Original Article

Mahidol University Journal of Pharmaceutical Science 2009; 36 (1-4), 44-49

Incidence of Medication Errors in Medication Reconciliation at General Medical Wards, Ramathibodi Hospital

T. Paiboonvong[1], P. Montakantikul[1], S. Chansirikarnjana,[2] and P. Tragulpiankit[1]*

[1]Faculty of Pharmacy, Mahidol University
[2]Faculty of Medicine, Ramathibodi Hospital, Mahidol University

Abstract

To determine medication errors (MEs) by pharmacist during medication reconciliation at the time of admission, transfer and discharge at Ramathibodi Hospital. A prospective descriptive study, patients were enrolled at the time of admission between February and April, 2008 at general medical wards, Ramathibodi Hospital, a teaching institution at Mahidol University, Thailand. One clinical pharmacist interviewed each patient to obtain medication history and reconciled the lists with medication orders during admission until discharge. At admission, current medications that the patients were taking were compared with admission medication orders. At transfer, medications during hospitalization were compared with medication orders at transferring units. At discharge, the medications before admission and during hospitalization were compared with discharged orders. All medication discrepancies were discussed with physicians to classify as intention, undocumented intention or unintention which were considered to be MEs. Overall, 41.1% of patients had MEs at the time of admission, transfer or discharge. Most of MEs (29.9%) occurred at the admission time. Of 77 MEs, omission of medications (61%) was commonly found at admission through discharge and 87.3% of errors were prevented by the pharmacist before reaching the patient. MEs at transition points of patient care were common and medication reconciliation was a strategy to prevent MEs. Pharmacist had an important role in preventing MEs by reconciling medications.

Key words: medication errors, medication reconciliation, Ramathibodi Hospital

INTRODUCTION

Medication errors (MEs) are preventable events and commonly occur at the interfaces of care when a patient is admitted, transferred, or discharged from a health care facility. Medication discrepancy at transition points of patient care may lead to MEs and adverse drug events (ADEs) among hospitalized and discharged patients[1-3]. According to the Institute for Healthcare Improvement (IHI), poor communication of medication information at transition points was responsible for a half of all MEs in hospitals. Therefore, the IHI has provided medication reconciliation as one strategy to prevent MEs[4]. Medication reconciliation has been announced by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) as a new 2005 National Patients safety Goal, the strategy to reduce medication error. In 2006, National Patients safety Goal required accurate and complete reconciling medications across the continuum of care[5,6]. The medication reconciliation process consists

***Corresponding author:** Faculty of Pharmacy, Mahidol University, 447 Sri-Ayudhya Road, Bangkok, Thailand. Email: pypmt@mahidol.ac.th

of a three-step. Verification is the first step by collecting the patient's history and other medication information. Second step is clarification that ensures medications and dosages are appropriate for the patient, and the final step is reconciliation by resolving any discrepancies, documenting communications, and change in orders[4].

Cornish et al found that 53.6% of patients had at least one ME at admission time and 38.6% of discrepancies had the potential to cause harm[2]. Vira et al studied to identify and rectify MEs at admission through discharge, and they found that 60% of patients had MEs[7]. In addition, Gealson et al found that 22% of discrepancies caused patient harm during hospitalization if the pharmacist did not provide interventions. Moreover, one discrepancy resulted in patient's death[8]. Pharmacist participated in the admission process can improve the process by obtaining a medication history[9,10]. Pharmacist's actions were involved by obtaining an accurate and complete medication history to reconcile a medication at transition points of care. Pharmacist's participation with health-care teams, including nurses and physicians is useful because the knowledge and skill of clinical pharmacist in pharmaceutical care[11]. Nester and Hale found that patient's medication histories taken by pharmacists have effectiveness in more accurate medication and allergy information at the time of admission[9]. Unfortunately, there were few studies to determining medication errors at admission through discharge, including impact of pharmacist in medication reconciliation process. For these reasons, the present study was to determine MEs by pharmacist in medication reconciliation at the time of admission, transfer and discharge.

METHODS

A prospective descriptive study was conducted at Ramathibodi Hospital, Thailand. Patients were selected from the general medical wards between February and April 2008. Inclusion criteria: The first of all patients who were admitted to the general medical wards in each day, and receiving at least one medication before admission. Exclusion criteria: Patients who were discharged or transferred to other care units within 24 hours after admitting to the general medical wards.

The pharmacist conducted study for reconciling medications at admission, transfer and discharge. Medication history of all patients was reviewed by nurse, physician, and pharmacist as usual care. The initial process, the pharmacist reviewed medication history, including allergy, dietary supplement and herbal medicines used of all patients from several sources of medication information; interviewed patient or caregiver, previous medical record, pharmacy record and the medication bottle. Consequently, the pharmacist compared admission medication orders with medications that patient were taking before admission. Any differences between the two were considered to be a medication discrepancy at admission classified as intentional, undocumented intentional and unintentional by discussing with the physician. When discrepancies were identified as MEs the pharmacist will intervene and resolve these problems with physician. Moreover, reconciliation time also was recorded at admission. Discrepancy in dietary supplement and herbal medicines were excluded from medication discrepancy in this study.

All patients were followed to reconcile medications during transfer and discharge. For patients transferred to other care units within the hospital, their current medications before transfer were compared with medication orders at transferring units to classify type of discrepancy by discussing with the physician. During discharged phase, hospitalized medications and medications taken before admission were compared with discharge medication orders as well as admission and transfer phase. Our study defined unintentional medication discrepancies as MEs and severity of MEs were assessed by potential to cause patient harm. Characteristics of MEs were categorized as omission, different dose, route or frequency, commission, and medication change within a medication class. Data were analyzed by classifying type of discrepancies, type of MEs and

severity of MEs (appendix) shown as the number and percentage at admission, during transfer and discharge.

RESULTS

One hundred and seven patients were enrolled at the general medical wards following the inclusion and exclusion criteria. Of these, 100 patients were followed until discharge, and 7 patients died during hospitalization. Patient's characteristics and the characteristics of MEs were summarized in table 1 and 2, respectively.

At admission, medication discrepancies were found in 97 out of 107 patients (90.7%) with 450 items (4.6 items per patient). Intentional discrepancy was identified in 135 items (30.0%), Undocumented intentional discrepancy was identified in 259 items (57.6%), and the mean number of current medications before admission was 6.15 items per patient. MEs were identified in 32 out of 107 patients (29.9%) in 56 items or 1.8 items per patient. Omission of medications was the most commonly found in 36 items (64.3%). Different dose, route or frequency was found in 11 items (19.6%) and commission errors were found in 8 items (14.3%), respectively. Group of medications causing MEs was vitamins and minerals (16.1%), followed by antimicrobial drugs (14.3%) and ophthalmic drugs (12.5%). Most of MEs did not reach the patient and were prevented by the pharmacist in 38 items (86.4%) and others were prevented by other health care professional. The physician accepted 90% of the pharmacist's intervention. Reconciliation time was identified as the pharmacist complete medication reconciliation for any problems to the physician. The time was mean $\pm$ SD of 9.65 $\pm$ 6.35 hours per patient. Most patients had the reconciliation time in 6 hours, ranging from 2-48 hours.

Seven patients were transferred to other care units within the hospital. Most of discrepancies were undocumented intentional discrepancy (44.4%). MEs were identified in 28.6% of patients for 3 items. Type of MEs was identified as omission, commission, and different dose, route or frequency category (each of 1 ME; 33.3%). Group of medications causing MEs was vitamins and minerals in 2 items (66.7%) and only 1 item was antihyperglycemic drugs. Most of MEs reached the patient, but did not result in harm (66.7%). Only one error was prevented by nurse at transferring unit. In addition, all the pharmacist's interventions were accepted by the physician.

At discharge, intentional discrepancy was found in 66 out of 95 patients (69.5%) in 156 items (2.4 items per patient). Undocumented intentional discrepancy was found in 85 out of 95 patients (89.5%) in 322 items (3.8 items per patient). MEs were identified in 16% of all patients in 18 items. Group of medications causing MEs were identified as antihyperglycemic drugs (6 items; 33.3%). Omission was commonly found in 10 items (55.6%). All MEs were identified as category B (18 items) prevented by the pharmacist in 17 items (94.4%). All of the pharmacist's interventions were accepted by the physician.

Table 1. Characteristics of patients (n=107)

Characteristics	**N (%)**
Gender	
Male	50(46.7)
Female	57(53.3)
Age	
Mean $\pm$ SD (year)	57.3$\pm$19.6
Range	17-97
Length of hospitalization	
Mean $\pm$ SD (days)	8.5$\pm$6.82
Median	7.00
Range	1-38
Current medications before admission	
Mean $\pm$ SD (items)	6.2$\pm$3.65
Range	1-15
Total	658

Table 2. Characteristics of MEs

	Overall (N=107)	Admission (N=107)	Transfer (N=7)	Discharge (N=100)
Number of patient with medication errors	44(41.1%)	32(29.9%)	2(28.6%)	16(16%)
Number of medication errors	77	56	3	18
Mean number of medication errors per patient	1.5	1.8	1.5	1.1
Type of medication errors				
Omission	47(61.0%)	36(64.3%)	1(33.3%)	10(55.6%)
Different dose, route or frequency	20(26.0%)	11(19.6%)	1(33.3%)	8(44.4%)
Commission	9(11.7%)	8(14.3%)	1(33.3%)	0
Medication change within a medication class	1(1.3%)	1(1.8%)	0	0
Severity of medication errors	77(100%)	56(100%)	3(100%)	18(100%)
Category B	63(81.8%)	44(78.6%)	1(33.3%)	18(100%)
Category C	14(18.2%)	12(21.4%)	2(66.7%)	0
Medication errors prevented by the pharmacist	55(87.3%)	38(86.4%)	0	17(94.4%)

Category B: An error occurred but the error did not reach the patient
Category C: An error occurred that reached the patient, but did not cause patient harm

DISCUSSION

The study's results were similar to the previous study that found MEs at transition points of care. Importantly, most of the patients had omission of medications (61%) which were necessary for continuing in treatment. This finding is consistent with other studies[7,12]. Most of the pharmacist's interventions were accepted by the physician and resulted in change of medication orders.

At admission, the majority of medications involving in MEs in this study were vitamins and minerals (16.1%). This was consistent with the finding of Gealson's study[8] and Lessard's study[12]. However, in our study 50% of vitamins and minerals were ferrous sulfate and folic acid, which were prescribed by the physician for treatment of anemia. Therefore, vitamins and minerals were not concerned by the physicians. Nevertheless, antimicrobial drugs and ophthalmic drugs were responsible for MEs as well as vitamins and minerals. Omission of medications was the most commonly found when the patients were admitted to the hospital. Patients did not receive some medications that were necessary for continuing treatment when admission. Therefore, medication reconciliation process can prevent MEs in omission of medications. The severity of MEs was mostly identified as category B (78.6%). The pharmacist's interventions were able to prevent MEs before reaching the patients (86.4%). However, 3 MEs which reached the patient resulted from the physician reject for the pharmacist's intervention, and 2 MEs were partially accepted by the physician. Other MEs which reached the patients due to the pharmacist could not reconcile medication in time. MEs that reached the patient did not result in patient harm as hospitalization. The reconciliation time was initiated when the patient was admitted to the general medical wards. The pharmacist created complete current medication lists of the patients and any differences between current medications and admission orders were communicated with physician to identify any discrepancies. Other studies required the time to obtain medication history as reconciliation time. Therefore, reconciliation time in this study was longer than others.

At transfer, MEs were identified in 28.6% of the patients (1.5 items per patient). The incidence rate was 0.43 per patient. Moreover, Seutrong[13] reported that MEs during transfer were 4% of patients. The incidence rate was 0.04 items per patient which was lower than our study. However, only 7 patients were transferred to other units and our study did not focus on MEs during transfer. Thus, the result might not reflect the incidence of MEs during transfer in this study

At discharge, MEs found at this point were lower incidence than one in admission. Omission was commonly found in discharge orders, and followed by the different dose, route, or frequency. However, these two types of errors were similar proportion in this study. Most of omission errors resulted from the physician discontinued the drugs at admission, and did not order when the patient was discharged. Most patients were commonly absence of antihyperglycemic drugs that might result in ADEs at home when the pharmacist did not intervene for these MEs. All of MEs did not reach the patients because the pharmacist was able to prevent these errors. This study still had several limitations. First, the study did not interview patient for a last dose medications. The patients might not receive the medication in regular administration time before admission to the general medical wards. Second, our study was not a randomized control trial. Therefore the study might not reflect on the effectiveness of pharmacist to prevent MEs in medication reconciliation. However, the result reflected on the effectiveness of pharmacist in obtaining medication history which was an important process for reconciling medication at admission. Third, the pharmacist did not follow up the patient during hospitalization that might affect the creation of the best possible medication discharge plan. Despite these limitations, results of this study were beneficial for further development of medication reconciliation process.

CONCLUSION

This study found that 41.1% of all patients had MEs in their admission or transfer or discharge. Type of MEs commonly found was omission of medications. Most of MEs (81.8%) did not reach the patients and were prevented by the pharmacist (87.3%). Pharmacist had an important role to obtain medication history and prevent MEs in medication reconciliation.

APPENDIX

Severity of MEs

Category A: Circumstances or events that have the capacity to cause error.

Category B: An error occurred but the error did not reach the patient.

Category C: An error occurred that reached the patient but did not cause patient harm.

Category D: An error occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm.

Category E: An error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention.

Category F: An error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization.

Category G: An error occurred that may have contributed to or resulted in permanent patient harm.

Category H: An error occurred that required intervention necessary to sustain life. Error, Death

Category I: An error occurred that may have contributed to or resulted in the patient's death.

Type of MEs

Omission: Omission of a medication without documented clinical explanation for the omission

Commission: Commission of a medication without documented clinical explanation for the initiation

Different dose, route, or frequency: Different dosage, route, or frequency of a medication what the patient is taking; differences are not explained by changes in the patient's clinical status.

Medication change within a medication class: Different medication from what the patient is taking but within the same medication class without documented clinical explanation or formulary justification for the substitution.

REFERENCES

1. Pippins JR, Gandhi TK, Hamann C, et al. Classifying and predicting errors of inpatient medication reconciliation. *J Gen Intern Med* 2008; 23(9):1414-22.
2. Cornish PL, Knowles SR, Marchesano R, et al. Unintended medication discrepancies at the time of hospital admission. *Arch Intern Med* 2005; 165(4):424-9.
3. Schnipper JL, Kirwin JL, Cotugno MC, et al. Role of pharmacist counseling in preventing adverse drug events after hospitalization. *Arch Intern Med* 2006; 166(5):565-71.
4. Manno MS, Hayes DD. Best-practice interventions: how medication reconciliation saves lives. Nursing 2006; 36(3):63-4.
5. Joint Commission on Accreditation of Healthcare Organizations, Using medication reconciliation to prevent errors. *J Comm Perspect* 2006; 26(3):13-5.
6. Rich DS, Medication reconciliation handbook, Joint Commission Resources, American Society of Health-System Pharmacists, 2006.
7. Vira T, Colquhoun M, Etchells E. Reconcilable differences: correcting medication errors at hospital admission and discharge. *Qual Saf Health Care* 2006; 15(2):122-6.
8. Gleason KM, Groszek JM, Sullivan C, et al. Reconciliation of discrepancies in medication histories and admission orders of newly hospitalized patients. *Am J Health Syst Pharm* 2004; 61(16):1689-95.
9. Nester TM, Hale LS. Effectiveness of a pharmacist-acquired medication history in promoting patient safety. *Am J Health Syst Pharm* 2002; 59(22):2221-5.
10. Lizer MH, Brackbill ML. Medication history reconciliation by pharmacists in an inpatient behavioral health unit. *Am J Health Syst Pharm* 2007; 64(10):1087-91.
11. Varkey P, Cunningham J, O'Meara J, et al. Multidisciplinary approach to inpatient medication reconciliation in an academic setting. *Am J Health Syst Pharm* 2007; 64(8):850-4.
12. Lessard S, DeYoung J, Vazzana N. Medication discrepancies affecting senior patients at hospital admission. *Am J Health Syst Pharm* 2006; 63(8):740-3.
13. Suetrong C. Developing and implementing medication reconciliation process following transition points in patient medication system. Thesis, Chulalongkorn University. Thailand, 2005.