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Original

Effective Factors on Occurrence of Drugs Mistakes from the Viewpoints of Nurses

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Abstract

Background: Human error is more prevalent among nurses than other health care occupations. These mistakes are used as important index for determination of the safety of patients in hospitals. The purpose of this study was to evaluate the different factors resulting in the occurrence of medication mistakes in an educational hospital. **Methods**: This study was performed on 236 nurses working in a hospitals affiliated to Babol University of Medical Sciences, Iran. The data collection tools were demographic and organizational information questionnaire, containing questions about the main causes of medication mistakes. Data were analyzed using SPSS software using descriptive statistic and analytical statistics such as independent t-test and one-way ANOVA. **Results**: The lowest and the highest score among the four dimensions of the causes of medication mistakes questionnaire were related to the dimension for nursing management (mean=3.13, SD= 0.66) and causes related to nurses (mean=3.54, SD= 0.68), respectively. Also, based on Pearson Correlation, there was a significant and direct correlation between all the four dimensions of the questionnaire and the demographic and organizational factors of nurses. Only the shift work variable of the employees had a significant statistical relationship with the final score of the causes of medication mistakes. **Conclusion:** Nursing staffs need to pay more attention to possible causes of medication errors such as reducing workload and reducing the working hours of nurses, because the mentioned factors can lead to fatigue and decrease of concentration of nurses and may increase the possibility of occurrence of mistake.

Keywords: Medication mistakes; Medical error; Nursing; Human error

Introduction

The health of an individual may be compromised for a variety of reasons, including affliction by illnesses or occurrence of accidents. Among the various causes of health failure, medical mistakes have attracted much attention in recent years which can be ascribed to drug mistakes.[1]Drug mistakes is considered one of the most important causes of death in the United States. Statistics have shown that thousands of people die in the United States annually as a result of drug mistakes. The financial cost implication of drug mistakes resulting in complications is estimated at $77billion annually.[2] Experts know these mistakes are consequences of some structural weaknesses in the health system of the country.

Common drug mistakes include drug prescription errors, failure to consider proper drug timelines, failure to follow laid down procedure/principles in prescribing drugs,, giving medicines more than prescribed orders, mistakes in calculating dosage, and prescribing drug to

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patient without considering patient's health history t.[3,4]Majority of these mistakes are made by the nurses who are over labored and stretched beyond their capacity.[5]Increase in workload, increasing job stress, and continuous reduction in job satisfaction have created major concerns for nurses.[5] The mistakes mentioned above are more prevalent amongst nurses than other health care personnel's. These mistakes are considered as an important index for determining patient's safety due to its high prevalence and possible risk factors.[6]A study in one of Iran's public hospitals within a month's duration reported 79% of drug mistakes among nurses.[7] In countries like Iran, compiled statistics of medical mistakes such as drug mistakes, are not available but experts have predicted that billions of dollars will be spent annually on maintaining and taking care of victims.[8]

This valuable index should be reported and analyzed in a reliable manner in hospitals and health facilities.[9]The occurrence of drug mistakes by nurses, regardless of individual causes, is influenced by several other factors that can be prevented. It is helpful to identify these effective factors in the adoption of measures to prevent drug mistakes. Therefore, according to above subjects, the purpose of this study is to evaluate the relationship between job content and the causes of drug mistakes and to determine the most important psycho-social l factors and their effect on drug mistakes among nurses working in several public hospitals of Iran.

Methods

This is a descriptive-analytic research that was carried out between April to December 2016. The research environment included all departments of hospitals. The statistical population consisted of 1020 nurses working in 6 hospitals affiliated with Babol University of Medical Sciences. Accordingly, the sample size was determined at 236 people using the Cochran formula, considering the probability ratio of 0.5, confidence interval of 0.95 and error level of 5%. The sample size was allocated randomly by considering the ratio of nurses in each hospital and were selected for the study by using random numbers table. This study was conducted after obtaining a license from Babol University of Medical Sciences (ethics code: MUBABOL, HRI, REC 2016.26). It should be noted that according to the principles of privacy in the research, confidentiality of induvial is being upheld. The studied individuals completed the questionnaire with complete and informed consent.

The entry criteria of nurses to the study included the privilege of Bachelor of Science in Nursing field, full-time job, lack of second occupation, lack of physical and mental health problems (based on self-report) and at least one year of work experience in the current departments. The exit criteria from study also included refusal to continue cooperation and incomplete completion of questionnaires. A researcher-made questionnaire was used to collect demographic and organizational information, including age, gender, work shift status, marital status, department or work place, employment status, total work record, work experience in the desired department, level of education and position. The questionnaire of main causes of drug mistakes included 28 items in four areas related to nurses (8 items), causes related to department (5 items), causes related to nursing management (10 items) and the causes of drug (5 items) (10). Items were scored on a Likert scale of 5 degrees from very high (score 5) to very low (score 1).

In the next step, the average score of each question and average score of each domain were calculated and then the average scores were compared in different domains. Validity and reliability of used questionnaire was confirmed by Amrullahiet al.[10]Also, the questionnaire was re-evaluated in this study and Cronbach's alpha calculation (0.91) indicates the acceptable reliability of this tool. The questionnaires were delivered to the hospitals affiliated with Babol University of Medical Sciences during the morning and afternoon shift from Saturday to Thursday of each week. In order to reach all nurses, hospitals were referred. The purpose of the study was explained to

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each nurse. After obtaining oral satisfaction from them, a questionnaire was provided to the nurses. According to the request of each nurse, considering the amount of work and the speed of response, a sufficient amount of time was given to complete the questionnaire (average of one hour). Finally, the questionnaires were collected by the researcher.

Thereafter results were collected to evaluate the descriptive statistics including average, standard deviation and relative frequency of observations were investigated, then inferential statistics were analyzed. Normal distribution of research data was evaluated by Kolmogorov-Smirnov test. Independent t-test was used to evaluate the relationship between each of the effective domains on the occurrence of drug mistakes with demographic and organizational factors including gender, marital status, employment status, work system and education level. One-way ANOVA test was also used to evaluate the relationship between the effective domains on the occurrence of drug mistakes with other factors (age groups and work experience). The significance level in all tests was considered 0.05. Data analysis were carried out by SPSS software version 23 (version 23, SPSS Inc., Chicago IL).

Results

In this study, 83.90% (198 people) female nurses and 45.30% (107 people) were evaluated in the age group of 30-39 years. Among these, 73.30% (173 people) had a work experience less than 10 years. Most of the nurses (90.70%) were circular in the shift system and only 10.6% of them had master and Ph.D. degrees Table 1.

According to the obtained results of the questionnaire evaluation, the effective factors resulting in the occurrence of drug mistakes from the nurses' viewpoint, showed that, in the aspect of causes related to nurses, the question of "fatigue due to heavy workload", in the aspect of causes related to department, question of "High number of tasks", in the aspect of causes related to nursing management, the question of "Insufficient number of nurses, and in the aspect of the drug causes, the question of "availability of different doses of a single drug), respectively, obtained the highest average Table 2.

Items 1-8 are about Nurse-related factors.
Items 9-13 are about Workplace-related factors.
Items 14-23 are about Management-related factors.
Items 24-28 are about Medication-related factors.

The lowest and the highest average in the questionnaire dimensions and the causes of drug mistakes were related to the causes of nursing management 3.13 (0.66) and causes related to nurse 3.40(0.68). Also, based on Pearson Correlation, there was a significant and direct correlation between the quadratic dimensions of the questionnaire. The internal consistency evaluation of the four aspects and the 28 questions of the questionnaire of the causes of drug mistakes, used in this study, was obtained between 0.44 and 0.85. Meanwhile, the aspect of the drug causes was allocated the highest value and the causes related to department was the lowest alpha Cronbach value Table 3. The obtained results of statistical tests showed that among the demographic and organizational factors of nurses, the only variable of employees' shift was statistically significant with the final score of the questionnaire for the causes of drug mistakes Table 4.

Table 1. Participating nurses' demographic characteristics

Variables	Total
Gender	
Male	38(16.10)
female	198(83.90)
Marital status	
Married	58(24.60)
Unmarried/ single	178(75.40)
Employment Status	
Permanent	155(65.70)
Contract	81(34.30)
Shift Work	
Fixed duty	214(90.70)
Shift duty	22(9.30)
Educational Level	
BSN	211(89.4)
MSN/PhD	25(10.60)
Age (year)	
20-29	96(40.70)
30-39	107(45.30)
40	33(14.00)
Clinical experience (year)	
≥10	173(73.30)
11-20	49(20.8)
> 20	14(5.9)

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Table 2. Frequency, mean, and standard deviation of the reasons behind medication errors

Item		Reasons behind medication errors					
		very high	high	medium	low	very low	M(SD)
1	Lack of pharmacology knowledge	41(17.40)	71(30.10)	102(43.2)	20(43.20)	2(0.80)	3.55(0.90)
2	Errors in calculating drug dosage	37(15.70)	66(28.00)	78(33.10)	48(20.30)	7(3.00)	3.33(1.06)
3	Insufficient attention to patients' medical records	30(12.70)	55(23.30)	50(21.20)	61(25.80)	40(16.90)	2.89(1.29)
4	Job dissatisfaction	43(18.20)	55(23.30)	74(31.40)	40(16.90)	24(10.20)	3.22(1.22)
5	Dissatisfaction with income	71(30.10)	66(28.00)	32(13.60)	41(17.40)	26(11.00)	3.49(1.36)
6	Personal problems	70(29.70)	78(33.10)	49(20.80)	22(9.30)	17(7.20)	3.69(1.19)
7	Occupational stress	72(30.50)	105(44.50)	38(16.10)	15(6.40)	6(2.50)	3.94(0.97)
8	Fatigue due to heavy workload	117(49.60)	77(32.60)	27(11.40)	14(5.90)	1(0.40)	4.25(0.90)
9	Environmental noises	59(25.00)	80(33.90)	66(28.00)	29(12.30)	2(0.80)	3.70(1.01)
10	Problems related to ward rooms (such as poor lighting)	41(17.40)	49(20.80)	95(40.30)	45(19.10)	6(2.50)	3.31(1.04)
11	High number of tasks	93(39.40)	83(35.20)	46(19.50)	13(5.50)	1(0.40)	4.08(0.91)
12	Improper drug arrangement in shelves	15(6.40)	67(28.40)	94(39.80)	46(19.50)	14(5.90)	3.10(0.98)
13	Inappropriate drug protocols	10(4.20)	47(19.90)	101(42.80)	62(26.30)	16(6.80)	2.89(0.94)
14	Lack of drug information sources in the ward	17(7.20)	45(19.10)	103(43.60)	57(24.20)	14(5.90)	2.97(0.98)
15	Insufficient number of nurses	111(47.00)	62(26.30)	40(16.90)	14(5.90)	9(3.80)	4.07(1.10)
16	Inadequate supervision	10(4.20)	59(25.00)	81(34.30)	58(24.60)	28(11.90)	2.85(1.06)
17	Incompetent staff	15(6.40)	65(27.50)	96(40.70)	49(19.90)	13(5.50)	3.09(0.97)
18	Wrong drug administration route	8(3.40)	58(24.60)	99(41.90)	53(22.50)	18(7.60)	2.94(0.95)
19	Illegible medical orders	52(22.00)	92(39.00)	58(24.60)	28(11.90)	6(2.50)	3.66(1.02)
20	Illegible cardex (patient care and medication sheet)	31(13.10)	53(22.50)	63(26.70)	61(25.80)	28(11.90)	2.99(1.22)
21	Working the morning shift	18(7.60)	37(15.70)	78(33.10)	74(31.40)	29(12.30)	2.75(1.10)
22	Working the evening shift	10(4.20)	44(18.60)	89(37.70)	73(30.90)	20(8.50)	2.79(0.98)
23	Working the night shift	32(13.60)	60(25.40)	83(35.20)	47(19.90)	14(5.90)	3.21(1.09)
24	Diversity of drugs in the ward	31(13.10)	69(29.20)	87(36.90)	37(15.70)	12(5.10)	3.30(1.04)
25	Using abbreviations instead of the full names of the drugs	27(11.40)	68(28.80)	76(32.20)	48(20.30)	17(7.20)	3.17(1.10)
26	Similarity in drug names	43(18.20)	84(35.60)	76(32.20)	24(10.20)	9(3.8)	3.54(1.02)
27	Similarity in drug shapes	57(24.20)	79(33.50)	68(28.80)	25(10.60)	7(3.00)	3.65(1.05)
28	Availability of different doses of a single drug	30(12.70)	83(35.20)	80(33.90)	36(15.30)	7(3.00)	3.99(0.99)

Table 3. Internal consistency and Mean and standard deviation of sub-scales of causes of medication errors items

Items	Sub-scales					M (SD)	α
	1	2	3	4	Total		
1	1					3.54(0.68)	0.75
2	0.58**	1				3.41(0.69)	0.74
3	0.62**	0.60**	1			3.13(0.66)	0.83
4	0.39**	0.50**	0.62**	1		3.41(0.83)	0.85
Total	0.78**	0.81**	0.87**	0.70**	1	3.37(0.58)	0.91

Sub-scales description: 1= Nurse related, 2= Workplace related, 3= Management related, 4= Medication related
**Correlation is significant at the 0.01 level (2-tailed)

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Table 4. Comparison of Reasons behind medication errors means based on demographic variables

Variables	Category	N (%)	Mean (SD)	P-value
Gender	Male	38(16.1)	3.39(0.42)	0.81
	female	198(83.9)	3.37(0.61)	
Marital status	Married	58(24.6)	3.36(0.60)	0.91
	Unmarried/ single	178(75.4)	3.37(0.57)	
Employment Status	Permanent	155(65.7)	3.39(0.58)	0.41
	Contract	81(34.3)	3.33(0.59)	
Shift Work	Fixed duty	214(90.7)	3.35(0.59)	0.043
	Shift duty	22(9.3)	3.56(0.49)	
Educational Level	BSN	211(89.4)	3.36(0.56)	0.46
	MSN/PhD	25(10.6)	3.45(0.71)	
Age (year)	20-29	96(40.7)	3.35(0.50)	0.39
	30-39	107(45.3)	3.35(0.64)	
	≥ 40	33(14)	3.50(0.59)	
Clinical experience (year)	10 ≥	173(73.3)	3.33(0.59)	0.15
	11-20	49(20.8)	3.47(0.54)	
	> 20	14(5.9)	3.56(0.60)	

Discussion

Considering the importance and effect of drug mistakes in increasing mortality and hospital costs, studies on the causes and effective factors resulting in the occurrence of these mistakes are thus significant.[11] The result of the topic under study reveals that among the four groups of causes related to the occurrence of drug mistakes (nurse, management, department and drug causes), those related to nurse from the nurses viewpoint is the most important cause in the occurrence of drug mistakes. Although, in one study on 200 nurses in Tabriz, Iran, the most important group of effective causes resulting in the occurrence of drug mistakes was reportedly related to department.[12] Also, one study on 248 nurses reported management factors as the main causes of drug mistakes of nurses[13] which contrary to the results of this study. The contradiction in the results can be attributed to the difference in the environment, working conditions, and the difference in sample size employed in this study.

Based on the results of the study, fatigue, which is as a result of excess workload was ranked highest amongst the questions related to nurses. Studies on nurses working in Qazvin and Shahroud hospitals, respectively, also reported fatigue due to excessive work load to be the most important effective factor resulting in the occurrence of drug mistakes in the nurses' domain.[14,15] In this regard, another study evaluated 112 common drug mistakes and reported the fatigue feeling due to excessive work load as the most important individual factor in occurrence of drug mistakes.[16] This finding is consistent with the results of the United States Pharmacopeia report, which is based on almost 35,000 records in the drug mistakes reporting database from 1998 to 2002.[17] One of the consequence of fatigue due to excessive work load carried out by nurses, is the error in the review of drugs or disruption in drug preparation, which can lead to a drug mistake.[18]

The fatigue resulting from overcrowding and excessive workload in working environment also causes distraction, which in turn causes the neglect of safe procedures in preventing drug mistakes by nurses. Therefore, managers of health facilities (including head nurses and supervisors), should make deliberate effort in allocating tasks and ensuring a secure and calm working environment conducive for all nurses. It is in accordance with the results of the interventional study, which indicated that by adopting an interventional program for reducing heavy work shifts and reducing weekly working hours, the occurrence rate of drug mistakes was decreased significantly.[19] In this study, it was observed that concentration of work in departments ranked highest as the most important

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factor amongst the causes associated with departments in the occurrence of drug mistakes. This was also observed in other similar study reports.[20,21] Nurses deal with complex functional roles in work environment that increase their responsibilities, managerial expectations, and thus increase the workload on them. These hierarchical factors can facilitate the occurrence of drug mistakes by this occupational group.[22-24]

The result also pointed out that the ratio of nurses to patient is such that can cause the occurrence of drug mistakes streaming from the managerial domain. This is in line with another study who mentioned the shortage of nurses to be the most important cause of drug mistakes.[25] Tang et al. also stated that shortages of employees lead to decrease in quality of work and subsequent drug mistakes.[26] In this study, a significant effective cause of (as a factor) the occurrence of drug mistakes was related to the availability of different doses of a single drug. Two other studies on nurses found wrong dosage of drug as a major cause of drug mistakes by nurses which is in accordance with the results of our study.[27,28]

Many nursing researchers have mentioned the increase in nurses' pharmacological information as an important strategy to reduce drug mistakes and have stated that updating nurses' information in relationship with drugs can be an important factor in order to reduce drug mistakes.[29,30] Although drug mistakes are sometimes unavoidable due to negligence and human mistakes, but considering the accurate principles of giving medicine (including pay attention to the correct patient, correct medicine, correct time, correct dose and correct using way) can greatly reduce the amount of mistakes.[31] Taylor, considers two other principles necessary in time of giving medicine in addition to these five principles, which includes the correct reason for giving the drug and correct recording in the case.[32] It is also recommended to hold classes and training workshops to increase the awareness and information of the drug, and to use the drug book or pharmacy software in the departments. Based on the results, there was a significant difference between the effective factors in the occurrence of drug mistakes and with work schedule (working system). Most of the drug mistakes occurred in unusual shifts, (evening and night) from the viewpoint of nurses, which is consistent with the results two other studies.[12,33] However, it is in conflict respectively with the results of two other studies on Iranian and Japanese nurses.[12,34] It should be noted that in unusual shifts (evening and night shifts) due to reduction in the force in the evening and night shifts and the reduction of the supervision of the relevant authorities in these shifts, the occurrence of drug mistakes increases by employees, such that managers and hospital officials should pay attention to this issue and consider the arrangement of force in the departments with the number of patients properly.

It should be noted that the present research is confronted with limitations that affect the power of the generalizability of the results. One of these limitations is the cross-sectional study and using of self-report questionnaires to collect data so that the psycho-emotional conditions of individuals when completing the questionnaire are one of the determining factors in how to answer the questions, which was beyond the control of the researcher. To adjust the effect of this limitation, nurses were asked to select a time to complete a questionnaire to have sufficient time and not to worry about working with a sick patient. Regarding the results of this study, nursing managers need to pay more attention to logical proportion of the number of employees with available patients in the departments, reducing the workload and reducing the working hours of nurses, because the mentioned factors can lead to fatigue and decrease the concentration of nurses, as well as increase the possibility of mistake occurrence. Generally, using a systematic approach in order to evaluate the effective factors in occurrence of drug mistakes and eliminating these factors is of utmost

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importance. On the other hand, the risks associated with drug mistakes in all stages of prescribing, preparing, and administering drugs are conducted. Therefore, hospital authorities in this regard should focus on effective processes on reducing of drug mistakes, including proper employee training. Holding retraining classes in relation to the principled drug prescribing techniques and encouraging nurses from nursing managers to motivate them is one of the solutions that can have positive and effective impacts in order to reduce the number of drug mistakes in clinical environments.

Conflict of interest

No conflict of interest was reported

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