



Medication errors of nurses in the emergency department

Seyyede Roghayeh Ehsani¹, Mohammad Ali Cheraghi², Amir Nejati³, Amir Salari⁴, Ayeshe Haji Esmaeilpoor⁵, Esmaeil Mohammad Nejad⁶

¹ Department of Nursing, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran;

² Associate Professor, Department of Nursing, Faculty of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran;

³ Assistant Professor, Department of Emergency Medicine, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran;

⁴ PhD Student in Disaster & Emergency Health, Department of Disaster Public Health, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran;

⁵ Department of Medical Surgery, Faculty of Nursing & Midwifery, Medical Branch of Islamic Azad University, Tehran, Iran;

⁶ PhD candidate in Nursing, International Branch, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Corresponding Author:

Esmaeil Mohammad Nejad

Address: Floor, No. 9, Kavusi Alley, Urmia St, South Eskandari St, Tehran, Iran.

Email: asreno1358@yahoo.com

Tel: +98-2166936626

Fax: +98-2166936626

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Abstract

Patient safety is one of the main concepts in the field of healthcare provision and a major component of health services quality. One of the important stages in promotion of the safety level of patients is identification of medication errors and their causes. Medical errors such as medication errors are the most prevalent errors that threaten health and are a global problem. Execution of medication orders is an important part of the treatment and care process and is regarded as the main part of the nurses' performance. The purpose of this study was to explore the medication error reporting rate, error types and their causes among nurses in the emergency department.

In this descriptive study, 94 nurses of the emergency department of Imam Khomeini Hospital Complex were selected based on census in 2010-2011. Data collection tool was a researcher-made questionnaire consisting of two parts: demographic information, and types and causes of medication errors. After confirming content-face validity, reliability of the questionnaire was determined to be 0.91 using Cronbach's alpha test. Data analyses were performed by descriptive statistics and inferential statistics. SPSS-16 software was used in this study and *P* values less than 0.05 were considered significant.

The mean age of the nurses was 27.7 ± 3.4 years, and their working experience was 7.3 ± 3.4 years. Of participants 46.8% had committed medication errors in the past year, and the majority (69.04%) had committed the errors only once. Thirty two nurses (72.7%) had not reported medication errors to head nurses or the nursing office. The most prevalent types of medication errors were related to infusion rates (33.3%) and administering two doses of medicine instead of one (23.8%). The most important causes of medication errors were shortage of nurses (47.6%) and lack of sufficient pharmacological information (30.9%).

This study showed that the risk of medication errors among nurses is high and medication errors are a major problem of nursing in the emergency department. We recommend increasing the number of nurses, adjusting the workload of the nursing staff in the emergency department, retraining courses to improve the staff's pharmacological information, modification of the education process, encouraging nurses to report medical errors and encouraging hospital managers to respond to errors in a constructive manner in order to enhance patient safety

Keywords: medication errors, nurse, patient safety, emergency department

Introduction

The main goals of care in health care systems are preservation and promotion of health (1). Patient safety is one of the main concepts in the field of health care provision and a key factor in maintaining the quality of health care services (2). Preservation of patient safety is a major concern in health care provision systems (3). According to Valentin et al. one of the important stages of raising the safety level of patients is identification of medication errors and their causes (4). Since the Institute of Medicine (IOM) raised awareness about human errors in 2000, many attempts have been made to improve patient safety, such as epidemiological and etiological identification of medication errors (5). Medication errors are among the most prevalent health errors threatening patients' safety and are regarded as an index for determining patients' safety in hospitals (6). These errors are one of the five medical errors classified by the National Institute of General Medical Sciences (7). The first report related to medication errors was released in 1940 and attracted the attention of authorities (8). Based on the conducted studies, thousands of people die in America due to these errors every year and financial expenses relating to medication side effects are near 77 million dollars in a year (9). Studies indicate that medication errors increase hospitalization term by 2 days and increase cost to 2000 - 2500 dollars for each patient. Most expenses are related to hospitalization due to inappropriate use of medicines, for example, drug side effects, failure to take appropriate medicine and inappropriate administration of medicine (10). Most medication errors are committed by nurses (11,12). The reason is that nurses are the largest therapeutic team and most of them comply with the drug orders and 40% spend their time in hospitals administering medicine to patients (13,14). Medication errors of nurses can lead to different problems such as unsuccessful and imperfect treatment, legal problems (15), increase of term and cost of hospitalization (16), damage to the professional reputation of nurses (17) and mistrust of patients and the society in the health care system (18). Prevalent medication errors include administration at inappropriate times, committing errors in prescription of medicine, overprescribing, failure to follow the proper prescription, error in drug concentration, and giving medicine to the wrong patient due to improper identification of patients (19). Among the important causes of medication errors are: a) personal reasons such as stress, fatigue, absentmindedness, error in administration of orders, reduced attention to details, lack of satisfaction with job and workplace, shortage of dutifulness or work

consciousness and so on; b) predisposing causes such as shortage of educated personnel, excessive overtime, long working days, busy environment, provision of intensive care etc.; and c) reasons relating to knowledge and awareness such as lack of experience or knowledge about medications or patient's condition, and incorrect mathematical calculations (20). Although there are abundant advantages and ethical bases in elaboration and reports of nurses' errors, it is very difficult to obtain accurate statistics of medication errors due to nurses' protection against punishment, managerial laws regarding detection of errors, absence of an appropriate reporting and recording system, and shortage of information (21-23). One study conducted in England reported a medication error rate of about 15% and nurses were responsible for 56% of these errors (24). The study by Simpson et al. showed that 71% of errors were due to imperfect prescriptions and 29% were due to dose calculation of medications, and the most prevalent types of errors were no administration, inappropriate medication, and medication at inappropriate time (25). In Iran, a study by Penjvini in Sanandaj showed medicinal errors occurred for 16.7% of the nurses and the most common types of medicinal errors were omission of medicine and inappropriate dosage (26). Overall, in the third world and developing countries, it is difficult to acquire accurate estimates due to absence of a proper recording and reporting system and shortage of research information, but experts speculate that the rate of these errors is high, and the increasing number of complaints against health care team in courts and to judicial authorities also confirms this (27). Identifying the types of errors is the first step toward preventing them, and according to the findings of this paper, one can face the problem of medication errors as a nurse or trainer during professional activity. Accordingly we aimed at conducting a study on medication errors and their causes in order to find out the number of recalled committed medication errors per nurse over the course of his/her nursing career, and the rate of medication errors reported to nurse managers using incident reports, in the nurses of the emergency department.

Method

In this descriptive study, 94 nurses of the emergency department of Imam Khomeini Hospital Complex were selected based on census from 30 June, 2010, to 30 June, 2011. This complex is the largest educational and therapeutic center of the Tehran University of Medical Sciences (TUMS)

which accommodates more than 1300 hospital beds and includes three independent hospitals and a joint emergency department for those three hospitals.

The information gathering and data collection tool was the self made questionnaire prepared and adjusted by the researchers based on literature reviews and scientific papers (17, 28, 29).

A questionnaire of two parts was prepared as follows: the first part aimed to collect the demographic information of the nurses (gender, age, level of education, work shifts, type of employment, and years of experience in nursing); the second part was related to the type and causes of medication errors.

In this research, medication errors have been defined as 'any medication administered or prepared in a way that deviates from the prescription chart, the manufacturer's instructions and hospital policy which can be prevented and may cause injury to the patient' (30).

Face and content validity of the questionnaire were assessed by previous studies, books and through asking 10 members of Faculty of Nursing of TUMS to comment on the questionnaire, and by considering their correctional comments. The reliability of the questionnaire was determined using Cronbach's alpha test ($r = 0.91$).

In order to comply with ethical considerations, the researchers explained the aim of the study to the study participants and then they were assured that the information will be confidential; also the questionnaire was anonymous and participation in the study was optional.

Inclusion criteria of nurses in this study was considered as physical and mental health, working

in the emergency department for at least 6 months, and holding a bachelor's degree or higher. The study protocol was approved by deputy of research of the Imam Khomeini Hospital Complex.

Data analyses were performed by descriptive statistics (frequency, mean, median and standard deviation) and inferential statistics. SPSS software version 16 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis and P values less than 0.05 were considered significant.

Results

All questionnaires were returned to the researchers after being completed. The average age of the studied nurses was 27.7 ± 3.4 years and their working experience was 7.3 ± 1.9 years. Of participants 59 nurses (62.7%) were married, 82 nurses (87.2%) were female, and 42 nurses (46.8%) had committed medication errors in the past year. Majority of the nurses (69.04%) had committed medication errors only once, and most (88.3%) held bachelor's degree while the rest of them held higher degrees. The mean overtime of the study participants was 83.4 ± 43 hours per month and 54.2% of the nurses had fixed work shifts. The routine performance in ED is case method. According to the nurses' comments, fortunately, no complication had arisen in most cases of medication errors (97.5%). The most prevalent type of medication error was related to errors in infusion rates, administration of two doses of medicine instead of one and omission of medicine. In Table (1), types of medication errors have been reported.

Table 1. Types of medication errors

Medication Error Types	Number	Percent
Omission of medicine	6	14.2
Medication at inappropriate time	3	7.14
Mistaken medication	5	11.9
Administration of two doses of medicine instead of one	10	23.8
Giving medicine of a patient to another patient	4	9.5
Wrong infusion rate	14	33.3

The most prevalent causes of medication errors in organizational and human domain is a high patient -to- nurse ratio in the ward, insufficient

pharmacological knowledge, fatigue resulted from hard work, and use of abbreviated names (Table 2).

Table 2. Distribution of factors affecting the incidence of medicinal errors

Factors Affecting Medication Errors	Number	Percent
<i>Medical Factors</i>		
Large variety of drugs in the ward	2	4.2
Using abbreviated names	23	48.93
Similarities among drug names	11	23.40
Using some drugs in the rare cases	2	4.20
Different medicinal dosages	9	19.14
<i>Managerial and Human Factors</i>		
Fatigue resulted from hard work	9	19.14
High patient -to- nurse ratio	6	12.76

Insufficient education	2	4.2
insufficient pharmacological knowledge	13	27.65
False medicinal calculations	4	10.63
Illegibility of patients records	7	14.89
Illegibility of physicians' prescriptions	4	8.51

The rate of under-reporting of medication errors by nurses was 72.7%. Examples of the reported medication errors by nurses were presented in table 3. There was no statistically significant relationship between demographic specifications (age, gender, education) and job specifications (type of ward, work experience, monthly overtime) and medication errors committed by nurses ($P > 0/05$).

Table 3. Examples of reported medication errors by nurses

- Mistaken infusion rate of nitroglycerine and dopamine
- Reconstituting antibiotics in dextrose 5% serum instead of normal saline
- Giving nitrocontin tablet instead of warfarin
- Giving 80 mg aspirin tablet instead of 325 mg aspirin tablet or vice versa
- Preparing 10000 units heparin instead of 5000 units
- Intradermal injection of insulin instead of subcutaneous injection
- Venous injection of antibiotics such as cefazolin and ceftriaxone instead of venous infusion (microset)
- Giving 6.4 mg nitrocontin tablet instead of 2.6 mg tablet

Discussion

This study showed that half of the nurses committed medication errors. The extent of medication errors committed by nurses in different studies varied from 67% in Stratton et al. study (31), 43% in the study by Lisby et al. (32), 42.1% in the study by Mrayyon et al. (7) to 10% in the study by Koohestani et al. (17). The great difference in medicinal error rates in this study compared to similar findings in other countries can result from the negative reaction of colleagues, trainers and managers after giving reports (33), lack of medication monitoring, absence of a proper recording and reporting system (6), bad condition of patients, unpleasant physical conditions, noise and overcrowding (34).

The results of this study showed that the most common errors were associated with wrong infusion rates and giving two doses of medicine instead of one. In a study in Jordan, the most common types of medication errors were wrong patient and wrong dose (35). In a study on the incidence of medication errors among Iranian nurses, Nikpima et al. concluded that the most common medication errors were wrong do-

sage, medication omission and medication administration at inappropriate times (6). Cheraghi et al. detected 64 nursing medication errors including mistaken infusion rates (44%), inappropriate dosage (23%) and wrong administration times (12%) (21).

According to our findings, shortage of nursing staff, inadequate pharmacological knowledge and fatigue resulting from high workload were among the managerial and human factors associated with medication errors. Hosseinzadeh et al. suggested the most important reasons for medication errors as shortages of nursing staff, nursing burn-out and high workload (36). Al-Shara observed that many medication errors were due to heavy workload (41.4%) and new staff (20.6%) (35). In contrast, Stratton et al. reported that only 5% of the nursing staff considered lack of knowledge as an effective factor affecting the incidence of medication errors (31). In a study in United States, 42% of the nurses mentioned that there was no factor causing their error while 23.6% referred to carelessness and distraction of nurses, and 11.3% referred to long working hours as the factors causing medication errors (30). Anoosheh et al. reported that 69 nurses and nursing managers believe that factors such as unsuitable work shifts, shortage of manpower, shortage of suitable equipment, performance of duties unrelated to the care role of nurses and lack of awareness caused working errors in nursing (37). Carelessness of nurses during execution of drug orders is a very important subject which is affected by different factors such as fatigue caused by high work load. It seems that changes are required in the working conditions of nurses in order to reduce human errors (16). In different studies, inadequacy of job training and insufficient knowledge of the graduates are mentioned as the causes of medication errors (38).

The results of this study showed that use of abbreviated names and similarities in drug names were among the medical factors associated with medication errors. Micro et al. studied the process of drug prescription in internal wards for two years and mentioned that the most prevalent causes of medication errors were illegibility of drug orders in patient records (13.3%), error in preparation of drug (30%) and error in prescription of drugs (28.3%) (40). All of these errors are related to pharmacological information and many nursing researchers mention raising nurses' pharmacological knowledge as a serious strategy for reducing medication errors, and conclude that updating the information of nurses and nursing students about

medicines and in particular new medicines can be an important factor in reducing medication errors (41). Lack of pharmacological knowledge is one of the most important factors affecting medication errors, although the risks relating to medicines and their side effects are not limited to the nurses and many defects can be found during prescription, distribution and execution of orders (42).

In this study, 72.7% of the nurses never reported these errors. The rate of reporting medication errors among nurses was far less than the medication errors they had made. A study conducted in Jordan by Mrayyan et al. revealed that 42.1% of the nurses had made at least one medication error in their career (7). In other studies, the number of medication errors reported by the nurses was less than the real value (43). Although the disparity between the number of medication errors committed in the emergency department and their reporting rate is desirable to the authorities, it can be quite worrisome for the therapeutic system. Report of medication errors can prevent potential harms to patients and is also regarded as a valuable information source for preventing similar medication errors in the future. The most important motivation of reporting medication errors should be protection of the health and safety of patients and prevention of potential harmful effects of medicines in patients (17).

It is evident that the low rate of medication errors is desirable for authorities, but it should be noted that minimization of the gap between errors and their report should also be considered as an important matter. Studies show that medication errors are one of the important problems in health care system and more importantly, prevention of these errors depends on their accurate report (37). In addition, these reports can be a way of better managing medication errors and preventing their emergence in the future. It should be noted that executive managers and trainers should not consider the negative undesirable results of these reports and punish the nurses, but they should try to remove the barriers of report and should ethically and legally compensate for the damages and side effects caused by nursing errors as far as possible (44). For this purpose, nurses should consider the principle of honesty as a virtue based on Aristotle's

teachings and should be encouraged to report medication errors considering patient's benefit, that is, perform an ethical task for maximization of benefits (45).

Although the confidentiality of demographic and information data was ensured and all identifiable data such as name and surname were eliminated, the participants may have provided incorrect answers to the questions as a result of fear of disclosure which can be considered as the limitation of our study.

Conclusion

Today, reducing medication errors and improving patient safety have become common topics of discussion in health care systems. Despite increased attention to patient safety and the quality of health care services, medication errors are still frequent in the ED. This study showed that the risk of medication errors among nurses is high and medication errors are a major problem of nursing in the emergency department. The rate of reporting medication errors among nurses was far less than the medication errors they had made and this indicates a gap between the actual rate of medication errors and the reporting rate among nurses. We recommend increasing the number of nursing staff, adjusting the workload of the nurses in the emergency department and retraining courses aiming to improve nurses' pharmacological information, and to modify the education process, encourage nurses to report medical errors and encourage hospital managers to respond to errors in a positive ethical and logical manner in order to enhance patient safety.

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