Original Article

Errors Related to Medication Reconciliation: A Prospective Study in Patients Admitted to the Post CCU

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Abstract

Medication errors are one of the important factors that increase fatal injuries to the patients and burden significant economic costs to the health care. An appropriate medical history could reduce errors related to omission of the previous drugs at the time of hospitalization. The aim of this study, as first one in Iran, was evaluating the discrepancies between medication histories obtained by pharmacists and physicians/nurses and first order of physician. From September 2012 until March 2013, patients admitted to the post CCU of a 550 bed university hospital, were recruited in the study. As a part of medication reconciliation on admission, the physicians/nurses obtained medication history from all admitted patients. For patients included in the study, medication history was obtained by both physician/nurse and a pharmacy student (after training by a faculty clinical pharmacist) during the first 24 h of admission. 250 patients met inclusion criteria. The mean age of patients was 61.19 ± 14.41 years. Comparing pharmacy student drug history with medication lists obtained by nurses/physicians revealed 3036 discrepancies. On average, 12.14 discrepancies, ranged from 0 to 68, were identified per patient. Only in 20 patients (8%) there was 100 % agreement among medication lists obtained by pharmacist and physician/nurse. Comparing the medications by list of drugs ordered by physician at first visit showed 12.1 discrepancies on average ranging 0 to 72. According to the results, omission errors in our setting are higher than other countries. Pharmacy-based medication reconciliation could be recommended to decrease this type of error.

Introduction

Medication error can be defined as a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient (1). Adverse drug events (ADEs), defined as a drug-related injury (2), is a widespread patient safety concern, happening in 5–40 % of hospitalized patients and in 12–17% of patients

post-discharge (3-6). Beyond their human toll, MEs and ADEs are economically costly as well. These errors can extend treatment courses and hospital stays as well as necessitate therapeutic and pharmacologic intervention. Cost modeling study, compiled in 2000 at the University of Arizona revealed that the morbidity and mortality costs for MEs were in the range of $177 billion among the U.S. ambulatory population alone (7).

Part of ADEs is due to medication discrepancies, or unexplained variations in medications in hospital admission and discharge

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or across different sites of care (8, 9). Medication discrepancies at the time of hospital admission are common occurring in up to 67 % of patients at admission (10, 11). ADEs associated with medication discrepancies can prolong hospital stays and, in the post-discharge period, may lead to emergency room visits, hospital readmissions, and utilization of other healthcare resources (12, 13).

Medication reconciliation, the process of identifying the most accurate list of all patient's medications is a strategy to identify many medication discrepancies and reduce potential harm (14). Up to a quarter of all prescription medications taken by patients prior to admission are not correctly documented within the medical record in hospital admission (15). Several studies have reported that high-quality medication reconciliation improves the overall care provided to hospitalized patients with decreasing drug discrepancies (16-18). Medication discrepancies have been categorized as omission of prescription or nonprescription medications; differing dosage form, dose, or route recorded; and/or therapeutic substitutions; among others. Furthermore, the impact of these discrepancies can be great, with up to 40% of noted discrepancies having the potential to cause "moderate to severe" patient discomfort and/or a decline in patient clinical status (17).

Despite clear evidence, which shows the importance of pharmacy-based medication reconciliation in the ED (19-22), pharmacists are rarely on site at our hospital, and medication reconciliation is almost often performed by nurses. Because little is known about how medication reconciliation is currently practiced in our country, the aim of current study, as the first research in Iran, is evaluation of the error rate in patients′ medication history in hospitalized patients.

Experimental

This study was carried out in the Post CCU of a 550-bed university hospital affiliated to Shahid Beheshti University, Tehran, Iran. In this prospective single center observational study, 250 patients who admitted from September 2012 until March 2013 to the post CCU were assessed by a fifth-year Pharm. D., student of the Shahid Beheshti University of Medical Sciences, with supervision of a clinical pharmacy specialist two days a week for inclusion in this study. Patients were included if they were Farsi-speaking, aged 18 years or older and admitted to the hospital in the past 24 h.

Pharmacy students were trained by his preceptor, a clinical pharmacy faculty member with an active practice site at the institution, to conduct patient interviews and obtain detailed medication histories. Medication reconciliation, for the purposes of this study, was defined as reviewing the preadmission medication list (s) obtained by interviewing the patient and/or family member(s) of the patient, and checking the pre-admission documents (if available) to obtain the most accurate pre-admission medication list. All patients, regardless of their inclusion in this study, had standard-of-care medication reconciliation performed by the hospital nursing and medical staff as part of their admission to the institution.

Discrepancies were defined as any deviation between the student pharmacist-obtained admission medication′ list at two levels; with list obtained by the nurses and/or physicians and with list of drugs ordered at first visit by attending physician. A discrepancy was classified as an omission if a medication was not included within the nurse or physician-obtained medication reconciliation list and/or list of prescribed medications, either in whole or in part (e.g. omission of dosage form, route, strength, or frequency). Any newly started medication(s) related to admission were excluded from this count.

Statistical analysis was performed using SPSS, version 16 (SPSS Inc., Chicago, IL). Continuous variables in each group of subjects were expressed as mean values ± standard deviation (SD).

Differences between mean of two groups were performed using student t-test. Chi-square tests to compare dichotomous variable were used. A p value of less than or equal to 0.05 was considered significant.

Results

During the study period, 250 patients met

Table 1. Demographics of Patients Enrolled in the Study.

Characteristic		Value
Male Gender, No. (%)		160 (64%)
Age in years, Mean ± SD		61.19± 14.14
	Male	60.06 ± 14.52
	Female	63.19 ± 14.09
Before admission medications, Mean (range)		3.99 (0-12)

the criteria for recruitment in the study. All patients were visited within 24 h after hospital admission for review of their medication history by Pharmacy studen t. The mean interview time by pharmacy student to document the patient's medication history was 15 min. The mean age of patients was 61.19 ± 14.41 years. The baseline patient characteristics are listed in Table 1.

In total 998 medications, including 5988 potential for errors (6 error potential for each medication including missed drug, generic name, dosage form, strength, rout of administration and frequency), were recorded by pharmacy student.

Comparing pharmacy student drug history with medication lists obtained by nurses or physicians revealed 3036 discrepancies. On average, 12.14 discrepancies were identified per patient; however, the number of discrepancies per patient ranged from 0 to 68. Only in 20 patients (8 %) there was 100% agreement among medication lists obtained by pharmacist and physician/nurse. Comparing the medications by

list of drugs ordered by physician at first visit showed 12.1 discrepancies on average ranging 0 to 72. The frequencies of various types of omission errors are shown in Table 2.

The Omission errors according to ATC classification between drug history of pharmacy student, physician/nurse medication list and first prescriptions of physician are summarized in table 3.

Discussion

This study shows that the actual use of medications at home by patients admitted to the cardiac ward of hospital was largely discrepant with the medication history recorded by usual care. The amount of discrepant medication histories varies widely from 10% to 96% in different settings (10, 23). In our study, compared to usual care, the pharmacist-based procedure identified a discrepancy in medication use in 92 % of the patients resulting in a total of 3036

Table 2. Description of discrepancies between pharmacy student medication list, physician or nurse medication list and physician drugs ordered at first visit.

Omission error	History of physician/nurse				Physician's first order		
	No.	Mean ±SD	IQR		No.	Mean ±SD	IQR
Medication	269	1.1±1.9	0-1		438	1.8±2.5	0-2
Generic name	360	1.4±2.0	0-2		497	2±2.5	0-3
Dosage form	510	2.0±2.6	0-3		430	1.7±2.5	0-2
Strength	543	2.2±2.6	0-3		462	2.2±2.6	0-3
Frequency	565	2.3±2.6	0-4		473	1.9-2.5	0-3
Route	789	3.2±2.7	1-5		731	2.9±2.7	1-4

Table 3. Prescription errors according to ATC classification.

ATC	Major drugs	No. of omission errors	
		List of physician/nurse	Physician's first order
A. alimentary tract and metabolism	Insulin	7	16
	Pantoprazole	6	12
	Metformin	6	9
	Clopidogrel	6	7
B. blood and blood-forming organs	Nitroglycerin	11	28
C. cardiovascular system	Atorvastatin	18	27
	Losartan	17	25
G. genitourinary system and sex hormones	Trazocin	2	3
H. systemic hormonal preparations, excl. sex hormones and Insulin	Levothyroxin	1	2
J. anti-infective for systemic use	Ciprofloxacin	3	3
	Amoxicillin	3	3
M. muscular-skeletal system	Celecoxib	5	7
N. nervous system	Aspirin	20	18
R. respiratory system	Theophyllin	3	4
Z. Uncoded	Thymus vulgaris	2	2
	Silybum marianum	2	2

discrepancies (mean 12.14, range 0–68).

The Medication reconciliation on admission to a health care system has provided many challenges with respect to the admission medication order process (20). In several studies increased accuracy of medications per patient was demonstrated using pharmacy service to obtain medication histories (24-27).

Winter *et al* (28) defined discrepancies as any difference between the pharmacist-acquired medication history and that obtained by the physician and compared medication histories obtained in the Emergency Department (ED) by pharmacists versus physicians. In this prospective study, 5963 discrepancies were identified and from 3594 medication histories, 59% revealed discrepancies. The authors concluded that medication histories are very often incomplete in the ED. In our study, the disagreement between physician and pharmacist drug histories found in 92% of patients, which could be due to poor attention of clinical team to proper medication histories and lack of structured pharmacy based service for medication reconciliation process.

A similar study was conducted by Prins MC *et al* (29) in a psychiatric clinic to determine the number of discrepancies in medication use at admission, comparing the structured history of medication use procedure with the usual procedure for taking the medication history. They identified 100 discrepancies (median 2 per patient, range 0-8) in medication use in 50 elderly psychiatric patients; 78 % (n= 39) of the patients had at least one discrepancy. Of the discrepancies, 69 % were drug omissions, and 31 % were drug additions or discrepancies in the frequency or dosage of medications. The percentage of discrepancies in our study was higher than the study by Prins *et al*. (92 % vs. 78 %). This could be due to the difference in the definition of errors. We evaluated 6 error potentials for each medication compared to three in the study by*Prins*.

To the best of our knowledge, this is the first

prospective observational study in an inpatient cardiac setting that has focused on the first step of medication reconciliation and the medication prescribed by first visiting physician. The results of this study suggest that the frequency of discrepancies in medication use recorded at admission is at least in post CCU setting as high as in other settings. Another finding of this study is the high number of discrepancies in first visit, which shows more than 90 % of patients did not received at least one medication at the first day of hospital stay. A factor, could be effective on the data gathering of physician or nurses, was related to the process timing. Most nurses and physicians, who are involved, spent lower time than pharmacy student because of their limitations such as work loading, level of their responsibility, and stressful conditions. The data indicated that student pharmacist more reasonable document complete medication lists as compared with nurses and physicians . In addition to the patient care benefits, institutions could persuade by using student pharmacists for medication reconciliation

This study had some limitations. It was not feasible to take a reliable drug history from some patients because of the level of their consciousness or education state, so some medications were missed. Also, we didn't evaluate the clinical importance of detected medication errors. The nurses and physicians in this study did not receive same training on how to obtain a medication history such as pharmacy student and did not follow a same method for interviewing patients. These differences of obtaining the medication list approach may impact on accuracy of our findings.

Conclusion

Proper medication histories at the time of hospital admission are the important points of medication safety. To make a comprehensive medication history, addition to role of patients and family members, use of systematic method for standardization of data gathering seems necessary. Pharmacists' attendance can be a considerable element for making an accurate medication history of patients .

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