.7, 3.3 respectively). Along with being in alignment with previous studies, this shows consistency between the two students, and serves to validate the quality of the training program prior to beginning this pilot study.

To ensure sustainability of this program, the college of pharmacy and the institution with continue to train students to complete medication histories in the emergency center. The students with receive Introductory Pharmacy Practice Experience (IPPE) hours. The number of students will expand to two student per evening, every day of the week. More data will be collected to assess the need for improvements and workflow changes.

CONCLUSION

Pharmacy student-led medication histories, with appropriate oversight, upon admission to the hospital are helpful in identifying and preventing medication errors. This experience is also beneficial in helping develop the clinical and professional knowledge of student pharmacists. The data presented here is consistent with previous studies that looked at pharmacy student involvement in the medication history process. We should continue to develop new opportunities to involve student pharmacists in this process and others.

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KEY POINTS

1. Student-led medication histories in a large, tertiary pediatric emergency center are useful in identifying and preventing medication errors.

2. Adequate training and education on how to complete an accurate medication history is crucial for students to be successful.

3. It is important for both patient safety and student learning to have a pharmacist reconcile the student completed medication history and address any major concerns with the medical team.

TABLES

Demographics (n=180)	
Male, no. (%)	98 (54)
Mean ± S.D. age, yr	6.3 ± 6.1, range, 0-22
Mean ± S.D. weight, kg	28.7 ± 27, range, 3.2-173

Table 1: Patient Characteristics from all patients with a completed medication history

Discrepancy	No. (%) Medications	No. (%) Patient Charts (n=180)
Discontinued/Not Taking Drug	186 (34)	52 (29)
Incorrect/Missing Drug	170 (31)	6 (3)
Incorrect/Missing Dose	78 (14)	40 (22)
Incorrect/Missing Frequency	62 (11)	81 (45)
Duplication	33 (6)	6 (3)
Incorrect/Missing Route	9 (2)	7 (4)
Incorrect/Missing Allergy	7 (1)	73 (41)
Incorrect/Missing Formulation	7 (1)	33 (18)
TOTAL	**552**	**298**

Table 2: Number of discrepancies categorized by type

FIGURES:

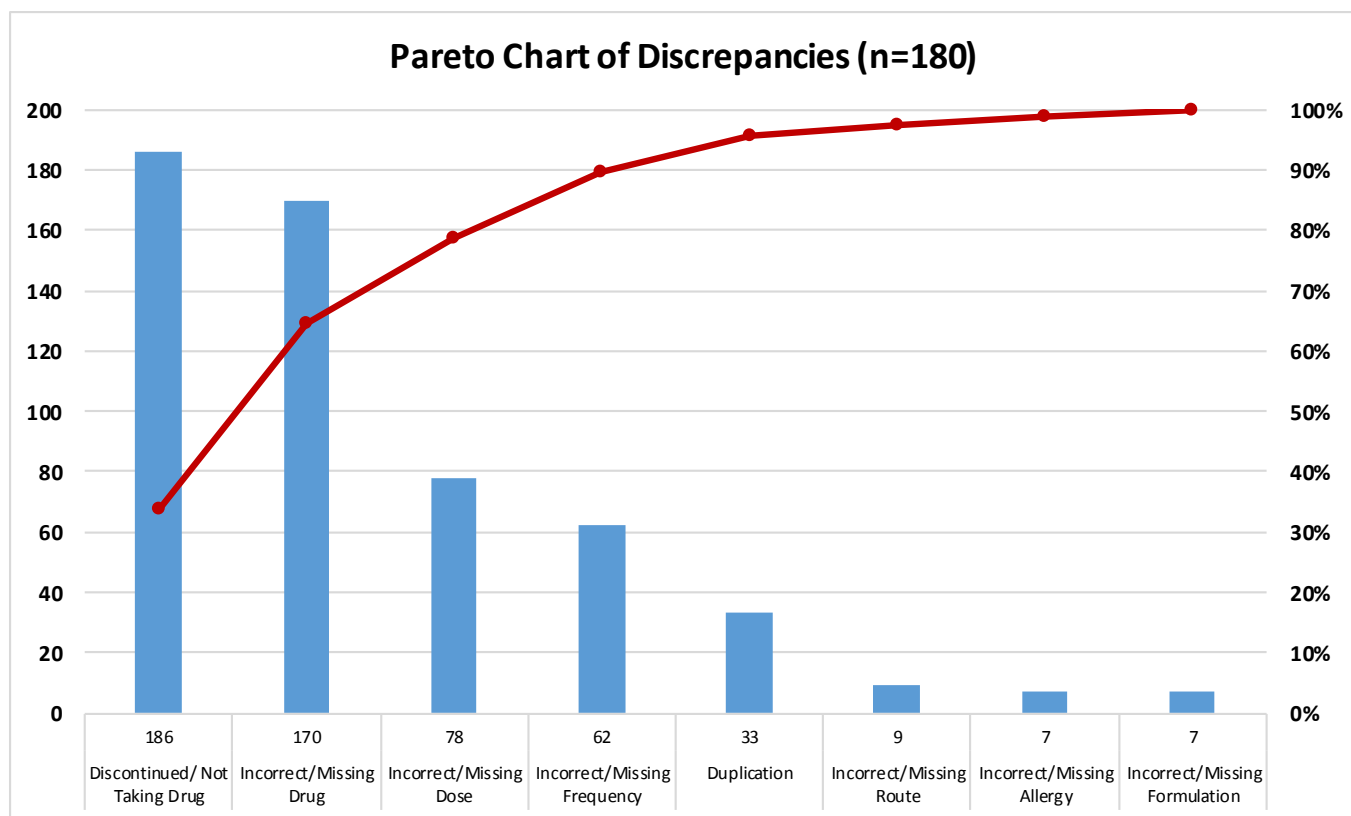**Patient Name:** _____ **MRN:** _____ **Bed #** _____

Allergies

Name of Substance (drug or food)	Type of Reactions		Pharmacies, Locations, and Phone Numbers
☐ Check if none			

Current Medications

Prescription Medications with Strength / Concentration (susp / tablet / oint / drops)	Dose (mg)	Frequency	Last dose (date / time)
☐ Check if none			

Over-the-Counter Medications (susp / tablet / oint / drops)	Dose (mg)	Frequency	Last dose (date / time)
☐ Check if none			

Herbs, Vitamins, Minerals, Etc. (susp / tablet / oint / drops)	Dose (mg)	Frequency	Last dose (date / time)
☐ Check if none			

Figure 1: Data Collection form used by students to complete medication history via interview with patient

Pareto Chart of Discrepancies (n=180)

186	170	78	62	33	9	7	7
Discontinued/ Not Taking Drug	Incorrect/Missing Drug	Incorrect/Missing Dose	Incorrect/Missing Frequency	Duplication	Incorrect/Missing Route	Incorrect/Missing Allergy	Incorrect/Missing Formulation

Figure 2: Pareto chart displaying distribution of discrepancy categories