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Medication Reconciliation at Admission by Pharmacists in a Teaching Referral Hospital in Iran

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Abstract

Medication errors may prolong hospitalization period, enhance its costs and make harmful impacts on health. Inappropriate drug history taking is a type of medication errors which may occur on admission, resulting in medication discrepancies. This work presents a report of discrepancies between the drug history acquired by pharmacists and the drugs administered by the physicians at a teaching hospital in Shiraz, Iran. This cross-sectional study was conducted during three months from October to December 2017 in 7 wards of Namazi hospital affiliated to Shiraz University of Medical Sciences. Both the physicians/nurses and pharmacists obtained medication history from patients recruited in this study during the first 24 hours of their admission. The medications were classified according to the Anatomical Therapeutic Chemical classification. Totally, 103 patients were recruited and 557 medications were recorded in this study. The mean±standard deviation age of patients was 58.52±18.75 years. Comparing pharmacist drug history with medication lists obtained by nurses or physicians revealed 353 discrepancies. On average, 3.42 discrepancies were identified per patient (ranged from 0 to 12). Most (85.8%) of medication discrepancies were related to omission errors. Metformin and aspirin were the most common medications involved in omission errors. The rate of medication discrepancies at admission in our hospital was high. Active contribution of pharmacists and providing accurate medication histories at the time of hospital admission can be considered as possible solutions for this problem.

Keywords: Hospital admission, Medication reconciliation, Medication errors, Pharmacists.

1. Introduction

Medication errors (MEs) can be defined as avoidable happenings that may result in improper use of medications, harm for the patient and failure in the treatment process in which the health care professional, patient or consumer are responsible (1). According to the Institute for Safe Medication Practices (ISMP) Canada, adverse drug events (AEDs) include adverse drug reactions and damage from medication incidents and are defined as injuries from a medicine or lack of an intended medicine (2). AEDs are common and costly in the hospital settings while more than half of them are estimated to be preventable (3, 4). Increased costs can be due to increases in length of stay or pharmacy and laboratory costs (5).

AEDs occur more frequently when the patients are admitted or discharged from the hospitals through medication discrepancies which is considered as differences among documented medication regimens across different sites of care (6-8). Sixty percent of all MEs occur at hospital admission, intra- hospital transfer and discharge. On the other hand, 70% of patients experience discrepancies, while approximately one-third of them are potentially harmful and 3% may be clinically serious (9, 10). The most common MEs occurring in

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the process of transferring patients are unintended medication changes, including medication omissions, incorrect route of administration, incorrect dose and incorrect frequency of medication given (11, 12).

Medication reconciliation was established as a National Patient Safety Goal (NPSG) by The Joint Commission (TJC) in 2005 (13). It is defined as identifying an accurate list of medications that the patient has been taken before and comparing with the current medication list. This reconciliation can help decreasing MEs including omissions, duplications, dosing errors, and drug interactions. Medication reconciliation should be done at any stage in which the patient's medications are being changed.(14) Medication reconciliation is a highly complex process but if it is conducted correctly, it can enhance the quality of care greatly (15). Clinical data have shown that employing reconciliation systems can led to reduced MEs in health care organizations (16).

Different studies have indicated that the process of medication reconciliation at various stages including hospital admission, transition, and discharge are better done by pharmacists. Involving pharmacists in this process can lead to enhanced patients' safety, more accurate medication history, and decreased costs (17-20). Currently, medication reconciliation is considered as a criterion for accreditation of health care settings in countries such as Canada and the United States (21). In contrast, little attention has been given to this matter in our country.

The aim of current study is to present a report of discrepancies between the drug history acquired by pharmacists and the drugs administered by the physicians at a teaching hospital in Shiraz, Iran.

2. Methods

This study was conducted in 7 wards of Namazi hospital, a general multispecialty, referral, tertiary, teaching health-care setting, affiliated to Shiraz University of Medical Sciences, Shiraz, Iran. The wards included emergency (n=4), internal (n=2), and neurology (n=1). This cross-sectional, observational study was carried out on patients admitted to the above wards from October to December 2017. No specific inclusion/exclusion criteria such as age, diagnosis, or number of administered medications were considered for patient recruiting. The Medical Ethics Committee of the hospital approved the study and each patient or his/her family members gave their written consent form.

Five educated pharmacists obtained medication history from patients during the first 24 hours of hospital admission. Two faculty member clinical pharmacists provided education and training regarding the medication reconciliation process.

A data collection form was designed which included the patients' demographic information (name, age, gender, ward, disease), the drugs used by the patient before admission to the hospital and those prescribed by the physician in the hospital. The medications were classified according to the Anatomical Therapeutic Chemical (ATC) classification system (22). The medical histories of all patients were taken by nurses or medical staff as a routine practice. The preadmission medication list was also obtained by pharmacists via taking best possible medication history (BPMH). This was done by interviewing the patient and/or the family members of the patient along with reviewing of at least one other reliable source of information to verify patient's medication use. These sources included: 1) physician medication list or referral letter, 2) patient self-medication list, 3) patient's own medications, prescriptions or dose administration aids, and 4) previous hospital discharge summary. Then, the pharmacist compared the patient's medications prior to admission with the current new prescriptions ordered at first visit by the physician. Any discrepancy was recorded and classified as a dose (dosage differed from previous use) or omission discrepancy (deletion of a drug previously used).

Statistical analysis was performed using SPSS, version 20 (SPSS Inc., Chicago, IL). Continuous and categorical variables were expressed as mean values ± standard deviation (SD) and percent, respectively. Pearson correlation analysis was used to define the correlation between the number of administered drugs and the number of discrepancies. Univariate and multivariate logistic regres-

Table 1. Discrepancies between pharmacists' medication list and physician drugs ordered at first visit according to the Anatomical Therapeutic Chemical classification system.

ATC	Number of Stopped Drugs (%)[1]	Number of Drugs with Changes in Dose (%)[2]	Total
A. Alimentary tract and metabolism	107 (57.5%)	13 (6.98%)	120
B. Blood and blood-forming organs	21 (51.2%)	2 (4.8%)	23
C. Cardiovascular system	79 (48.6%)	17 (11.5%)	96
D. Dermatologicals	2 (100%)	0	2
G. Genitourinary system and sex hormones	8 (88.9%)	0	8
H. Systemic hormonal preparations, excl. sex hormones and Insulin	3 (20.1%)	1 (2.5%)	4
J. Anti-infective for systemic use	17 (68%)	0	17
L. Antineoplastic and immunomodulating agents	7 (43.8%)	2 (12.5%)	9
M. Muscular-skeletal system	14 (87.5%)	0	14
N. Nervous system	36 (47.3%)	12 (15.7%)	48
P. Antiparasitic products, insecticides and repellents	0	0	0
R. Respiratory system	8 (50%)	3 (18.8%)	11
S. Sensory organs	0	0	0
V. Various	1 (100%)	0	1

[1]% = (the number of stopped drugs/ the total number of administered drugs in each category) * 100.

[2]% = (the number of changed drugs/ the total number of administered drugs in each category) * 100.

sion analyses were exploited to determine the associated factors of omission errors. In the first step, each of the demographic and clinical characteristics (age, sex, type of ward, number of discrepancies, and number of co-administered medications) as independent variables were separately entered into the univariate logistic regression analyses. Those with p values <0.1 were selected and then entered together into the final multivariate logistic regression model. Odds ratio (OR) and their 95% confidence interval (CI) were calculated for all independent variables in both univariate and multivariate logistic regression models. Except for univariate logistic regression analysis (*P* value<0.1), p values less than 0.05 were considered to be statistically significant for other tests.

3. Results and Discussion

During the three-month study period, 103 patients were recruited. Their mean ± SD age was 58.09±19.61 years. More than half (56.3%) of the cohort were females. In total, 561 medications and 195 various types of medications were recorded by the pharmacists. The five most commonly used drugs among patients were aspirin (4.5%), atorvastatin (4.3%), pantoprazole (3.9%), prednisolone (3.9%), and nitrocantin (3.2%).

Comparing pharmacist drug history with medications prescribed by the physicians at their first visits revealed 353 discrepancies. Among them, 303 were the omission errors. On average, 3.42 discrepancies were identified per patient (ranged from 0 to 12). Only 6 patients (5.8%) did not experience any discrepancies. The number of stopped drugs and those with changes in dose according to ATC classification are summarized in table 1. Alimentary tract and metabolism, cardiovascular system, and nervous system were the 3 most common medication classes involved in discrepancies. Regarding omission errors, metformin and aspirin were the most commonly affected medications (Table 2).

A positive and significant correlation was observed between the number of medications and the number of detected discrepancies (P<0.001 and r=0.757). According to results of univariate logis-

Table 2. The most common drugs associated with omission errors according to the Anatomical Therapeutic Chemical classification system.

ATC	Major Drugs	Number of Omission Errors
A. alimentary tract and metabolism	Metformin	14
	Ranitidine	9
	Calcium supplements	9
	Glibenclamide	7
B. blood and blood-forming organs	Aspirin	13
	Warfarin	4
C. cardiovascular system	Captopril	10
	Nitrocantin	8
	Losartan	6
	Metoprolol	6
G. genitourinary system and sex hormones	Tamsulosin	3
H. systemic hormonal preparations, excl. sex hormones and Insulin	Prednisolone	2
J. anti-infective for systemic use	Ciprofloxacin	3
M. muscular-skeletal system	Diclofenac	4
N. nervous system	Alprazolam	7
	Gabapentin	7
R. respiratory system	Theophylline	2
	Salbutamol	2

tic regression analysis, age (p=0.03), type of ward (p=0.053), number of discrepancies (p=0.001), and number of medications (p=0.06) were selected. Multivariate logistic regression analysis demonstrated that only number of discrepancies (OR=3.656 [95%CI=1.513-8.835], p=0.004) was significantly associated with omission error(s) (Table 3).

This study presents a report of discrepancies between the pharmacist- acquired drug histories and those acquired by physicians or nurses in 7 wards of a referral hospital in Iran. Medication discrepancies, usually omission as the most harmful one, may increase drug adverse events. Medication reconciliation can prevent these events along with providing beneficial cost effects for the health-care system (23, 24). Several studies have showed that pharmacists', particularly a clinical pharmacist (25), involvement in obtaining the drug history could lead to a more accurate and complete patient medications list compared with physicians or nursing staff (26-29).

The current study showed that in many cases, medications used by the patients at home were not in agreement with the drug history reported in their medical file. As Winter et al. defined (30), discrepancies in our study are also considered as any differences between the drug history acquired by a pharmacist and the one obtained by nurses or physicians in the wards. Discrepancies in this study were 353 totally, of which 303 errors were omissions. There were 3.42 discrepancies per patient. In other words, 94.17% of the cohort experienced at least one medication discrepancy.

In fact, medication histories are often incomplete in our hospital, which may be partially due to the heavy workload of healthcare professionals especially in teaching and referral clinical settings after the Health Revolution Program since May 2013 in Iran. Stressful environment, lack of responsibility and knowledge about pharmacologic and pharmacokinetic features of drugs are other probable reasons for this finding (31). All of these can result in spending less time or even overlooking drug histories by nurses and physicians.

In line with our findings, Haji Aghajani

Table 3. Comparison of demographic and clinical characteristics of patients with and without omission errors.

Variable	Patients without omission error(s) (n=10)	Patients with omission error(s)(n=93)	Univariate		Multivariate	
			OR (95% CI)	p value	OR (95% CI)	p value
Age (years)						
Mean ±SD	59.95±18.68	45.8±14.78	1.04 (1.004-1.078)	0.03	1.018 (0.97-1.068)	0.471
Range	2-91	25-64				
Sex (%)						
Male	6 (60)	39 (41.93)	2.077 (0.549-7.857)	0.282	---	---
Female	4 (40)	54 (58.06)				
Ward (%)						
Emergency	8 (80)	42 (45.16)	0.206 (0.041-1.022)	0.053	0.189 (0.03-1.202)	0.078
Non-emergency	2 (20)	51 (54.84)				
Number of discrepancies						
Median (interquartile range)	3 (3)	0 (2)	4.315 (1.794-10.38)	0.001	3.656 (1.13-8.835)	0.004
Range	1-12	0-3				
Number of medications						
Median (interquartile range)	5 (5)	3 (3)	1.338 (0.988-1.811)	0.06	1.090 (0.761-1.563)	0.637
Range	1-17	1-10				
Medication category (%)						
Alimentary tract & metabolism, cardiovascular system, and nervous system	6 (60)	86 (92.47)	3.909 (0.64-23.879)	0.14	---	---
Others	4 (40)	7 (7.53)				

et al.(31) showed 92% medication discrepancies (average 12.14, ranging from 0 to 68) regarding medication histories obtained by pharmacists and physicians/nurses and first order of physician in the first 24hr admission of 250 patients in the post-CCU ward of a university hospital in Tehran. Prins et al.(32) also reported that 78% of patients admitted to the psychiatric clinic of a large psychiatric teaching hospital in the Netherlands had at least one medication discrepancy, of which 69% were drug omissions. The rate of medication discrepancies at admission in the general medicine, cardiology, or general surgery services of a tertiary care teaching hospital in the United States was 23% (33). Finally, in a systematic review on 22 studies involving a total of 3,755 patients by Tam et. al., medication discrepancies occurred in 10-67% of cases. Sixty percent to 67% had at least 1 omission or commission error (34). A cross sectional study on 200 patients in a teaching hospital in Tehran, Iran also reported that 77.5% of patients had at least one discrepancy between home medications and medications ordered in the emergency department (35). This large difference in the rate of medication discrepancies could be attributed to the definition of discrepancies, patient turn over, level of staff training about drug reconciliation, and pharmacist cooperation in the centers in which studies were conducted.

Regarding omission errors, alimentary

tract and metabolism, cardiovascular system, blood and blood-forming organs were the most commonly affected medication classes in our study. Similar results were reported by Haji Aghajani et. al. from a university hospital in Tehran (31). In another study at the emergency department in Iran, most of discrepancies were developed in cardiovascular and nervous system medications. However, medication groups were not linked statistically to the discrepancies in this survey (35). In the case of medication discrepancy, antibiotics, antihypertensives, antihyperglycemics, opioid analgesics, antipsychotics, anticoagulants, and immunosuppressives can have a more clinical relevance (36).

A number of researches have demonstrated that using information technologies (ITs) in various forms (25) and computerized physician order entry (CPOE) (23) may diminish the medication errors. These technologies can facilitate the reconciliation process and its integration into clinical practice. Determining the person in charge, appropriate time and method of reporting medication discrepancies to the prescriber are crucial issues in the reconciliation process (36). Major identified barriers to medication reconciliation are insufficient knowledge about benefits and necessities of the process, unclear task reallocation, and lack of collaboration as well as arrangements between members of the health-care team (37).

In this study, multivariate logistic regression analysis revealed that the number of discrepancies was significantly associated with the omission errors (OR=3.656 [95%CI=1.513-8.835], p=0.004). In line with this finding, a positive as well as significant correlation was also observed between the number of medications and the number of detected discrepancies in our cohort. A retrospective cohort study on medication reconciliation at admission and discharge in tertiary care academic teaching hospital in the United States identified age, general surgery service, and being on high-risk medication classes at admission as risk factors for medication discrepancies on admission (33). Additionally, Geurts et al. in a retrospective study in the Netherlands found out the number of post-discharge medication discrepancies was significantly associated with the number of drugs administered after discharge (38). Higher age, patient's lack of understanding of his/her drug treatment, prolonged hospital stay, and polypharmacy have been reported as other risk factors of reconciliation errors (36).

The current study had several limitations. First, obtaining an accurate drug history was not so feasible in some cases, since patients and/or their relatives were not cooperative or informative and also other reliable source of information were not available. Second, no interventions or clinical evaluations were implemented on medication discrepancies due to the cross-sectional and observational methodology of the study. Last but not least, there was no data whether identified discrepancies were either intentional or unintentional. Therefore, the rate of omission errors in our cohort may be overestimated. According to Tam et al systematic review, only 5 out of 20 studies reported unintentional and intentional discrepancies. In this regards, 19-75% of medication discrepancies at admission were unintentional (34).

4. Conclusion

In conclusion, the rate of medication discrepancies between prescribed medications at admission and medication history taken by the pharmacist team in our hospital was high (94.17%). Most (85.8%) medication discrepancies at hospital admission of the cohort were related to the omission errors. Metformin and aspirin were the most common medications involved in omission errors. Number of discrepancies was significantly associated with the omission errors. Commitment and active contribution of healthcare staffs especially pharmacists is crucial in taking a comprehensive and appropriate medication history at hospital admission and consequently, minimizing errors relevant to medication discrepancies. Pharmacist-led medication reconciliation programs at patient transitions between wards and discharge from hospital can be interesting topics for the future relevant investigations in our clinical settings.

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Conflict of Interest

None declared.

5. References

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