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Original Article

REDUCING OF ERROR IN THE MEDICATION PROCESS OF A PRIVATE HOSPITAL IN NORTHEAST OF THAILAND

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ABSTRACT

Objective: The aim of this study was to compare the decreasing of medication error before and after the developed prevention strategies were used.

Methods: The data of medication errors during January 2009 to December 2010 were retrospective collected. The stages of medication error were identified and medication error rate of each stage was calculated. The developed strategies for prevention of medication errors; look-alike sound-alike drugs management, adverse drug reaction report system, medication error report system, drug information service, and ward stock system were constructed. The data of medication errors during January 2011 to June 2012 were collected. The stages, type, percentage of occurrence, and severity of medication error were identified and calculated. Reducing of medication error was monitored.

Results: Before the developed strategies for prevention of medication error were used, the most stage of medication error was higher error rate than the goal in both out-patient and in-patient departments. However, after the developed strategies were used, the error rate was decreased and less than the goal in both out-patient and in-patient departments indicated that the developed strategies are successful to reduce medication error of this private hospital.

Conclusion: The developed strategies for prevention the medication error reduce the error in the medication process both out-patient and in-patient departments. However, the surveillance of the ME rates should be further monitored.

Keywords: Medication error, Prevention, Private hospital.

INTRODUCTION

A medication error (ME) is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer [1]. There are many stages of medication errors; prescribing error, transcribing error, pre-dispensing error, dispensing error, and administration error. The National Coordinating Council for Medication Error Reporting and Prevention classifies ME index according to the severity of the outcome, categories A-I. Circumstances or an event that have the capacity to cause error was categorized to category A. An error occurred but the error did not reach the patient was categorized to category B. An error occurred that reached the patient but did not cause patient harm was categorized to category C. 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 was categorized to category D. An error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention was categorized to category E. An error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization was categorized to category F. An error occurred that may have contributed to or resulted in permanent patient harm was categorized to category G. An error occurred that required intervention necessary to sustain life was categorized to category H. And an error occurred that may have contributed to or resulted in the patient's death was categorized to category I [2].

The ME may cause patient harm or deaths especially for high alert drugs or narrow therapeutic index drugs [3, 4]. James reports the ME associated with preventable harm in 2008-2011, about 400,000 Americans die each year. In addition, serious harm seems to be 10- to 20-fold more common than lethal harm [5]. Some researches showed that the new medical residents may produce errors and worsen patient outcome by increasing in 10% of fatal medication errors [6]. The medical records of some hospital of Saudi Arabia in 2000-2002; wrong strength, wrong route of administration and wrong dosage form usually observe and human factor is the important cause of ME in hospitalized patients. The serious error was found in estimated 1% [7].

In 2006, there is a publication about the medication error of in-patient department of Songklanagarind Hospital, a medical school of Prince of Songkla University had prescribing error, pre-dispensing error, and pre-administration error of 0.16, 0.35, and 0.04%, respectively (based on 443,580 prescribed drugs) [8]. Thus, the prevention of ME by health care personnel is very necessary to improved patient safety. The aim of this study was to compare the decreasing of ME before and after the developed prevention strategies were used.

MATERIALS AND METHODS

Hospital profile

A studied private hospital located in northeast of Thailand. This hospital is a secondary hospital, the 50 beds hospital. The number of prescriptions in 2009-2012 was 44805, 43525, 42197, and 21408 (January-June), respectively. Furthermore, this study was approved by the hospital administrative team with the reference approval no. PS 2555/063 (12 July 2012).

Phase 1 (problem identification)

The data of medication errors during January 2009 to December 2010 were retrospective collected. The stages of medication error; prescribing error, transcribing error, pre-dispensing error, dispensing error, and administration error were identified and ME rate of each stage was calculated follow Eq.1 for out-patient department (OPD) and Eq.2 for in-patient department (IPD), which ME of OPD was represented in times per 1,000 prescriptions unit and IPD was represented in times per 1,000 patients-day unit.

$$\text{ME rate of OPD} = \frac{\text{Number of drug items which error occurred}}{\text{Number of prescriptions}} \times 1000 \quad \text{Eq.1}$$

$$\text{ME rate of IPD} = \frac{\text{Number of drug items which error occurred}}{\text{Number of patients - day}} \times 1000 \quad \text{Eq.2}$$

Type of ME was identified and calculated for each stage of error. The severity of ME was identified into category A-I.

Phase 2 (problem elimination and monitoring)

The collected medication errors were presented to the Pharmacy and Therapeutic Committee (PTC) of the hospital. The strategies for prevention of medication errors were constructed by PTC follow the causes of error; look-alike sound-alike (LASA) drugs management, adverse drug reaction (ADR) report system, ME report system, drug information service (DIS), and ward stock system. The target groups of constructed strategies were health care personnel team including doctor, pharmacist, and nurse. The data of medication errors during January 2011 to June 2012 were collected. The stages, type, and severity of ME were identified and calculated as mention previously. Reducing of ME was monitored. The developed prevention strategies were focused in five topics including LASA drugs management, ADR report system, ME report system, DIS, and ward stock system.

LASA drugs management: The private hospital in this study had many drug lists in LASA group. In 2009-2010, LASA drug were put in the same place or near each other, make confusion occur. The Pharmacy Department modified drug shelf and rearrange drugs alphabetically with tall man letter especially for LASA drug [9]. In addition, the pink reflect sticker was used for identified and is of concern for both pharmacists and pharmacist assistants. Furthermore, the drug purchase and drug inventory system were modified to select a new trademark instead of look-alike drugs. The PTC considers reducing the drug items that may cause ME such as drug that had two strengths and unnecessary drug. Furthermore, the LASA drugs list manual was produced and distributed to all associate departments.

ADR report system: Wakefulness about ADR can reduce irrational use of medicines [10]. ADR report system was developed. A new case of drug allergy must be diagnosis by doctor and evaluation by pharmacist before giving the drug allergy card. The pink reflect sticker and drug allergy card were used. The reflect sticker was stick in the first page of OPD card of all drug allergic patients. The drug allergy card was given to the patient with proved drug allergy. Drug allergy data was recorded into computerized program to avoid repeated drug allergy.

ME report system: The ME report system was modified; all health care team personnel can report the ME via the director of each department. The PTC suggests the director of each department that they must demonstrate positive responses to a person who reports ME in order to improve patient safety not for punish them [11]. Furthermore, when an error was occurred the director of each department can report directly to the risk management manager (pharmacist) by telephone follow by report documents. The PTC concern the importance of communication of people in different departments needed to reduce ME [12]. These strategies will improve the communication between departments.

DIS: DIS was systematic developed and DIS data was systematic records. Health care team personnel can consult pharmacists anytime whenever they need. The frequent questions were considered to make hospital guidelines. The hospital guidelines were already constructed such as high alert drug manual, LASA drug list, and injectable drug manual. In addition, the hospital drug list including generic name, trade name, and drug strength was categorized and inform to doctors in document. Pharmacist line was constructed, doctor and other health care personnel can call pharmacist via telephone or mobile phone when they need to consult about drugs information.

Ward stock system: This private hospital uses ward stock system for individual OPD and IPD make it lack of double check between multidisciplinary personnel, the ME will be occurred. There is a research in Australia, the medication errors occur in 15–20% of drug administration when ward stock systems are used and 5–8% when individual patient systems are used [13]. The developed strategies were modified ward stock system by reduce the number and items of stocked drugs. Drugs that were administered to patients must be checked by pharmacist and nurse to reduce the risk of ME. In addition, when stat dose was required, the OPD card or doctor order sheet must be seen by pharmacist before dispensing it to the wards or other departments.

RESULTS AND DISCUSSION

Normally, for OPD, the doctors prescribe drugs in OPD card, after that the OPD card was sent to Finance Department. OPD card and laboratory bill were sent to Pharmacy Department for record in computerized program. If some mistakes have occurred, a pharmacist will consult the doctor for solving the problem or changing the prescription. After that, the medication record was returned to Finance Department. While patients paid for medication expenses, all prescribed drugs were prepared by pharmacist assistant and double checked by pharmacist. All mistakes were solved before dispensing drugs to patients. All prescribed drugs as well as administration methods were given to the patients. The top-down flow chart of prescribing and dispensing for OPD is shown in Figure 1.

For IPD, doctor will prescribe drugs in medication records, the copied of medication record was sent to Pharmacy Department for recording in computerized program. If some mistakes have occurred, pharmacist will consult the doctor for solving the problem or changing the prescription. After that, all prescribed drugs were prepared by pharmacist assistant and double checked by pharmacist. All mistakes were solved before dispensing drugs to IPD. All prescribed drugs were given to the IPD. The top-down flow chart of prescribing and dispensing for IPD is shown in Figure 2.

This study separated into 2 periods, before and after the strategies for prevention of ME was developed. During 2009-2010, the ME report system is not clear in management protocol. Even though, the ME rate data were retrospective collected. However, ME type and severity were not recorded, make the data incomplete. The data of 2011 had both ME rate and ME type but the severity of ME was not recorded while all data were completed in 2012.

The ME of OPD in 2009-2010 showed that the prescribing error and administration error rate were less than 10 and 5 times per 1,000 prescriptions, respectively. However, the pre-dispensing error and dispensing error rate were higher than the goal of the hospital. The transcribing error in 2009-2010 is not recorded separately, but included in pre-dispensing error. The medication error rates of each stage of error are shown in Table 1.

The confusing of drug name is one of the common causes of medication error worldwide [14]. In Thailand, A total of 5,327 pairs of drugs were identified as LASA drugs; ranitidine-roxithromycin pair in the highest frequency for tablets/capsules, diazepam-furosemide pair in the highest frequency for injection, alum milk-milk of magnesia pair in the highest frequency for liquid dosage form, 0.02% triamcinolone cream and 0.1% triamcinolone cream pair in the highest frequency for external drugs, and 14 pairs of chemotherapeutic agents [15].

After the developed prevention strategies were used, all of the ME rates in 2011-2012 were decreased comparing to 2009-2010 except that pre-dispensing error rate in 2011 was still high. However, it was decreased in 2012. The prescribing error and administration error rate in 2012 were higher than in 2009-2011; however, it remained less than the goal rate (Table 1).

Prescribing error rate in 2011 was higher in wrong regimen order. Some doctors usually prescribe omeprazole for take after meal. However, in 2012 this error was not reported. For transcribing error, wrong strength was mostly found. Some drugs had two strengths but the doctor prescribes only drug name but not specifies for drug strength that makes the error occur. This error was not found in 2012. Wrong regimen is usually found in 2012 for

transcribing error. Dose omission was the most error found in pre-dispensing process. For dispensing error, dose omission was usually found in 2011. Furthermore, the severity categories C were found in 2012. The wrong strength, dose omission, and wrong drug were reported. For example, wrong strength was found in 140 mg and 70 mg of silymarin, wrong drug was found between Colofac® (135 mg of mebeverine hydrochloride) and Cafergot® (1 mg of ergotamine tartrate and 100 mg of caffeine), Ponstan® (500 mg of mefenamic acid) and 500 mg of paracetamol, and dose omission was found that missing of 500 mg of cloxacillin and mecobalamin. Furthermore, both OPD and IPD still use handwritten prescription that may cause relatively high error rates in the same manner of previous study [16]. Type of error, percentage of occurrence, and severity are identified in Table 4

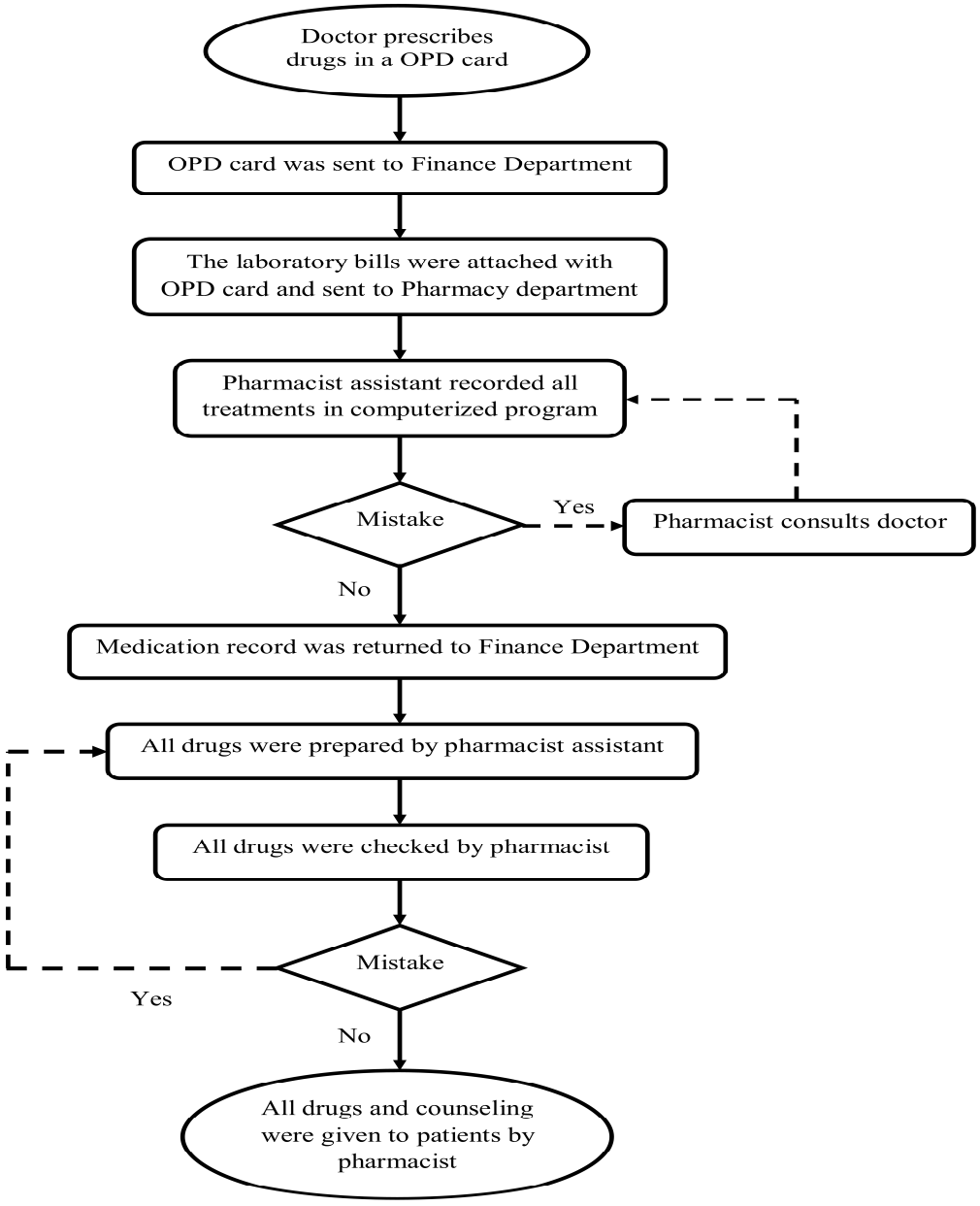

Fig. 1: Top-down flow chart of prescribing and dispensing for OPD

Table 1: Medication error rate of OPD during January 2009-June 2012

Stages of medication error	Goal	Medication error rate*			
		2009	2010	2011	2012**
Prescribing error	< 10.0	4.5	3.4	2.7	5.1
Transcribing error	< 10.0	N/A	N/A	9.4	7.3
Pre-dispensing error	< 10.0	23.4	26.6	18.9	1.9
Dispensing error	< 5.0	6.3	5.5	2.1	0.4
Administration error	< 5.0	0.4	0.2	0.1	0.6

* Times per 1,000 prescriptions, ** January-June 2012, N/A= not available

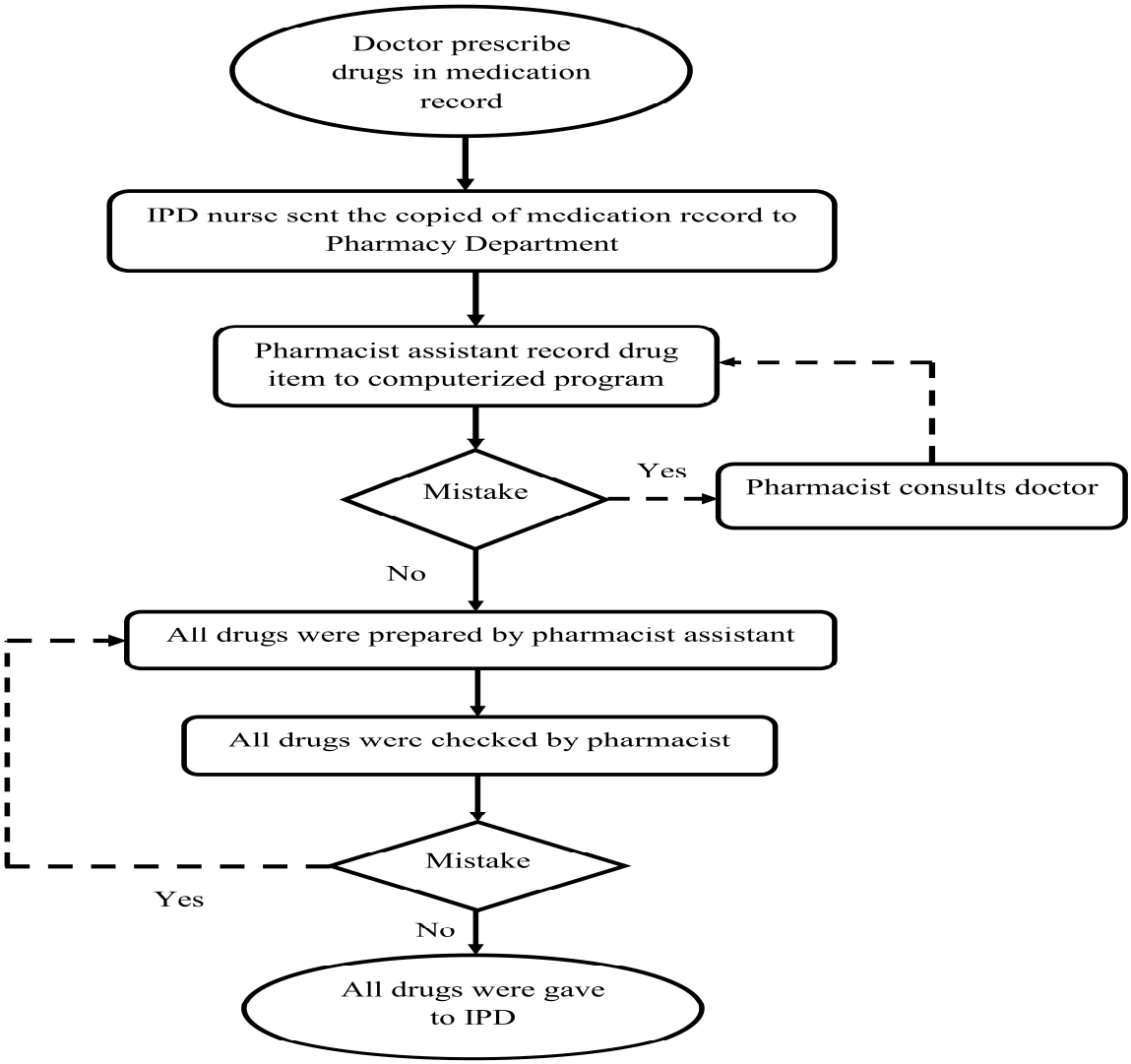

Fig. 2: Top-down flow chart of prescribing and dispensing for IPD

Table 2: Type, percentage of occurrence, and severity of each medication error stage of OPD during January 2009-June 2012

Stages of medication error	Type	Percentage of occurrence (%)				Severity*
		2009	2010	2011	2012*	
Prescribing error	Wrong regimen	N/A	N/A	60	-	B
	Wrong strength	N/A	N/A	20	-	B
	Dose omission	N/A	N/A	-	42	B
	Contraindicated drug	N/A	N/A	20	29	B
	Improper dose	N/A	N/A	-	29	B
Transcribing error	Wrong regimen	N/A	N/A	-	55	B
	Wrong strength	N/A	N/A	82	-	B
	Dose omission	N/A	N/A	14	27	B
	Wrong drug	N/A	N/A	2	18	B
	Wrong dosage form	N/A	N/A	2	-	B
Pre-dispensing error	Wrong regimen	N/A	N/A	10	-	B
	Wrong strength	N/A	N/A	13	9	B
	Dose omission	N/A	N/A	34	55	B
	Wrong drug	N/A	N/A	26	9	B
	Wrong dosage form	N/A	N/A	13	27	B
	Wrong patient	N/A	N/A	4	-	B
Dispensing error	Wrong regimen	N/A	N/A	20	-	B
	Wrong strength	N/A	N/A	20	40	C
	Dose omission	N/A	N/A	40	20	C
	Wrong drug	N/A	N/A	20	40	C
Administration error	Dose omission	N/A	N/A	100	100	B

* January-June 2012, N/A = not available

The ME of IPD in 2009-2010 showed that prescribing error, pre-dispensing error, dispensing error, and administration error rates were higher than goal. The transcribing error in 2009-2010 is not reported, but included in pre-dispensing error. After the prevention strategies were developed (2011-2012), ME rate were reduced. Overall results in 2012 showed that the ME rates were decreased comparing with the former years. The medication error rates of each stage of error are shown in Table 3.

Table 3: Medication error rate of IPD during January 2009-June 2012

Stages of medication error	Goal	Medication error rate*			
		2009	2010	2011	2012**
Prescribing error	< 1.0	1.2	1.5	0.2	0.1
Transcribing error	< 1.0	N/A	N/A	0.3	0.4
Pre-dispensing error	< 1.0	1.5	1.3	0.3	0.1
Dispensing error	< 0.5	1.0	0.7	0.3	0.2
Administration error	< 0.5	1.3	1.5	0.4	0.4

* Times per 1,000 patients-day, ** January-June 2012, N/A= not available

Type of error, percentage of occurrence, and severity are identified in Table 4. After the developed prevention strategies were used, the prescriptions with wrong regimen were usually found. In addition, the prescriptions with improper dose of drug treatment were usually found especially pediatric drugs. For transcribing error, health care personnel usually transcribe the prescription into wrong strength and wrong drug. Problems were caused by lack of the communication between different vocations and different departments. Thus, communication among health care team members improves the patient safety [17]. Because doctor usually prescribe drug name without drug strength, this problem affects pre-dispensing and dispensing process resulting wrong drug and wrong strength were usually found. Dose omission usually found for administration error. However, all ME occurred in IPD was in category B severity, means that the error was detected before it reach the patients.

Table 4: Type, percentage of occurrence, and severity of each medication error stage of IPD during January 2009-June 2012

Stages of medication error	Type	Percentage of occurrence (%)				Severity*
		2009	2010	2011	2012*	
Prescribing error	Wrong regimen	N/A	N/A	75	50	B
	Wrong strength	N/A	N/A	25	-	B
	Improper dose	N/A	N/A	-	50	B
Transcribing error	Wrong strength	N/A	N/A	-	100	B
	Dose omission	N/A	N/A	33	-	B
	Wrong drug	N/A	N/A	67	-	B
Pre-dispensing error	Wrong strength	N/A	N/A	-	100	B
	Dose omission	N/A	N/A	25	-	B
	Wrong drug	N/A	N/A	50	-	B
	Wrong dosage form	N/A	N/A	25	-	B
Dispensing error	Wrong strength	N/A	N/A	100	100	B
Administration error	Dose omission	N/A	N/A	100	100	B

* January-June 2012, N/A= not available

CONCLUSIONS

The ME can cause patient harm thus the prevention of error are necessary. The developed strategies for prevention of the ME were used and it can reduce the error in the medication process both OPDand IPD. However, the surveillance of the ME rates should be further monitored.

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