

## The Impact of Training on Medication Error Rate of the Emergency Department in Hospitals Affiliated to Golestan University of Medical Sciences

Azam Hajibeglo<sup>1</sup>, Mansoureh Zagheri Tafreshi<sup>2,\*</sup>, Farhad Kamrani<sup>3</sup>, Malihe Nasiri<sup>4</sup>

<sup>1</sup> MS Nursing Student, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

<sup>2</sup> PhD in Nursing, Associate Professor, Department of Nursing Management, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>3</sup> MSN. Faculty member of Department of Medical Surgical Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>4</sup> PhD in Biostatistics, Assistant Professor, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran



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\* **Corresponding author:** Mansoureh Zagheri Tafreshi, PhD in Nursing, Associate Professor, Department of Nursing Management, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran. E-mail: [mailto:malihe-nasiri@gmail.com](mailto:mailto:malihe-nasiri@gmail.com)

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### Abstract

**Introduction:** Medication errors are the most common type of medical errors that can cause serious problems for public health and are considered a threat to patient safety. This study was conducted to determine the effectiveness of patient safety training on nurses' medication errors at the emergency department of a hospital of Golestan Province in Iran.

**Methods:** The present quasi-experimental study was conducted from March to September 2016. The study population consisted of nurses working at a hospital affiliated to Golestan University of Medical Sciences and a sample of 40 nurses at the emergency department of this hospital were selected through a census. The data collection tools used included a demographic questionnaire and Wakefield's Medication Error questionnaire for nurses (consisting of 21 domains), which were used once their reliability was confirmed. A patient safety training program was designed and implemented for the selected emergency nurses in the form of a two-day workshop. The obtained data were analyzed using the SPSS-18 software with the Wilcoxon test.

**Results:** Results showed that the rate of medication errors (80.62%) of nurses were at a low level. The majority of nurses (80.62%) scored low in terms of the frequency of medication errors; after the training, a significantly greater number of nurses scored low in terms of this index (90.31%;  $P < 0.001$ ). The analyses showed the effectiveness of the patient safety training program for nurses in the two domains of wrong time error and missed dose error ( $P < 0.001$ ); however, the training had no significant effects in the other domains.

**Conclusions:** As patient safety training can be effective on nurses' medication errors, retraining courses on safe medication administration are necessary regarding nurses' significant role in the prevention of medication errors.

## INTRODUCTION

Medication errors are defined as the failure to properly implement physicians' orders and can occur at any stage of the medication use process, including administration, preparation, dispensing, application or distribution. The administration of medication is one of the most important and complicated processes of nursing care that requires adequate

knowledge and proper performance on the part of the nurses [1]. Medication errors are one of the main subsets of medical errors that are considered a major threat to the health sector in all countries [2]. Medication errors are an old problem and one of the most common accidents in nursing. The first reports of medication errors were made as early as 1940 [3].

Medication errors include wrong route error, wrong dose error, omission error, neglecting symptoms of toxicity and incorrect administration technique error, and are considered a failure in the treatment process that harms the patient [4]. Medication errors may occur at different stages of the medication use process, including prescription, transcription of physician's orders, medication distribution, dispensing medications to the patient or checking the medications [5]. Studies show that the majority of medication errors occur during the administration and dispensing of medications to the patients [6]. The first reports of medication errors were made in 1940 and attracted great attention from the authorities and practitioners. Medication errors are the eighth leading cause of death in the US and cause injury, death, and increased healthcare costs in different countries [7]. A study conducted at Harvard Medical Center showed that 19.4% of all medical errors were related to medication errors [8]. Medication errors cause harm to approximately 1.5 million people every year and the costs of treating these errors at hospitals are estimated at 3.5 billion per year. The rate of medication errors committed on hospitalized patients varies from 2% to 14%. The number of deaths from medication errors in the US is estimated at 44000 to 98000 per year, which is higher than the number of deaths caused by motor vehicle accidents, breast cancer, and Human Immunodeficiency Virus (HIV) infection [9]. There are no accurate statistics on the rate of medication errors in Iran; however, this lack does not imply that there are no medication errors. According to a report by the Ministry of Health and Medical Education, a lot of money is spent on care for patients due to medication errors and also on the complications arising from prolonged hospital stay. The increasing number of complaints from physicians and nurses referred to the medical system and to court is a manifestation of this claim [10]. For example, a series of isolated studies have reported the rate of medication errors in teaching hospitals of Sanandaj, Iran, as 16.7%, and as 10% per nurse each 3 months, at hospitals surveyed in Tehran [2]. Medication administration is one of the most important, complicated, and time-consuming activities for nurses that takes about one-third of a nurse's time at work. As medication therapy is a complex activity, there is a high possibility of errors in the process, and as nurses are the ones, who give the medications to the patients, they are often considered the main person responsible for the error, although different causes and individuals are involved in the occurrence of medication errors [11]. Although several people are involved in the administration, prescription, and injection of medications, nurses make more medication errors compared to physicians, pharmacists, and other healthcare workers [6]. There are 5 principles that could lead to significantly less medical errors if carefully observed, including the right patient, right medication, right time, right dose, and right route [12]. Tang argues that medication errors are caused by a disregard for 5 principles, including right medication administration, distraction, and heavy workload and being a novice [9], and Bijani suggested that the most important causes of medication errors are work-related fatigue, shortage of personnel, long work hours, and heavy workload [13]. A study by Hughes and Ortiz showed that in 30% of cases, patients, who are victims of medication errors either die or become disabled for more than 6 months [14]. In addition, such mistakes could lead to the patients' distrust in and dissatisfaction with the

healthcare system and results in stress and ethical conflicts in the healthcare personnel and reduce the quality of care [15]. One of the main strategies for reducing these mistakes is to determine factors involved in medication errors. According to Harding, the main causes of medication errors include inadequate experience in reading medication orders, heavy workloads, and lack of concentration [16]. The first step in achieving patient safety and properly implementing medication therapy is to be aware of the existing situation and determine the causes of medication errors and identify effective ways for dealing with and preventing these errors; this study was therefore conducted to determine the rate of medication errors among emergency nurses of a hospital affiliated to Golestan University of Medical Sciences.

## METHODS

The present research was conducted in the form of pre and post intervention in the first half of 2016 at the emergency department of Baghiyatallaho Azam Hospital in Ali Abad Kattoul. This study was performed only at this hospital due to the long distance to other hospitals. After obtaining the relevant licenses for this study, the permissions for conducting the research were obtained. The statistical population of the research included all bachelor and higher education employed nurses ( $n = 40$ ), who were recruited in the research without loss and with consent in the form of the census method. The data collection method in this study was the demographic questionnaire of nurses with 8 questions, which was made by the researcher. The inventory of medication error including a 7-item tool by Wakefield et al. (2005) was used, which was translated and evaluated by Pazokian [17]. In addition, the item of mistake in the medicine rate (wrong dose) was added by review of professors, and its validity and reliability were tested again. The content validity index was at least 90% and at most 100% for each phrase, 92% for the entire questionnaire, and the Cronbach's alpha coefficient was 0.94. The percentage of medication errors was in the range of 0 to 25, 25 to 50, 50 to 75, and 75 to 100 and the minimum and maximum scores were 0 and 100, respectively. In this research, SPSS version 18 software was used to measure the variables, and descriptive statistics methods, such as mean and standard deviation and inferential statistics, were used to determine the status of the indicators and measure the impact of their training. The Wilcoxon test was also used to evaluate the difference between the average rate of medication errors at the emergency department before and after training.

In the next stage, the safety training program for patients was designed and ran for nurses at the emergency department in a one-day workshop for 4 hours in two sessions. The workshop took place on two consecutive days in the form of theoretical teaching with teamwork and pre-test and post-test. This program was conducted in two sessions to provide the opportunity for all nurses to participate in the workshop. In other words, the nurses, who were unable to participate in the workshop in the first session due to working in different shifts or leaving, could participate on the second day of the workshop. Before completing the questionnaires by nurses, they were confided about confidentiality and anonymity. In this workshop, the basic training booklet of clinical governance at Bushehr University of Medical Sciences and Health Services Department of Health (2013), safety and risk management

manual of the patient at Alborz University of Medical Sciences and Health Services (2015), patient safety friendly hospitals manual of Imam Rizvi, and scientific articles were used. Educational contents were approved by various experts, including an emergency physician, accreditation in charge of hospital, training supervisor, nursing manager, and consultants and supervisors. A 25-page booklet was prepared, in which the topics of emergency, the definition of patient safety, familiarity with the 7-step patient safety protocol, patient safety indicators, 9 patient safety solutions, the patient safety friendly hospital program, definition of error and its different types, the causes of medication errors, risk management approach, error reducing steps in a clinical section, and solutions to prevent medication errors were presented. Improving the knowledge and skills of nurses was emphasized by focusing on two items of wrong time error and missed dose. Then, the participants were asked to volunteer to list drugs that are similar in appearance and calculate the exact dose of drugs. In addition, the proper way of weighing drugs was displayed. Then, the contents and conclusions were summarized. After 6 weeks, the questionnaire of medication errors was recompleted by nurses. The achieved data were then evaluated and compared with the results of the pre-training stage.

**RESULTS**

A total of 40 questionnaires were properly filled out by the nurses before and after the training. Table 1 presents the demographic characteristics of the nurses. Table 2 presents the nurses' reports of their medication errors at the emergency department before and after the training. According to the results of the Wilcoxon test for medication errors, it could be argued that a significant difference emerged in the subjects after the training in terms of frequency of committing wrong time error and missed dose error ( $P < 0.001$ ), while no significant differences emerged with the training in terms of frequency of committing wrong route error, wrong patient error, wrong drug error, unauthorized drug error (for

example pain relievers), ignoring patients' drug allergies, and wrong dose error. The t-test was used to evaluate the effectiveness of the patient safety training program for nurses. Table 2 presents the results. As shown in Table 2, the patient safety training program for nurses at the emergency department had sufficient effectiveness.

**Table 1:** The demographic characteristics of the participating nurses

Demographic Characteristic	Percentage
<b>Gender</b>	
Female	90
Male	10
<b>Type of Employment</b>	
Full-Time and Part-Time	38
Employees	55
7	7
<b>Work Shift</b>	
Fixed Morning	10
Rotating	90
<b>Work Experience in Nursing</b>	
Years and Less 10	80
<b>Work Experience in the Emergency Department</b>	
Years and Less 4	50
<b>Average Monthly Overtime</b>	
Hours and Less 50	60
<b>Nursing as a Second Job</b>	
Yes	7
No	93

**Table 2:** The rate of medication errors in nurses at the emergency department before and after the training

Type of Medication Error	0-25		26-50		51-75		P Value						
	Before		After		Before			After					
	Number	%	Number	%	Number	%		Number	%				
Wrong Route	38	95	39	97.5	2	5	1	2.5	0	0	0	0	0.317
Wrong Time	15	37.5	28	70	23	57.5	12	30	2	5	0	0	0.001
Wrong Patient	40	100	40	100	0	0	0	0	0	0	0	0	1.000
Wrong Drug	39	97.5	39	97.5	1	2.5	1	2.5	0	0	0	0	1.000
Missed Dose	12	30	31	77.5	27	67.5	9	22.5	1	2.5	0	0	0.001
Unauthorized Drug Error (ex. pain relievers)	40	100	39	97.5	0	0	1	2.5	0	0	0	0	0.317
Ignoring Patients' Drug Allergies	40	100	38	95	0	0	2	5	0	0	0	0	0.157
Wrong Dose	34	85	35	87.5	6	6	5	12.5	0	0	0	0	0.564
Average	80.62		90.31		18.43		9.68		0.93		0		

## DISCUSSION

As for the mean frequency of committing medication errors before the training, 80.62% of the subjects had a low rate of errors (0% to 25% level) while 90.31% had a high rate (51% to 75% level); after the training, 90.31% of the subjects showed a low rate of errors while zero percent had a high rate, which makes for a statistically significant difference ( $P < 0.001$ ); it could therefore be argued that the training has effectively helped the nurses reduce their medication errors. With a significance level of 0.001, the difference between the scores obtained before and after the training was significant and the training could therefore be considered effective in the two domains of wrong time error and missed dose error. The results of a study conducted by Kohn et al. [18] on medication errors at 482 hospitals and health care centers in the US revealed the main types of these errors as wrong route error and incorrect administration technique and reported the main causes as the turbulent work environment, shift changes, and increased workload, which are not consistent with the results of the present study. Liu and Frank [17] reviewed the medical records of 104 patients discharged from the hospital and reported the main causes of the medication errors committed on them to include illegible Medication Administration Records (MARs), illegible medication orders, and the use of medical abbreviations. A study by Panjavini [19] identified the most common errors in the administration of medications as incorrect drug selection for the patient, wrong time error, wrong route error, overdose error, wrong dose error, and wrong patient error, which are consistent with the present findings in some domains. In the present study, no significant differences were observed in the subjects before and after the training in terms of unauthorized drug error, ignoring patients' drug allergies, and wrong dose error. In the study of Tang et al. the most common medication errors was wrong dose type [20]. Dean et al. [21] examined the frequency and type of medication errors in nurses in the US and UK and found omission error and wrong dose error as the most common medication errors among UK nurses and wrong dose error and unauthorized drug error as the most common among US nurses [21]. Panjavini's study [19] on the frequency and type of medication errors among nursing staff showed a 16.7% frequency of medication errors, most of which were of the omission and wrong dose types, which is consistent with the present findings.

According to the results of the present study, medication errors may be caused by problems such as a lack of proper supervision on the medication use process, distraction during the administration of medication, carelessness in documentation, long work hours, heavy workloads, increased environmental stimulants, such as noise and having multiple responsibilities to fulfill, which cause fatigue in nurses and pave the way for the occurrence of medication errors; offering further training to this group, especially about medication safety, counts as a helpful preventive measure. Finally, a large-scale system should be established for recording medication errors committed on all patients so as to ensure and maintain the patients' safety by preventing these errors. In addition, the frequency of medical errors should be reduced in hospitals by modifying the existing guidelines, endorsing an error reporting system, and examining the causes of errors. Medical errors could be further prevented by measures, such as reduc-

ing nurses' workloads and work hours and setting committees to monitor nurses' performance, especially in large hospitals.

## MANUSCRIPT TITLE

The effect of patient safety training on medication error rate of emergency department in selected hospital affiliated with Golestan University of Medical Sciences.

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

## CONCLUSION

The results showed that the patient safety education program to nurses was significantly difference in the two areas of "Mistake in the time of drug using" and "forgotten drug" before and after training ( $P < 0.001$ ). In other areas the difference between before and after treating was not significant.

## ETHICAL CONSIDERATIONS

In order to analyze the data, descriptive statistics (central indicators and dispersion) and inferential statistics used. To define the quantitative data, the mean, standard deviation, percentage and frequency were used. To determine the differences before and after education, t-test was used. All statistical tests were performed at a significance level of 0.05. The ethical considerations for this research have been done to get the approval of the Ethics Committee of Shahid Beheshti University of Medical Sciences with ethics Code of IR.SBMU.PHNM.1394.207 and obtain the essential permissions and coordination with the authorities of the research community. In order to gain the trust of patients, the research objectives were clarified to them, and for the purpose of entering the study, informed consent and written consent were obtained from the units under study. Patients were assured that the company was volunteering and their information would be kept confidential and answered the questions asked by them and the fellows. At the beginning of the research, they were assured to the hospital and patients. If they wish to receive the final information of the research, they can be learned about the study results by communicating with the researcher at the end of the work.

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conflict of interest?

## FUNDING

According to the results of Wilcoxon signed-rank test for drug mistake, it can be said that the mistake in the time of taking medicine and forgotten drug before and after training was significant ( $P < 0.01$ ).

In the areas of the wrong way in using the drug, the wrong patient, the wrong drug, using medicine without a doctor's prescribe, taking medication despite the knowledge of the patient's allergy to the medication and the mistake in the amount of drug (wrong dose) before and after training, was no significant difference.

## AUTHOR CONTRIBUTION

Mansoureh Zagheri Tafreshi\*, Farhad Kamrani, E-mai: mali-henasiri@gmail.com

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