«Original Article»

Medication errors and their relationship with job and demographic characteristics among nurses in hospitals of Ahvaz jundishapur university of medical sciences

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Abstract

Background: Medication error in hospitals is a major cause of errors, which may cause disruptions in the workflow of the health care systems. The aim of this study was to assess medication errors made by nurses and the relationship of such errors with job and demographic characteristics.

Material and methods: This was a descriptive study on 225 nurses in various hospitals, selected through multistage random sampling. The data were collected through demographic and medication error questionnaires, and were analyzed using descriptive statistics, Chi-square, Kruskal-Wallis, One-way analysis of variance.

Results: The findings of the study revealed that medication errors such as untimely drug administration (55.6%), and drug administration without prescription (44.5%) occurs and exists in the hospitals. The findings also showed that demographics characteristics such as age, gender, work experience in a hospital or in a specific ward, passing training course, employment type and the type of medication errors were significant ($p<0.05$).

Conclusion: Based on the results, effective management and promotion motivate nurses. Therefore, increasing scientific and clinical expertise in the area of nursing medication orders is recommended to prevent medication errors in various states of nursing intervention. Employing experienced staff in areas with high risk of medication errors and supervising less-experienced staff through competent personnel are also suggested.

Keywords: Medication error, Nurses, Drug administration

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Introduction

Medication error is considered a major threatening factor for patients' safety, and consequently steps have been taken in recent years to identify and prevent it. Implementing medication is an important part of caring process and nursing practice, in which patients' safety plays a predominant role (1). Nurses must have sufficient information on the pharmacokinetics (absorption and excretion of the drug in body), growth, nutrition, mathematics, and one of their main responsibilities that is dispensing, or administration of a medicine. The latter that is neglected by some nurses (2) ultimately leads to serious health problems to patients and threatens their safety (3-5).

Based on the studies, annually thousands of people die from medication errors in the United States (6). Such errors lead to complications, especially in intensive care units, and mortality, longer stay in hospitals and extra costs imposed to health systems (6-7). The financial costs associated with medical complications are estimated to be nearly 77 billion dollars a year (6). Medication administration errors increase hospitalization for two days longer (9) and impose costs of around 2000 to 2500 USD for each patient. This is usually caused by inappropriate use of drugs, such as inappropriate administration of medicine and its consequent side effects (10). It is estimated that 30% of such patients die, or become disabled for more than six months (2). Such errors cause mistrust and dissatisfaction with the health care provider systems, and stress and moral insensitivity among nurses. The errors have negative effects on patients, nurses and organizations and results in a decreased quality of health care. Annually, due to medical complications, 48,000 to 98,000 deaths occur in the United States, of which 7,000 are related to medication errors (8, 11). This number is larger than the mortality rate caused by car accidents, breast cancer, and AIDS in the United States (12-14). According to a research conducted by Rose Ross and colleagues in the UK, the incidence of medication errors occurred 15% of the time, or in other words, in 1 out of every 662 patients. The highest rate of medication errors were related to critical care units such as neonatal, and domestically, 56% of nurses were responsible for them (8). In another study conducted in the UK, it was found that in preparing and administrating intravenous drugs, at least one error occurred, of which about 1% were serious, and 58% were average errors (15).

Some studies suggest that conditions are decisive in most errors while factors such as experience and education have little effect on medication errors. According to a recent study reported in Canada Health (2007), nurses with inadequate resources and those forced to work extra hours are more likely to commit medication errors (16). Proper and effective management of medicine therapy is an integral part of clinical roles, and responsibilities (16,17). Researches have shown that medication errors occur due to insufficient knowledge on pharmacology (13), misdiagnosis, failure to follow set procedures, illegible prescriptions of physicians, and shape, packaging and names similarity of some medications. (17). However, other issues are also influential such as lack of time, insufficient manpower and equipment, fatigue, and some concealed problems that indirectly contribute to the incidence of medication errors (5, 16). Other studies have shown that medication errors also occur as a result of shortcomings in education system, misidentification of medicines which can be tackled through increasing the staff knowledge (18) and identifying conditions that can be taken to

reduce errors (16,8). In other words, although human factors causing medical errors are relatively inevitable, a precise administration of medication (right patient, right drug, right time, right dose, and right route of administration) can greatly reduce the errors rate (19), therefore the researchers believe that more than half of the errors are preventable (20).

Despite the prevalence of medical errors, and the international studies carried out on their influences on patients and nurses, this issue is not well-received in different parts of Iran, and still a considerable number of medication errors exist in the different regions. This study aimed to determine the amount and type of medication errors by nurses in hospitals of Ahvaz University of Medical Sciences, and their relationship with demographic variables. The findings of this study can best help to identify the types of errors, and as a result to better plan to decrease the occurrence of these types of errors and complications on patients, and to reduce health care costs, length of hospitalization, ethical dilemmas, and to increase patients satisfaction and confidence.

Material and methods

This is a descriptive study, which examined the nurses' medication errors and the relationship of such errors with job and demographic characteristics of nurses. Samples included 225 nurses working in hospitals in Ahvaz University Departments, including surgical, pediatrics, CCU, emergency, neurology, lung, infection, gastroenterology, burn, and plastic surgery, women, and ICU units. They formed the multistage random sampling who worked in one of the three shifts (morning, afternoon, evening). The sampling process was conducted first in the training centers of Ahvaz University of Medical Sciences. They were then randomly selected during multiple visits; nurses who met the criteria for participating in the study and were willing to cooperate were selected from different shifts.

The inclusion criteria included having physical and mental health, being an employee of Ahvaz Medical University hospital, with at least six months of experience and having at least a bachelor's degree. Data were collected through a 2-part questionnaire designed by the researcher. The validity and reliability of the questionnaires were confirmed using test-retest method with the correlation coefficients of 0.8.

The first instrument used to collect demographic data included age, sex, education level, years of nursing, ward, working experience, having passed medication administration training courses, shift (in circulation-fixed), type and time of employment, having a second job. The second part consists of a self-report instrument containing 20 items of medication errors if any reported during the last three months of their nursery. The questionnaire also consisted of yes/no questions.

Results

In this study, the majority of nurses were women (93.8%) with an average age of 32 or above. Almost all of them (99.6%) had a bachelor's degree, and 33.8% had 8.4 years of experience, 63 participants (28%) had completed training courses, and 162 (72%) had not passed any training courses before. Among them, 50 (22.2 %) were official employees, 23 (10.2%) semi-official, 132 (58.7%) contractual employees and 20 (8.9%) were patients. Among the nurses, 12 (5.3%) were working in more than one hospital and none of the nurses had a second job (Table 1).

Among all the different types of medication errors, 55.6% included untimely administration of medicine, and 44.5%

administration without a prescription. Also, 40% of the errors occurred due to postoperative analgesics without a prescription, 6.38% due to oral medication regardless of interaction. It was also found that 35.5% of the errors were because of noncompliance with medications and timely manner. In general, 33.8% of the errors, which was the highest rate, were due to human factors (Table 2).

Based on the results from the chi-square test, a significant correlation existed with age and certain types of medical errors such as non-compliance with medication at the right time ($p<0.03$), giving the exact prescribed medicine to the patients ($p<0.0$) and the right prescribed dose to the patients ($p<0.02$), untimely administration of medication ($p<0.004$). The findings also showed that a significant correlation existed between nursing experience and the right time to administer medication to patients ($p<0.05$), lack of the necessary steps required for special attention ($p<0.02$), and postoperative analgesics without a doctor's prescription ($p<0.05$). A significant increase in the error rate was observed in the administrating medicine to a patient without a doctor's prescription ($p<0.03$), or without a right diagnosis on the disease ($p<0.02$), without a doctor's prescription ($p<0.002$), when the nurses' working experiences at a certain unit was low. In addition, a significant relationship existed between taking courses and occurrence of medication errors (Table 3).

The results of the chi-square test also showed a significant relationship between shift hours and rate of medication errors ($p<0.05$). Moreover, there was a significant relationship between the types of employment and certain errors such as prescribing medication to a wrong patient ($p<0.03$), giving some oral medication regardless of the interactions ($p<0.05$), analgesics after surgery without a doctor's prescription ($p<0.03$), administrating more or less medication than the prescribed dose ($p<0.02$), and untimely administration of medication ($p<0.01$). Consequently, it was observed that the lowest errors rate occurred in official type of employment and the highest errors existed among the contractual based nurses.

Test statistics of kruskal-wallis showed a significant relationship between work experience ($p<0.01$) in the current type of employment ($p<0.01$) and the occurrence of some types of medication errors such as untimely prescribed medication, prescribing painkillers after surgery without giving some oral medication regardless of their interactions. According to the Pearson correlation test, it was confirmed that there was an inverse relationship between the occurrence of medication errors, working background of nurses ($p<0.001$, correlation coefficient -0.316), age ($p<0.001$, correlation coefficient -0.282), and type of employment ($p<0.001$ correlation coefficient -0.228). One-way ANOVA showed that there was a significant relationship between the errors and the type of employment ($p<0.0$ and $f=9.7$), and the type section ($p<0.017$ and $f=1.77$). Independent *t*-test did not show any significant relationship between the occurrences of medication errors and the level of education, working extra and working in more than one hospital.

Table 1. The demographic data of the participating nurses

Variables	Frequency	Percent	Mean ± Deviation
Sex	Women: 211	93.8	-
	Men: 14	6.2	-
Education level	Bachelor: 224	99.6	-
	Master: 1	0.4	-
Type of ward	Interior: 9	4	-
	Surgery: 29	12.8	-
	CCU: 38	16.9	-
	ICU: 75	33.3	-
	Nephrology: 15	6.7	-
	Emergency: 16	7.1	-
	Infectious: 1	.04	-
	Lung: 5	2.2	-
	Digestion: 5	2.2	-
	Burns: 14	6.3	-
	Children: 9	4	-
	Orthopedics: 4	1.8	-
	Gynecology: 5	2.2	-
Nursing experience	-	-	8.33 ± 5.042
Working experience in current section	-	-	4.8 ± 3.85
Passed training classes	Yes: 63	28	-
	No: 162	72	-
Shift type	Circulation: 221	98.2	-
	Fixed: 4	1.8	-
Employment type	Official: 50	22.2	-
	Contract hiring: 23	10.2	-
	Contract: 132	58.7	-
	Hiring plan: 20	8.9	-
Working extra in one or more hospitals	Yes: 12	5.3	-
	No: 213	94.7	-
Additional non-nursing job	Yes: 0	0	-
	No: 100	100	-

Table 2. Types of medication errors occurred in nurses participating in the study

Types of medication errors	Error occurred and is reported		Error occurred and is reported	
	Frequency	Percent	Frequency	Percent
1-Giving the wrong medication to a patient	32	14.2	36	16
2-Not giving the prescribed medicine to patients	5	24.4	25	11.1
3-Giving medication without a doctor's prescription	74	32.9	26	11.6
4-Non-compliance with medication at right time (before or after a meal)	69	30.7	7	3.1
5-Not taking medications that require special attention are the necessary steps (taking the pulse, blood pressure, etc.)	44	19.6	1	0.4
6-Prescribed to a disease other than patients prescribed medication	31	13.8	9	4
7-The mixing of two or more drugs in micro set regardless of drug interactions	34	15.1	6	2.7
8-Rapid injection of a drug rather than a slow one	49	21.8	8	3.6
9-Medicine, chewing or swallowing a sublingual form	23	10.2	-	-
10-Oral medication regardless of their interactions	82	36.4	5	2.2
11-Postoperative analgesics without prescription	79	35.1	11	4.9
12-More or less medication than prescribed	45	20	5	2.2
13-Administrating without following instruction	20	8.9	5	2.2
14-Depending on the patient's non-compliance with appropriate medication	34	15.1	3	1.3
15-Untimely administration	116	51.6	9	4
16-No diluting a drug that should be diluted	19	8.4	2	0.9
17-Subcutaneous injection of intravenous	20	8.9	2	0.9
18-Intravenous injection subcutaneously	14	6.2	3	1.3
19-Intramuscular injection of intravenous	19	8.4	3	1.3
20-Intravenous injection into muscle	20	8.9	3	1.3

Table 3. The relationship between medication errors and completion of classroom training

Types of medication errors	Commitment of Error		Passing training class		P-value
			yes	no	
1-Administrating a wrong medication to a patient	yes	68	9	59	0.26
	no	157	54	103	
2-Not giving prescribed drug to patients	yes	80	13	67	0.5
	no	145	50	95	
3-Giving medication without a doctor's prescription	yes	100	15	85	29.0
	no	125	48	77	
4-Non-compliance with medication at right time (before or after a meal)	yes	76	16	60	0.007
	no	149	47	102	
5-Not taking medications that require special attention and necessary steps (taking the pulse, blood pressure, etc.)	yes	45	6	39	0.02
	no	180	57	123	
6-Prescribed to a disease other than patients prescribed medication	yes	40	5	35	0.01
	no	185	58	127	
7-The mixing of two or more drugs in micro set regardless of drug interactions	yes	40	6	234	0.15
	no	185	57	128	
8-Rapid injection of a drug rather than a slow one	yes	57	7	50	0.04
	no	168	56	112	
9-Medicine, chewing or swallowing a sublingual form	yes	23	3	20	93.0
	no	202	60	142	
10-Oral medication regardless of their interactions	yes	87	77	10	0.001
	no	138	53	85	
11-Postoperative analgesics without prescription	yes	90	9	81	0
	no	135	54	81	
12-More or less medication than prescribed	yes	49	6	43	0.5
	no	176	57	119	
13-Administrating without following instruction	yes	25	4	21	0.92
	no	200	59	141	
14-Depending on the patient's non-compliance with appropriate medication	yes	37	5	32	0.15
	no	188	58	130	
15-Untimely administration	yes	10	20	105	0.01
	no	125	43	57	
16-No diluting a drug that should be diluted	yes	21	0	21	0.01
	no	204	62	141	
17-Subcutaneous injection of intravenous	yes	22	4	18	0.13
	no	203	59	144	
18-Intravenous injection subcutaneously	yes	17	3	14	0.25
	no	208	60	144	
19-Intramuscular injection of intravenous	yes	22	3	19	0.09
	no	203	60	143	
20-Intravenous injection into muscle	yes	23	3	20	0.07
	no	202	60	142	

Discussion

This paper studied the incidence of medication errors and factors influencing it among 225 nurses working in Ahvaz training hospitals. The study found that untimely administration of medicine (55.6 %) was the most frequent type of error, a fact revealed in many other recent studies. Such errors increase mortality and hospital costs (8). Hajibabai et al. stated that in average once in 3 months a nurse untimely administers medicine in the hospitals in Iran (16). The studies in Western countries show that the rate of medication errors has been increasing in recent years (21). In the present study, medication errors such as untimely administration (55.6%), giving a prescription drug to a patient without a prescription (44.5%), postoperative analgesics without prescription (40%), giving some oral medication with no due interference (38.6%), and giving medicine to a patient (5.35%) accounted for the majority of the errors (22). However, in the study of Hajibabai et al. giving oral medication with non-compliance medication at right time (before or after a meal), rapid injection of a drug that must be injected slowly and untimely-prescribed medication had the highest rate of errors. Based on the findings of a study in France, the most common errors included wrong dose, wrong time, and wrong medication. In another study, the most common medication errors in 36 hospitals in Georgia and Colorado America proved to be wrong time, no prescription, wrong dosage, and administration of unauthorized drugs.

In a study in Taiwan, dosing errors accounted for most of the errors (23). Various studies suggest that wrong time of administration was the major medication error (24). In addition, lack of time in putting together some oral medication, given without an explanation of each one separately was regarded as the other main reasons of such errors. Discounting on interaction between medications can cause irreversible side effects in patients. However, nurses complying with five principles can reduce the rate of errors by approximately 50%; right patient, right medication, right dose, right time and right prescription medication (25). However, Errors rate in the study of Nikpeyma et al. (2008) indicated a 22% reduction, (12). The findings of this study indicated a 33.8% non-compliance with timely medication by the nurse while in the study of Mohammdnejad et al., the non-compliance with timely medication was shown to be 13.51% of medication errors (26). In Kohestani et al.'s study accounted for 5.08% of the errors (2) and in the study conducted by Nikpeyma et al., this was reported to be 18% (12), which is less than the amount obtained in the present study. The results of this study indicated that there was a significant correlation between the proper time of medicine administration and experience of the nurses; Therefore, nursing work experience can reduce the errors. In a study in Japan, Ito showed that the rate of medication error reduced with experience years (27). However, the study of Zahmatkeshan et al. ($p<0.318$) (28) and Hajibabai et al. showed that the rate of medication errors had no significant association with experience (22), while Mohammadnejad et al.'s study showed graduated nurses make less errors than those studying in term 6 (45.94%) and the term 7 (21.62%) of a medical university (26). Sheu et al. also found a significant relationship between the type of error with nurse experience and type of ward. Accordingly, the error rate in medical-surgical units was higher than in the obstetrics and gynecology wards, which had lower rates than other wards (29). In addition, another study showed that there was a significant

relationship between age and type of medication error, with the maximum errors rate being at the ages of 28 to 32. Errors rate is reduced as age is increased. Nikpeyma's study revealed that most errors occur at the age group of 25 to 30. In this study, it was found that there was a significant association between the incidence of medication errors in the morning and intravenous medicine by subcutaneous injection or subcutaneous injection by intravenous ($p<0.05$). In this regard, Nikpeyma also showed that medication error rate in morning shift was the highest (12), however, the study of Zahmatkeshan et al. (2007) showed that work shift has no effect on the incidence of medication errors (28). Hajibabai et al.'s study showed that no statistical significance existed between the incidence of medication errors and work shift. The findings of other studies show that night shifts can cause insomnia and fatigue, changes in heart rate compared to the morning shift and therefore a decrease in nurses' performance at nights, creating unawareness of the problems leading to the rise of medication errors (22). The findings also indicated that there was a significant relationship between the type of employment and the occurrence of medication errors ($p<0.05$). The results of Zahmatkeshan's study showed a significant relationship between type of employment and the rate of medication errors ($p<0.05$) (28). Other findings showed that a significant association existed between gender and medication errors, (intravenous or intramuscular injection of the drug) ($p<0.01$), that in this regard women failed more than men did. The study of Kouhestani et al. Showed that the error rate in females (64.3%) was more than that in males (16.7% of cases) ($p<0.02$) (2). Hajibabai et al.'s study showed that the errors rate in male nurses occur more than in females ($p<0.001$). Moreover, based on the study by Marian et al. gender of nurses was a predictor of medication errors and that was more in women than in men. They concluded that women tend to make more medication errors than men do, but they do not necessarily make the same errors as men (5). A study carried out by Penjvini et al. showed that there was a significant correlation between gender and occurrence of medication errors in intravenous way, indicating that in their study, the error rate was higher in women than in men (30). The results of this study showed a significant correlation between passing training courses in medication administration and medication errors ($p<0.05$) Thus, nurses who had not passed a training course made more errors. This result is inconsistent with the study of Hajibabai et al. ($p<0.01$) (22). In the present study, no significant correlation was observed between the type of education, employment, having no second job, working extra, and occurrence of medication errors. This finding is inconsistent with Hajibabai et al.'s study. In this study, a significant correlation between medication errors and type of employment was seen (Table 7), which is inconsistent with the results of Hajibabai et al.'s study.

The limitations in this study included self-report and the self-evaluation way of collecting data, though it seems that more valuable data could be achieved following other ways, as well. Nevertheless, many national and international studies have also used the same method for data collection. Given that human and organizational causes of medical errors is a major reason in medication errors (8), we can conclude that changing labor laws, strong management and an increased labor force can increase the quality and safety of nursing. Health managers should note that administration of medication in all stages of preparation and implementation of drug prescribing is a key indicator of the quality process (31,32). Therefore, the authorities should concentrate

on the processes affecting health systems to reduce medical errors, including proper training of personnel. Since the level of knowledge has an important role in the occurrence of medication errors, it is suggested that trained supervisors and nursing managers be employed to nurses' knowledge through job training programs, and to provide necessary training manuals and posters to raise nurses' awareness on medication errors(33,34).

Providing suitable conditions for nurses and other requirements in these courses are reaffirmed through the findings of this study. Instructions, should be provided on the best cases, new drugs and side effects, how to work with the new infusion pump through providing a short period of journal clubs for nurses. This will also encourage nurses, enhance their motivation, introduce them the capabilities and limitations of existing approaches, and can consequently have positive effects on reducing medical errors in clinical settings. In addition, since more work experience contributes to the reduction of the incidence of medication errors, it is recommended to employ experienced nurses to work with high risk medication administration and hire experienced nurses to supervise new nurses with less experience in the process of drug administration.

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