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Kraus, Sarah K.; Sen, Sanchita; Murphy, Michelle; Pontiggia, Laura
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Original Research

Impact of a pharmacy technician-centered medication reconciliation program on medication discrepancies and implementation of recommendations

Sarah K. KRAUS^{id}, Sanchita SEN^{id}, Michelle MURPHY^{id}, Laura PONTIGGIA^{id}.
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Abstract

Objectives: To evaluate the impact of a pharmacy-technician centered medication reconciliation (PTMR) program by identifying and quantifying medication discrepancies and outcomes of pharmacist medication reconciliation recommendations.

Methods: A retrospective chart review was performed on two-hundred patients admitted to the internal medicine teaching services at Cooper University Hospital in Camden, NJ. Patients were selected using a stratified systematic sample approach and were included if they received a pharmacy technician medication history and a pharmacist medication reconciliation at any point during their hospital admission. Pharmacist identified medication discrepancies were analyzed using descriptive statistics, bivariate analyses. Potential risk factors were identified using multivariate analyses, such as logistic regression and CART. The priority level of significance was set at 0.05.

Results: Three-hundred and sixty-five medication discrepancies were identified out of the 200 included patients. The four most common discrepancies were omission (64.7%), non-formulary omission (16.2%), dose discrepancy (10.1%), and frequency discrepancy (4.1%). Twenty-two percent of pharmacist recommendations were implemented by the prescriber within 72 hours.

Conclusion: A PTMR program with dedicated pharmacy technicians and pharmacists identifies many medication discrepancies at admission and provides opportunities for pharmacist reconciliation recommendations.

Keywords

Medication Reconciliation; Pharmacy Technicians; Medication Errors; Pharmacy Service, Hospital; Regression Analysis; United States

INTRODUCTION

Inappropriate prescribing due to inaccurate medication histories and reconciliation can lead to medication errors, which have been associated with increased morbidity, mortality, and healthcare costs.¹ Medication reconciliation is a strategy that has demonstrated the ability to reduce medication errors during transitions of care by enhancing communication between healthcare professionals and patients.²⁻⁴ Several studies have shown that pharmacist-obtained medication histories are more accurate than those collected by other healthcare professionals, thereby resulting in decreased medication errors.^{5,6} Consequently, organizations such as the World Health Organization and the Joint Commission support pharmacists in lead roles during the medication reconciliation processes.^{7,8} In

addition, studies have shown that under pharmacist supervision, medication histories obtained by pharmacy technicians are significantly more accurate than those collected by other healthcare professionals.^{6,9-11}

In response to the need for a high-quality and cost-effective method for providing medication reconciliation services, an inpatient Pharmacy Technician Medication Reconciliation program (PTMR) was initiated in January 2011 at Cooper University Hospital in Camden, NJ. The PTMR program is staffed by designated pharmacy technicians who are responsible for obtaining medication histories. The dedicated pharmacy technicians are trained by pharmacists to complete medication histories and are overseen by a dedicated medication reconciliation pharmacist. The pharmacist is responsible for providing clinical oversight to the pharmacy technicians as well as completing medication reconciliations for the patients that have received pharmacy technician medication histories. The pharmacists document their identified medication discrepancies and reconciliation recommendations in a medication reconciliation note in the electronic health record (EHR).

The purpose of this study was to evaluate the impact of a pharmacy technician-centered medication reconciliation program by quantifying and identifying the frequency of medication discrepancies and pharmacist's recommendations. Secondary study objectives were to identify the therapeutic drug classes most associated with the identified discrepancies, the number of recommendations per patient and the percentage of

Sarah K. KRAUS. PharmD, BCPS, BCOP. Clinical Pharmacy Specialist- Hematology/Oncology, Pennsylvania Hospital, Philadelphia, PA (United States).
Sarah.kraus@uphs.upenn.edu

Sanchita SEN. PharmD, BCPS. Clinical Pharmacy Specialist- Internal Medicine, Cooper University Hospital; & Associate Professor of Clinical Pharmacy, University of the Sciences, Philadelphia, PA (United States).
s.sen@uscience.edu

Michelle MURPHY. PharmD, MS, BCPS. Clinical Pharmacy Specialist- Anticoagulation/ Internal Medicine, Cooper University Hospital, Camden, NJ (United States).
murphy-michelle@cooperhealth.edu

Laura PONTIGGIA. MS, PhD. Professor of Statistics. Interim Associate Dean, Misher College of Arts and Sciences, University of the Sciences, Philadelphia, PA (United States).
l.pontig@uscience.edu



pharmacist recommendations interventions implemented by the prescriber within 72 hours.

METHODS

This study was approved by the Cooper University Hospital Institutional Review Board.

PTMR Service

PTMR service pharmacy technicians dedicated to obtain medication histories undergo various steps to complete each medication history from patient interview to EHR documentation. Every medication history starts with a brief patient work-up followed by a medication history interview with the patients or caregivers. The information gathered during the interview is then verified using objective pharmacy prescription history resources (e.g. prescription refill history data, medication bottles, or prescribers). When the pharmacy technician has compiled what they believe to be the most accurate medication history, it is then entered by the pharmacy technician into the patient's EHR as the prior to admission medication list. Once the medication history steps are completed, the pharmacist then verifies and approves the updated pharmacy technician entered prior to admission medication list. The pharmacist then reconciles the medications by comparing the prior to admission medication list to the current admission orders, identifies medication discrepancies, and documents identified discrepancies along with recommendations through an EHR medication reconciliation note. Further details regarding the implementation and specific processes of the PTMR program are outlined in a prior publication.¹²

Data Collection

Patients were retrospectively included in the analysis if they received PTMR services, which include a medication history and admission medication reconciliation, while they were on an internal medicine teaching service from May 2011 through February 2012. In order to trend data over time, 4 study months were selected during the study period, May 2011, August 2011, November 2011, and February 2012. A sample size of 50 patients was targeted for inclusion in each study month using a stratified systematic approach by screening every third patient in each selected study month for inclusion until a sample size of 50 patients was met for each study month for a total of 200 patients. Patients were excluded if they were less than 18 years old, unable to participate in patient interview, or had insufficient data to retrospectively calculate creatinine clearance (CrCl), since this would affect pharmacist renal dose adjustment recommendations. Duplicate patient encounters and patients that did not have a pharmacist medication reconciliation note documented in the EHR were excluded.

Pharmacist identified medication discrepancies were categorized as medication history related discrepancies and other medication related problems. Medication history related discrepancies were defined as omission, non-formulary medication omission, additional medication (i.e., a medication is inappropriately prescribed under the assumption that a patient was on it prior to admission),

dose discrepancy, formulation discrepancy (ex. Depakote vs. Depakote ER) and frequency discrepancy. Other medication related problems were also captured and categorized as failure to adjust for renal dysfunction, and drug-drug interactions requiring medication regimen modifications. Pharmacist's reconciliation recommendations were communicated to the provider as addition, discontinuation, dose or frequency modification, formulary substitution, or the recommendation to use a patient's own medication due to no formulary alternative.

Statistics

Descriptive and exploratory analyses were performed. The Cochran-Armitage trend test and Kruskal-Wallis test were utilized to assess the trend in medication discrepancies and pharmacist recommendations over time. Stepwise logistic regression and Classification and Regression Tree (CART) analyses were used to identify potential risk factors that increase the chance of medication discrepancies. Predictors that were statistically significant in the bivariate analyses were included as potential predictors in the multivariate analyses. Analyses were performed using SAS (version 9.3, SAS Institute Inc., Cary, NC) and CART (version 6.6, Salford Systems, San Diego, CA) software. The priority level of significance was set at 0.05.

RESULTS

Out of the 224 patients screened for inclusion using the every third sampling method, twenty-four patients were excluded due to absence of pharmacist medication reconciliation note in the EHR ($n = 19$), lack of data to retrospectively calculate CrCl ($n = 2$), and inability to interview the patient due to clinical conditions ($n = 3$). The study population included for analysis was 200 patients.

Baseline demographics and clinical characteristics are reported in Table 1. Compared to patients with no medication discrepancies, patients with at least one medication discrepancy were older on average, had a higher incidence of comorbidities (i.e. hypertension, coronary artery disease, diabetes, and chronic kidney disease), and were on more medications at baseline. The only significant risk factor for a medication discrepancy, identified by the logistic regression model, was the number of medications reconciled (odds ratio [OR], 1.221; 95% confidence interval, 1.144-1.303). Other predictors included in the model that were not found to be statistically significant were age, congestive heart failure, coronary artery disease, hypertension, diabetes, chronic renal disease, CrCl, and dialysis. Furthermore, a CART analysis with the same predictors found that if the number of medications reconciled per patient was 7 or less, the chance of having at least one medication discrepancy was 30.4%; whereas, if the number of medications reconciled was 8 or more, the risk for a medication discrepancy more than doubled (75.5%). In this study, the median number of medications reconciled per patient was 7.

A total of 1595 medications were reviewed, and 365 medication discrepancies were identified in 200 patients; an average of 1.8 discrepancies per patient with a standard deviation of 2.7. Approximately half (52.5%) of patients had at least one medication discrepancy identified. The most

Characteristic	Total (n = 200)	Medication discrepancy		p-value
		Yes (n = 105)	No (n = 95)	
Age, years, mean \pm SD	59 \pm 18	62 \pm 16	54 \pm 19	0.001
Female, n (%)	99 (49.5)	56 (56.6)	43 (43.4)	0.254
Comorbidities, n (%)				
Hypertension	118 (59)	74 (62.7)	44 (37.3)	0.001
Coronary artery disease	69 (34.5)	45 (65.2)	24 (34.8)	0.009
Diabetes mellitus	65 (32.5)	42 (64.6)	23 (35.4)	0.017
Psychiatric disorder	56 (28)	32 (57.1)	24 (42.9)	0.412
COPD/Asthma	49 (24.5)	28 (57.1)	21 (42.9)	0.454
Malignancy	33 (16.5)	21 (63.6)	12 (36.4)	0.161
Chronic kidney disease	29 (14.5)	23 (79.3)	6 (20.7)	0.002
Chronic kidney disease with hemodialysis	12 (6)	11 (91.7)	1 (8.3)	0.005
Congestive heart failure	24 (12)	17 (70.8)	7 (29.2)	0.055
Chronic liver disease	18 (9)	10 (55.6)	8 (44.4)	0.786
Length of hospital stay, days, median (IQR)	4 (3–7)	5 (3–7)	4 (2–8)	0.342
Number of medications reconciled, n, median (IQR)	7 (3–12.5)	11 (7–16)	4 (1–8)	<0.001
Time from admission to medication reconciliation, days, median (IQR)	2 (1–3)	2 (1–3)	2 (1–3)	0.283

n = number of patients, SD = standard deviation, COPD = chronic obstructive pulmonary disease, IQR = interquartile range

frequent discrepancies were omission (236 of 365, 64.7%), non-formulary medication omission (59 of 365, 16.2%), dose discrepancy (37 of 365, 10.1%), and frequency discrepancy (15 of 365, 4.1%). Additional discrepancies are reported in Table 2. Cardiovascular, psychiatric, neurologic, and gastrointestinal drugs classes made up 31.5%, 15%, and between 11.6% and 8.9% of the total number of medication discrepancies, respectively.

The most common pharmacist reconciliation recommendations were medication addition (234 of 355, 65.9%), dose or frequency modification (53 of 355, 14.9%), and formulary substitution (47 of 355, 13.2%). The mean number of recommendations per patient increased over time, with averages 1.36, 1.94, 1.68 and 1.94, respectively, in the 4 time periods under investigation, but this trend was not statistically significant ($p=0.482$, Cochran-Armitage trend test); this data is not shown. Overall, 22% of pharmacist recommendations were implemented by the prescriber within 72 hours of pharmacist documentation.

DISCUSSION

Few studies have examined the utilization and impact of pharmacy technicians taking medication history in combination with pharmacist medication reconciliation services and results from our study suggest that the pharmacy collaboration with technicians and pharmacists can decrease the amount of inpatient medication reconciliation related discrepancies.

Half (52.5%) of the patients were identified to have at least one medication discrepancy. As found in previous studies, the individual risk for a medication discrepancy at hospital

admission ranges from 34.2% to 61.6%.^{3,4,13} The most common medication discrepancy in this study was medication omission (64.7%), followed by non-formulary medication omissions (16.2%). Multiple studies have documented medication omission as the most frequent discrepancy amongst general medicine and orthopedic patients identified through medication reconciliation.^{3,4,13}

Cardiovascular, psychiatric, neurologic, and gastrointestinal drugs were the most frequent classes implicated in medication discrepancies. This is similar to the data previously reported for medication reconciliation in the internal medicine population, and is also a reflection of the patient comorbidities and the most commonly reconciled drug classes.¹⁴ Classifying the pharmacist's recommendations and the percentage of recommendations implemented by the prescriber during medication reconciliation is not well documented in literature. In this study only urgent recommendations were verbally communicated to prescribers and all other recommendations were documented in the EHR.^{15,16}

This study is limited by its retrospective nature, which restricts the ability to quantify true implementation rates, and to identify prescriber rationale for non-implementation. It is important to emphasize that this study was conducted during the first year of the PTMR program implementation, and that process improvement changes were continuously occurring at the time of data collection. This program was the first time pharmacists recommendations were documented in the HER at this institution. This new process of documenting pharmacist recommendations in the EHR likely contributes to the low rate of overall pharmacist's recommendation acceptance rate.

The study also includes various strengths. It presents data to support exploration and utilization of PTMR programs to decrease medication discrepancies. Additionally, this study analyzes the impact of the program over time, during which pharmacist identified medication discrepancies and reconciliation recommendations increased, possibly suggesting that the program's quality continues to improve.

Type of Medication Discrepancy	Number (%)
Omission	236 (64.7%)
Non-formulary omission	59 (16.2%)
Dose discrepancy	37 (10.1%)
Frequency discrepancy	15 (4.1%)
Drug interaction	8 (2.1%)
Additional medication	7 (1.9%)
Formulation discrepancy	2 (0.6%)
Failure to adjust for renal dysfunction	1 (0.3%)

CONCLUSIONS

Results from this study suggest that a collaborative approach with pharmacy technicians and pharmacists providing medication history and admission reconciliation services can identify many medication history and other dose related discrepancies. Ways to increase the provider acceptance rate of pharmacist's recommendations need to be further explored for continuing the success of a pharmacy driven medication reconciliation process. More outcome data is crucial to assess impact on long-term patient outcomes.

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CONFLICT OF INTEREST

None declared.

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