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Original Research

A retrospective review of student pharmacist medication reconciliation activities in an outpatient family medicine center

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ABSTRACT*

Background: Medication reconciliation in the outpatient setting is an important part of preventing medication errors, and is mandated by the Joint Commission.

Objective: To describe and quantify medication reconciliation efforts by student pharmacists in an outpatient family medicine center.

Methods: A retrospective review was conducted of medication reconciliation documentation forms completed by student pharmacists during an outpatient clinical rotation between May 2012 and April 2013. Discrepancies were defined as any lack of agreement between the medication list in the electronic medical record and the patient reported regimen. Descriptive statistics were used to report results.

Results: A total of 557 medication reconciliation documentation forms from 12 student pharmacists were reviewed. The average number of medications per patient interviewed was 9 (range 0-25). A total of 1,783 medication discrepancies were found with an average of 3.2 discrepancies per patient. An additional 272 medication allergy discrepancies were identified. The most common discrepancy was medications the patient was no longer taking (37.3%, n=766). The second most common discrepancy was over-the-counter and herbal medications that had not been added to the medication list (16.2%, n=335). Patient counseling was documented 159 times during the medication reconciliation process.

Conclusions: Medication reconciliation by student pharmacists in an outpatient family medicine center resulted in the identification of many discrepancies in medication lists in an electronic health record. Student pharmacists also documented and clarified medication allergies and performed patient counseling.

Keywords: Medication Reconciliation; Medication Errors; Electronic Health Records; Students, Pharmacy; United States

INTRODUCTION

Medication safety is a constant concern for all health-care practitioners, due to the large number of patients who take multiple medications and the complexity of managing those medications. With the abundance of polypharmacy, medication record accuracy has become an ever-increasing challenge for health-care systems. Effective medication reconciliation is a necessity to prevent medication errors and improve patient safety. The Joint Commission includes medication reconciliation as a national patient safety goal in ambulatory health-care.¹ The 2014 goal states: "Maintain and communicate accurate patient medication information".¹ The rationale for this goal is to identify and resolve discrepancies in order to prevent adverse patient outcomes. Medication reconciliation is the process of comparing the medications that a patient is taking to the medications listed in their health record. It is a complete account of all medications a patient is taking and how they are taking them. Obtaining an accurate and complete list can prove to be difficult in the outpatient setting as many patients visit multiple prescribing physicians, and may take over-the-counter (OTC) and herbal medications, which are often self-prescribed. This can cause discrepancies in medication records, which may lead to medication errors such as duplicate therapy, drug-drug interactions, drug-disease interactions, or adverse drug events.

Studies have shown the impact that outpatient medication errors have on patient safety as well as the financial system. In an 11-year national analysis from the National Center for Health Statistics, visits to outpatient clinics for an adverse drug event increased significantly between 1995 and 2005.² Drug-related adverse events were associated with 0.8% of all emergency department visits and 14.5% of those required hospital admission.² Hospitalization rates for adverse drug events increased with age and were as high as 24.9% in patients aged 65 and older.² An increase in the number of medications taken by patients was associated with an increased risk of a visit for an adverse drug event.² It has been estimated that more than 50% of admissions that are drug-related could have definitely or possibly been avoidable.³ These medication errors account for over USD3.5 billion in health-care costs⁴ and more than 7,000 deaths annually.⁵

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Several outpatient studies have shown the importance of medication reconciliation in correcting discrepancies that can lead to medication errors. Bedell and colleagues noted 1.7 discrepancies per patient in an outpatient practice, with 76% of patients having at least one discrepancy.⁶ Another study by Orrico noted discrepancies as high as 2.7 per patient.⁷ A study led by Wagner noted that only 37% of medication records in an outpatient practice were complete.⁸ Stewart and colleagues noted that 74% of patients who were interviewed by a pharmacist in the outpatient setting had at least one medication record discrepancy.⁹ The most common discrepancy varied between studies but included medications taken by patients but not recorded, medications taken differently than recorded, and medications no longer taken.⁶⁻⁹

Pharmacist based education techniques have been utilized to improve medication reconciliation in a few studies. Peyton and colleagues showed an improvement in nurse conducted reconciliation after pharmacist-provided education, with a decrease in discrepancies from 3.0 per patient to 2.4 per patient.¹⁰ Sixty-three percent of discrepancies were classified as potentially significant (i.e., a missing prescription). A similar improvement was noted in a study led by Varkey with pharmacist education for physicians with a decrease from 5.24 discrepancies per patient to 2.46 per patient.¹¹ The majority of discrepancies were classified as minor in severity (i.e., missing information), and approximately one fourth were classified as significant (i.e., drug dosage too low or too high). In both of these studies education helped to decrease the number of errors by teaching the importance of accurate reconciliation, however; a large number of discrepancies still existed.

The American Society of Health System Pharmacists believes that pharmacists are uniquely qualified to lead medication reconciliation efforts, due to their distinct knowledge, skills, and abilities.¹² Data supports the impact of pharmacists involved in medication reconciliation. Yusuff and colleagues noted that pharmacist involvement significantly increased the quality and quantity of medication information that was documented.¹³ An inpatient study led by Mergenhausen compared medication reconciliation by pharmacists to physicians and found that medication reconciliation by pharmacists was more comprehensive and led to lower odds of adverse drug events related to admission prescribing changes.¹⁴ Another inpatient study by Lancaster and colleagues demonstrated the value of student pharmacists in the inpatient reconciliation process.¹⁵ They noted that student pharmacists identified significantly more preadmission medications than did nurses or physicians, and provided the most thorough documentation.¹⁵

These studies highlight that pharmacists and student pharmacists can play a key role in improving the effectiveness of medication reconciliation. They have extensive training in patient interviewing, medication history taking, and assessment of adherence. Using these skills can assist in correcting errors in medication records and

help prevent duplicate therapies, drug-drug interactions, drug-disease interactions, unnecessary side effects and adverse drug events. However, there are few studies describing medication reconciliation conducted by student pharmacists in the outpatient setting. We previously conducted and published a pilot study to describe and quantify medication reconciliation activities by student pharmacists over a four-month period, and found an average of 2.6 discrepancies per patient.¹⁶ The medication reconciliation process by student pharmacists has been modified since the time of the pilot study. This study was an expansion of the pilot study and was designed to increase the amount of data collected to cover an entire academic year and include more specific types of medication record discrepancies. The objective of this study was to describe and quantify medication reconciliation efforts by student pharmacists from May 2012 to April 2013 in an outpatient family medicine center.

METHODS

Medication reconciliation efforts are routinely conducted in a large family medicine outpatient center that is staffed by approximately 36 family medicine residents and eight attending physicians. The clinic averages around 2,100 patient encounters per month with a patient population including obstetric, pediatric, and adult patients. The insurance mix consists of 35% Medicaid, 34% Medicare, 28% private insurance, and 3% uninsured. The practice site has employed the use of an electronic health record (EHR) since 2006 that includes a list of current and past medications. All prescriptions written by physicians in the practice are automatically included in the medication list. Prescription medications from physicians outside the practice and OTC and herbal medications can be entered into the medication list as a "new medication history" by practitioners at the center. Reconciliation of medications and allergies is required at every outpatient visit. When medication reconciliation needs to be completed, a reconciliation icon is highlighted in the EHR. However, medication reconciliation is not a required step before continuing with the patient encounter. It is unknown how often a thorough and accurate medication history is conducted by physicians or nursing staff, with full reconciliation of discrepancies.

Student pharmacists in their last year of the Doctor of Pharmacy program are assigned to the practice site for one of their five-week clinical advanced practice experience rotations. Student pharmacists conduct medication reconciliation as part of their rotation activities approximately one to two half-days per week, under the direct supervision of a clinical pharmacy preceptor. The preceptor starts by modeling the medication reconciliation process with a patient while the student pharmacist observes, and then observes the student pharmacist conducting medication reconciliation activities during the initial training, so that a standardized approach is consistently used. Student pharmacists conduct detailed patient interviews to reconcile

medications for patients who have been triaged by the nursing staff and are waiting to be seen by their physician. Student pharmacists are not able to see every patient, and attempt to see those with the longest medication lists and those with the longest wait time for their physician. Medication histories are conducted by reviewing the medication list in the EHR and comparing it to any medication bottles or lists brought in by the patient, verbally reviewing all prescription and OTC medications, and calling pharmacies if necessary to verify medications. Medication allergies are also clarified. No patients are specifically excluded from this process and patients can be seen by a student pharmacist more than once on different dates. Patients not seen by student pharmacists receive usual medication reconciliation performed by the physician.

After the student pharmacist collects information to reconcile medications and allergies, they update the EHR with any changes and reconcile any discrepancies. Student pharmacists are trained on this process during rotation orientation by the clinical pharmacy preceptor. Physician approval is not required for these updates, and the physician may make additional changes during the patient visit. A standardized medication reconciliation communication form that was developed by the pharmacy preceptor is used to communicate any discrepancies or new medication information to the physician (Online appendix). The form was also used in the pilot study and has been described previously.¹⁶ After completion, the standardized medication reconciliation form is left outside the exam room for the physician to review before seeing the patient. The student pharmacists do not always speak directly with each physician, but are available if any questions arise.

As part of their clinical rotation assignments, student pharmacists turn in documentation of their medication reconciliation activities to the clinical pharmacy preceptor every day using a medication reconciliation documentation form (Online appendix). This is a new process since the pilot study, and allows the pharmacy preceptor to quickly assess the quantity and type of medication reconciliation activities of student pharmacists. The form includes a count of active medications per patient before the reconciliation is performed, basic information about whether the interview was conducted with a medication list or medication bottles brought in by the patient, the number of changes made to the medication list by category, clarification of medication allergies, and documentation of patient counseling. This form does not include any patient information, as it is merely an assignment to document activities for the pharmacy preceptor for use in evaluations of student pharmacists. The clinical pharmacy preceptor reviews the medication reconciliation documentation forms completed by the student pharmacist on a daily basis to check for completeness.

The researchers received approval from the university's institutional review board to conduct this research. A retrospective review was conducted of

all medication reconciliation documentation forms (Online Appendix 2) completed and turned into the clinical preceptor from May 2012 to April 2013. Student names were not collected or recorded in any way for the research database. The number of reviews conducted as well as the frequency of each type of discrepancy was recorded. A discrepancy was defined as a lack of agreement between the medication list in the EHR and patient reported regimen. Patient counseling documentation was also reviewed. This new form allowed for more detailed information to be collected compared to the pilot study, including number of medications per patient, and how many patients brought their medications bottles or a medication list to the visit. Medications the patient was not taking for chronic conditions were also described separately from medications no longer taken, so that patients who were out of refills or needed to have chronic medications restarted were described separately from those who had discontinued medications. Also, compared to the pilot study, updates to medication allergies were more clearly defined as allergies added to the EHR, versus clarification of the type of reaction to a previously listed allergy. Descriptive statistics were used to calculate the mean number of discrepancies per patient and the percentages of each type.

RESULTS

A total of 557 medication reconciliation documentation forms from 12 student pharmacists were reviewed. The average number of medications per patient interviewed was nine (range 0-25, n=4,991). About 10% of patients (n=59) brought their medication bottles with them to the appointment, and 13% (n=74) brought their own medication list. A total of 1,783 discrepancies were found with an average of 3.2 discrepancies per patient (Table 1). An additional 272 medication allergy discrepancies were identified. The most common discrepancy was medications no longer taken. Examples of this type of discrepancy include medications for acute problems such as antibiotics or anti-inflammatories that were finished, but had not been removed from the medication list; medications that were prescribed that the patient never took; or medications that the physician verbally told the patient to stop or change, but were not taken off the medication list in the EHR. The second most common discrepancy was OTC and herbal medications that the patient was taking that had not been added to the medication list. This included medications that the physician may have verbally prescribed and instructed the patient to buy

Table 1. Medication and Allergy Discrepancies (n=2,055)	
Discrepancy	# (%)
Medications no longer taken	766 (37.3)
OTC and herbal medications added	335 (16.3)
Prescription medications added	266 (12.9)
Medications taken differently than prescribed	260 (12.7)
Medication allergies clarified	198 (9.6)
Chronic medications not taking	156 (7.6)
Medication allergies added	74 (3.6)
OTC = over-the-counter	

Table 2. Patient counseling activities (n=159)	
Counseling activity	# (%)
Drug information counseling	106 (66.7)
Disease state counseling	21 (13.2)
Diet counseling	20 (12.6)
Smoking cessation counseling	7 (4.4)
Exercise counseling	5 (3.1)

at the pharmacy, such as acetaminophen or a vitamin supplement; or medications that the patient bought independently for self-treatment or prevention of disease. A significant number of discrepancies were due to patients taking prescription medications from outside physicians or specialists that had not been added to the EHR medication list. Another significant discrepancy was medications that were being taken differently than prescribed. This included patients who were taking a different dose than what was prescribed, or taking the medication at a different frequency than prescribed. These differences could have occurred from physician verbal instructions to change a prescription, such as doubling a dose or taking a medication more frequently, without a change in the actual prescription written. However, it is likely that some patients may not have understood the instructions correctly or had chosen to change the administration of the medication on their own. Medications taken differently than prescribed were not changed in the EHR by the student pharmacist, but a note was left of the physician describing the discrepancy in need of reconciliation. Another alarming discrepancy that was documented was chronic medications that were not being taken, sometimes because the patient had run out of refills, or had been non-adherent with scheduled follow-up appointments to assess chronic disease states. In these cases, the chronic medication was not discontinued on the EHR medication list, but a note was left for the physician regarding the reason for non-adherence, so that the medication could be refilled if appropriate. Discrepancies on medication lists and allergies were reconciled in the EMR by the student pharmacist, except for medications taken differently than prescribed, and chronic medications no longer taken, resulting in over 1,300 changes to medication lists. Medication allergies frequently needed to be added to the EHR, or the type of allergic reaction clarified and documented (n=272). Medication allergy discrepancies were reconciled in the EHR by the student pharmacist.

Patient counseling was documented 159 times during the interviews (Table 2). This could have been from a question asked by the patient, or initiated by the student pharmacist. The most common type of counseling was drug information, which could have included information about the indication for the medication, possible side effects, instructions for administration, and possible drug-drug or drug-disease interactions. Other types of counseling included information on a specific disease state (such as diabetes), and/or diet and exercise counseling. Smoking cessation counseling was also occasionally documented. Multiple counseling activities could have occurred for one patient during an interview.

DISCUSSION

Generally, our patient population takes a large number of medications, with an average of nine medications per patient interviewed. Increasing numbers of medications has been found to increase the rate of adverse drug events.² Stewart and colleagues found that the presence of at least one medication discrepancy was associated with patients taking three or more medications.⁹ We found an alarming number of discrepancies in medication lists in the electronic health records of an outpatient family medicine population. The rate of medication discrepancies per patient (3.2) was slightly higher than the pilot study of shorter duration that had been conducted previously (2.6 discrepancies/patient).¹⁶ However, our findings are similar to those reported in other outpatient literature, which generally have found a rate of 1.7 to 5.2 discrepancies per patient.^{6-8,10} Patients often did not bring their own medication list or their medication bottles with them to the appointment, which made it more difficult to conduct medication reconciliation. This was an opportunity for student pharmacists to provide an updated medication list to patients; as they may not recall all medications and instructions if asked to do so from memory. If the student pharmacist had not been present during the encounter, the physician may not have had enough time allotted for the appointment to go through each medication in detail and update the medication list.

The second most common discrepancy we found was due to OTC and herbal medications that needed to be added to the medication list, which was also seen in other outpatient studies.^{6,7,9,10,13} This is concerning due to the potential for numerous drug-drug and drug-disease interactions with OTC and herbal products, particularly in patients who are self-treating without the knowledge of their primary care physician. There were also a significant number of prescription medications from outside providers which needed to be documented in the medication list. Again, other outpatient studies have had similar results.^{6-13,17} This is also concerning due to potential duplicate prescription therapy by different prescribing physicians, as well as the potential for drug-drug and drug-disease interactions. In a family medicine population, this type of error is likely to occur due to many patients seeing specialists such as nephrologists, cardiologists and psychiatrists who also prescribe multiple medications.

We found that often patients were taking medications differently than prescribed, or not taking chronic medications regularly. For example, a patient might be taking their chronic asthma controller medications on an as needed basis rather than on a scheduled regimen. Another example is a patient who had run out of their medication for hypertension, and was presenting with an elevated blood pressure. This is extremely important for the physician to know before assessing the control of chronic diseases, as additional medications may be prescribed or dosages increased which are not needed. This increases the potential for adverse effects as well as cost to the health-care system.

This was a prime opportunity for student pharmacists to provide patient counseling on the importance of medication adherence, as well as patient specific drug information.

Student pharmacists also commonly documented or clarified medication allergies. Clarification usually involved the type of reaction to a specific medication. Prescribing a medication to which a patient is allergic could cause a life-threatening event. This type of documentation is an important medication safety activity.

It is difficult to compare our results to other outpatient medication reconciliation studies, due to extremely variable study designs. For example, one study reviewed had a highly educated population, and one had a young female population with visits for acute illnesses.^{6,7} In some studies, medication reconciliation activities were conducted by nurses or physicians instead of pharmacists.^{7,10,11} Our study is larger than most other outpatient studies, and includes a general patient population seen for both acute and chronic problems. Also, this is the first large outpatient study reporting medication reconciliation activities by student pharmacists. This can increase the impact that a clinical pharmacist might have working independently, as student pharmacists can reach more patients than a single practitioner could alone. In addition, student pharmacists may have more time available to conduct patient interviews during their educational training, as they are not constrained by the concerns and financial burdens of seeing large numbers of patients during a short time.

There are several limitations to our retrospective study. The results are dependent on the accuracy of the information the student pharmacists documented during their clinical rotations. Some may have been more thorough than others in their documentation. The medication reconciliation documentation forms were handwritten, and could have been difficult to read or misinterpreted by the researchers. Also, the activities were somewhat dependent on the assertiveness of the student pharmacists in obtaining detailed information through repeated questioning, and taking the initiative to provide patient counseling. Another limitation is that the patients included in the study were only a convenience sample, as student pharmacists were not able to see every patient. This may have led to some selection bias in which patients who underwent medication reconciliation may have had more medications than the average patient at our practice site, and therefore may have more discrepancies than those with less complex medication lists. The information collected from patient interviews was dependent on the reliability of the patient and their ability to remember medications and instructions. We relied on patient reporting, as there is no way to document how patients were actually taking their medications. Medication reconciliation does not guarantee patient adherence. Discrepancies can be system-based due to practitioners not keeping medication lists up to date; or patient-based, due to non-adherence or

misunderstanding of instructions. We were not able to differentiate these types of errors in our study.

The overall impact on patient care was not measured, as the study was merely descriptive. Some discrepancies documented may have been very significant clinically, and could have resolved a current medication problem or prevented a future medication error. Other discrepancies could have had more minor significance. We did not collect data on the specific types of medications associated with discrepancies. We also did not collect information on the medication errors that were prevented through medication reconciliation; such as duplicate therapy, drug-drug interactions, drug-disease interactions or adverse drug events; or the significance of discrepancies identified. The physician may have also made additional changes to reconcile the medication list after the patient was seen by the student pharmacist. There was no practical way to quantify the significance in the current study. Although there is one inpatient study comparing student pharmacist conducted medication reconciliation to nurses and physicians¹⁵, there are no comparisons available between medication reconciliation activities conducted by student pharmacists versus pharmacists, or student pharmacists versus other health-care professionals in the outpatient setting. It would be helpful to compare the accuracy of medication lists obtained by student pharmacists to those obtained by physicians during usual care; however, this could not be feasibly done at our practice site. Also, our practice site is a teaching center, so there are likely differences in the medication reconciliation efforts of multiple resident physicians with different levels of training, as well as faculty physicians. Our patients may see different resident physicians at different appointments, and medical students are involved in patient care. This could contribute to the complexity of medication instructions and possible patient misunderstanding. There is no information available on the cost-effectiveness of employing a clinical pharmacist at outpatient sites who do not currently work with a pharmacist or student pharmacists. The time taken to complete these interventions was not recorded.

CONCLUSIONS

Medication reconciliation by student pharmacists in an outpatient family medicine center resulted in the identification of many discrepancies in medication lists in an EHR. Student pharmacists also documented and clarified medication allergies and performed patient counseling. Pharmacists are uniquely qualified to conduct medication reconciliation. However, the feasibility and cost-effectiveness of student pharmacists conducting these activities in outpatient settings has not been reported. Future research should concentrate on comparing the accuracy of medication reconciliation by student pharmacists and pharmacists to other health-care practitioners, documentation of prevention of medication errors, and cost-effectiveness of different models for conducting outpatient medication reconciliation.

CONFLICT OF INTEREST

No conflicts of interest to disclose.

The views expressed in the submitted article or that of the authors, and not an official position of the institutions.

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RECISIÓN RETROSPECTIVA DE LAS ACTIVIDADES DE RECONCILIACIÓN DE MEDICACIÓN DE ESTUDIANTES DE FARMACIA EN UN CENTRO AMBULATORIO DE MEDICINA DE FAMILIA

RESUMEN

Antecedentes: La reconciliación de la medicación en pacientes ambulatorios es un elemento importante de la prevención de errores de medicación, y es obligatoria para la Joint Commission.

Objetivo: Describir y cuantificar los esfuerzos en reconciliación de la medicación de los estudiantes de farmacia en un centro ambulatorio de medicina de familia.

Métodos: Se realizó una revisión retrospectiva de la documentación de la reconciliación de la medicación completada por estudiantes de farmacia durante la rotación clínica en ambulatorio entre mayo de 2012 y abril de 2013. Se definieron las discrepancias como la

falta de acuerdo entre la lista de medicación en la historia clínica electrónica y el régimen comunicado por el paciente. Se utilizaron estadísticas descriptivas para comunicar los resultados.

Resultados: se revisaron un total de 557 formularios de documentación de reconciliación de medicación de 12 estudiantes de farmacia. La media de medicamentos por paciente fue de 9 (rango 0-25). Se encontraron un total de 1.783 discrepancias con una media de 3,2 discrepancias por paciente. Se identificaron 272 discrepancias de alergias medicamentos adicionales. La discrepancia más común era la medicación que el paciente ya no tomaba (37,3%; n=766). La segunda discrepancia más común fue medicamentos sin receta o plantas medicinales que no habían sido añadidas a la lista (16,2%; n=335). Se documentó el consejo a pacientes en 159 ocasiones durante el proceso de reconciliación de la medicación.

Conclusiones: La reconciliación de medicación por estudiantes de farmacia en un centro ambulatorio de medicina de familia resultó en la identificación de muchas discrepancias en la lista de medicación en las historias clínicas electrónicas. Los estudiantes de farmacia también documentaron y clarificaron alergias a medicamentos y realizaron consejo a pacientes.

Palabras clave: Conciliación de Medicamentos; errores de Medicación; Registros Electrónicos de Salud; Estudiantes de Farmacia; Estados Unidos

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