

Determination of Nursing Interventions For Prevention of Medication Administration Errors

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ABSTRACT

Purpose: This research was a descriptive study performed with the aim of determining nursing practices about preventing medication administration errors.

Methods: This research was completed in an education-research hospital and a private hospital located in a metropolitan city in Turkey. For collection of data, forms about descriptive characteristics, features related to medication administration errors of nurses, individual practices and institutional precautions about preventing medication errors were used. The research included 275 nurses actively administering medication. Analysis of data used percentages, mean, standard deviation, one-way ANOVA, Kruskal Wallis and correlation analysis tests.

Results: As a result of the research, 87.2% of nurses stated they always checked the patient's name, medication name, medication dose, and medication administration route, while 8% stated they very rarely researched the correct preparation form based on medication properties. Nurses with postgraduate education, choosing the profession themselves and satisfied with the profession were identified to perform more interventions about preventing medication errors ($p<0.05$). As the precautions taken by institutions in the research increased, the precautions taken by nurses about preventing medication errors reduced. Of nurses, 96.6% recommended increasing the number of nurses to prevent medication errors.

Conclusion: It is recommended to implement standards related to medication administration, develop institutional policies, use technology in the medication administration process, expand lessons and topics related to medication administration errors and precautions in the basic nursing education curriculum and increase in-service training and activities.

Keywords: nursing, medication administration, medication error, prevention

ÖZET

Amaç: Bu araştırma ilaç uygulama hatalarının önlenmesine yönelik hemşirelik girişimlerinin belirlenmesi amacıyla tanımlayıcı olarak yapılmıştır.

Yöntem: Bu araştırma Türkiye'nin bir metropol şehirlerinden bulunan bir eğitim araştırma hastanesi ve bir özel hastanesinde gerçekleştirilmiştir. Verilerin toplanmasında tanıtıcı özellikler formu, hemşirelerin ilaç uygulama hatalarına ilişkin özellikler formu, ilaç hatalarını önlemeye yönelik bireysel ve kurumsal önlemler formu kullanılmıştır. Araştırmaya aktif olarak ilaç uygulaması yapan 275 hemşire dahil edilmiştir. Elde edilen verilerin değerlendirmesinde yüzdelik, ortalama, standart sapma, Tek yönlü Anova testi, Kruskal Wallis ve korelasyon analizi kullanılmıştır.

Bulgular: Araştırma sonucunda hemşirelerin % 87,2'si hastanın ismini, ilacın ismini, ilaç dozunu, ilacın uygulama yolunu her zaman kontrol ettiğini, %8'i ise çok nadir olarak ilacı özelliklerine göre doğru hazırlama şeklini araştırdığını belirtmiştir. Lisansüstü eğitim alan, mesleğini kendi isteğiyle tercih eden ve mesleğinden memnun olan hemşirelerin diğer hemşirelere göre ilaç hatalarını önlemeye yönelik yaptıkları girişimlerin daha fazla olduğu saptanmıştır ($p<0,05$). Araştırmada kurumlar tarafından alınan önlemler arttıkça, hemşirelerin ilaç hatalarını önlemeye yönelik aldıkları önlemlerin azaldığı belirlenmiştir. Hemşirelerin % 96,6'sı ilaç hatalarının önlenmesi için hemşire sayısının artırılmasını önermiştir.

Sonuç: İlaç uygulamaları ile ilgili uygulama standartlarının, kurumsal politikaların geliştirilmesi, teknolojinin ilaç uygulama sürecinde kullanılması, hemşirelik temel eğitim müfredatında ilaç uygulama hatalarına ve önlemlere ilişkin ders veya konuların genişletilmesi hizmet içi eğitimlerin ve faaliyetlerin artırılması önerilmektedir.

Anahtar Kelimeler: Hemşirelik, ilaç uygulamaları, ilaç hataları, önlemler

Health professionals prepare medications, administer them to patients and monitor the outcomes. Medication administration has become more complicated with the development of technology, and is among complex nursing practices requiring in-depth knowledge and skills. It is not possible to reverse errors made by nurses during medication administration (1,2). For this reason, in line with the legal and ethical responsibilities of nurses, it is necessary to take the precautions required to prevent harm to the individual/family/society they serve and ensure the safety of medication administration (3).

The Institute for Safe Medication Practices (ISMP) publishes reports containing the necessary precautions to ensure medication administration can be performed in the safest way at international levels due to medication safety problems which may cause mortal harm to patients. This report includes technological systems and some practices that health organizations should implement (4). Draft guidelines developed by the ISMP include technological implementations like electronic health records (EHR), computerized provider order entry (CPOE), electronic medication administration record system (eMAR), barcode scanning systems, smart infusion devices, and electronic prescription systems and the systems developed to ensure patient safety by preventing medication administration errors with these practices (4). In spite of advanced technology and precautions, the Food and Drug Administration (FDA) reported that each year more than 100,000 errors are reported each year related to medication errors, while the National Center for Biotechnology Information (NCBI) reported that 7-9 thousand patients die due to medication errors each year in the USA and the Patient Safety Network reported 8-25% rates of medication errors during medication administration.

When the literature is investigated, studies dominantly attract attention to the causes of medication errors, reporting status of medication errors and tendency of nurses to make medical errors (5-7). However, there are very limited studies about nursing practices related to prevention of medication administration errors (8,9). This research determined precautions taken by nurses and institutions to prevent errors experienced during the medication administration process and in this context is thought to provide a significant contribution to the literature in terms of acting as a guide to resolving these deficiencies.

Material And Method

Location of The Research

The research was performed in an education-research hospital and a private hospital located in a metropolitan city in Türkiye between January 2017-June 2017.

Research Population and Sample

The population for the research comprised nurses performing active medication administration in the study hospitals. Sample selection was not performed in the research as the plan was to access the whole population. The research removed nurses on annual leave, maternity leave, etc. from the sample and was completed with 275 nurses who volunteered to participate in the research.

Data Collection Tools

The data collection forms were created by the researcher based on the literature (10-12). After creating the data collection forms, opinions were sought from five lecturers specializing in the nursing field in order to assess the content and scope of the forms. Necessary corrections (statements were changed in four items) were performed based on expert opinions.

The data collection forms comprised four sections of "Descriptive Characteristics Form", "Features related to Medication Administration Errors Form", "Nursing Practices to Prevent Medication Administration Errors Form" and "Institutional Precautions about Preventing Medication Errors Form".

The descriptive characteristics form comprised 12 questions about nurses' age, nursing program they graduated from, years of employment, clinic name, form of shift worked, number of beds in the unit, number of patients cared for, weekly mean working hours, satisfaction with the profession, willing selection of profession, working hours and educational status. The form related to features of medication administration errors was prepared based on the literature (Fisun et al., 2014; Björkstén et al., 2016; Küçükakça and Özer, 2016). This form comprised 6 questions about the basic professional training of nurses, adequacy of in-service training, witnessing medication errors during professional life, reporting medication errors during professional life and participation in a scientific program about medication errors. The form about institutional precautions to prevent medication errors comprised statements related to precautions taken by the institution to prevent medication errors (Taylor et al., 2011; Hassink et al., 2012; Zhu et al., 2014; ISMP, 2015; Biffu et al.,

2016). This form comprised 24 questions about precautions related to medication administration errors in hospitals such as requesting medications, obtaining from the pharmacy, storage conditions, medication preparation, conditions of administering medication to patients, procedures related to high-risk medications, automatic medication distribution systems, and devices used for medication administration. Nurses were requested to answer the questions with yes or no.

The form about nursing practices to prevent medication errors was prepared by the researcher using the literature (Taylor et al., 2011; Hassink et al., 2012; Zhu et al., 2014; ISMP, 2015; Biffu et al., 2016). This form included 51 questions with Likert-type rating about precautions taken to prevent medication errors.

Analysis of Data

Data obtained in the research was analyzed with a statistical program. Questions about descriptive characteristics of nurses were classified and frequency and percentage distributions were calculated. Comparison of quantitative data in two groups used the independent samples t test for comparison of parameters with normal distribution. For comparisons of quantitative data in more than two groups, one-way ANOVA and Kruskal Wallis tests were used for comparison of parameters with normal distribution, with the Tukey test used to identify the group causing differences. Correlation analysis was applied to identify correlations between scales.

Ethical Aspect of the Research

Before beginning the research, ethics committee permission (date 02.01.2018 and number 16969557-36), and institutional permission from the hospitals (date 02.03.2018 and number 14574941-605.01) were received. During the stage of implementing the research, the aim of the study was explained to nurses and their written and/or verbal consent was obtained after giving information about the research.

Results

Of nurses, 90.9% were women and 44% were 31-40 years old. Among the nurses, 68% had undergraduate degrees, 32.7% had been employed for 6-10 years and 42.5% cared for 4 to 10 patients during working hours. For medication errors, 49.4% of nurses had received partial in-service training about preventing medication errors, 87.3% had not participated in a scientific activity related to medication administration, 42.6% had witnessed medication administration errors but 87.6% had not kept medication error forms/reports (Table 1).

Table 1: Descriptive characteristics of nurses and features related to medication administration errors

Characteristic	n	%
Age		
22 Years or younger	17	6.2
23 - 30 Years	115	41.8
31 - 40 Years	121	44
41 Years or older	22	8
Gender		
Female	250	90.9
Male	25	9.1
Education		
Health Vocational High School and Associate Degree	41	14.9
Undergraduate Degree	187	68
Undergraduate Completion Program	29	10.5
Masters	18	6.5
Total employment duration as a nurse		
0-1 years	31	11.3
2-5 years	87	31.6
6-10 years	90	32.7
11-15 years	35	12.7
16 years or longer	32	11.6
Number of patients cared for during a shift		
From 1-3	37	13.5
From 4-10	117	42.5
From 11-15	99	36
16 or more	22	8
Inservice education about preventing medication errors		
Received education	86	31.3
Did not receive education	53	19.3
Partly received education	136	49.4
Witnessing medication administration errors		
Witnessed	117	42.6
Did not witness	158	57.4
Medication error form/report		
Made report	34	12.4
Did not make report	241	87.6
Participation in scientific activities related to medication administration		
Yes	35	12.7
No	240	87.3

Nurses from 23-30 years of age were identified to have higher points for general principles (4.15±.63), medication preparation (4.75±.50), medication administration (4.66±.33) and assessment (4.61±.46) in the stages of medication administration compared to other nurses ($p<0.05$). Nurses with master's degrees were found to have higher points for general principles (3.99±.54), medication preparation (4.56±.63), medication administration (4.55±.52) and assessment (4.51±.64) compared to other nurses ($p<0.05$) (Table 2).

Nurses with total employment from 0-1 year had higher points for medication preparation (4.38±.70) and assessment (4.21±.75) compared to other nurses ($p<0.05$) (Table 2).

Table 2: Comparison of precautions during medication administration according to descriptive characteristics of nurses and medication administration

CHARACTERISTICS	MEDICATION ADMINISTRATION PROCESS							
	General principles	Diagnosis	Preparing medication	Administering medication	Assessment	Total	Institutional precautions	
	\bar{X} and SD	\bar{X} and SD	\bar{X} and SD	\bar{X} and SD	\bar{X} and SD	\bar{X} and SD	\bar{X} and SD	
Age								
22 years and younger	3.41 ± .47	4.78 ± .37	4.06±.66	4.36±.46	3.78±.71	4.18±.47	1.06±.06	
23-30 years*	4.15 ± .62	4.85±1.06	4.75±.49	4.66±.32	4.61±.46	4.62±.36	1.24±.17	
31-40 years	3.52 ± .63	4.68 ± .42	4.05±.57	4.38±.37	3.65±.59	4.16±.37	1.27±.15	
41 years and older	3.48 ± .64	4.70 ± .36	4.13±.62	4.56±.64	3.77±.74	4.25±.41	1.27±.16	
Statistics	*KW=14.85 p= 0.02	KW=1.339 p=0.72	KW=18.441 p=0.000	KW=12.829 p=0.01	KW=29.832p=0.000	KW=19.328 p=0.000	KW=28.890 p=0.000	
Education								
Health Vocational High School and Associate Degree	3.42 ± .64	4.66 ± .56	4.01 ± .61	4.36 ± .64	3.42 ± .64	4.17 ± .310	1.07 ± .10	
Undergraduate Degree	3.73 ± .57	4.77 ± .86	4.25±.71	4.44 ± .36	3.65±.62	4.23 ± .23	1.27 ± .16	
Undergraduate completion	3.50 ± .55	4.78 ± .33	3.97 ± .49	4.37 ± .43	3.50±.55	4.14 ± .42	1.29 ± .11	
Masters*	3.99 ± .54	4.56 ± .33	4.56 ± .63	4.55 ± .52	4.51 ± .64	4.49 ± .49	1.27 ± .12	
Statistics	KW=31.504 p=0.000	KW=1.512 p=0.680	KW=28.920 p=0.000	KW=17.754 p=0.000	KW=52.574 p=0.000	KW=31.175 p=0.000	KW=63.716 p=0.000	
Total years of employment								
0-1 year*	3.89 ± .75	4.82 ± .27	4.38 ± .70	4.52 ± .43	4.21 ± .75	4.41 ± .46	1.18 ± .16	
2-5 years	3.44 ± .62	4.77 ± .93	4.02±.65	4.34±.45	3.71 ± .66	4.14 ± .46	1.24±.16	
6-10 years	3.46 ± .61	4.78 ± .87	4.00 ± .54	4.35 ± .37	3.56±.51	4.13±.37	1.28 ± .16	
11 years or longer	3.59 ± .60	4.69±.42	4.23±.61	4.51±.48	3.94±.76	4.29 ± .41	1.23±.15	
Statistics	****F=3.537 p=0.005	F=0.376 p=0.829	F=3.200 p=0.006	F=2.423 p=0.068	F=7.030 p=0.000	F=3.646 p=0.003	F=2.634 p=0.021	
Thinks medication education received during professional training is adequate								
Adequate*		3.72 ± .65	4.82 ± .98	4.31 ± .60	4.48 ± .40	4.02 ± .72	4.34±.43	1.20±.16
Inadequate		3.19 ± .60	4.66 ± .49	3.94 ± .61	4.37±.58	3.52 ± .60	4.07 ± .44	1.28 ± .16
Partly adequate		3.42 ± .56	4.72 ± .43	3.89±.57	4.32 ± .41	3.54 ± .54	4.08 ± .38	1.29 ± .16
Statistics		F=13.532 p=0.000	F=0.850 p=0.429	F=15.909 p=0.000	F=3.912 p=0.021	F=18.861 p=0.000	F=13.611 p=0.000	F=10.469 p=0.000
Opinion about adequacy of in-service training								
Received training*		3.87 ± .68	4.65 ± .49	4.51±.62	4.50±.47	4.29 ± .71	4.41 ± .47	1.13 ± .14
Did not receive training		3.35 ± .70	4.71 ± .48	3.87 ± .64	4.25 ± .47	3.50 ± .57	4.03 ± .46	1.35 ± .17
Received partial training		3.40 ± .50	4.85 ± .95	3.94 ± .49	4.40 ± .39	3.56±.51	4.14 ± .33	1.27 ± .12
Statistics		F=19.303 p=0.000	F=1.941 p=0.146	F=31.506 p=0.000	F=5.065 p=0.007	F=46.963 p=0.000	F=17.598 p=0.000	F=45.583 p=0.000
Participation in scientific activities about medication administration								
Yes		3.55 ± .56	4.74± 1.49	4.25 ± .54	4.44 ± .35	3.86 ± .69	4.26 ± .40	1.21 ± .13
No		3.53 ± .65	4.76 ± .62	4.09 ± .63	4.40 ± .45	3.76 ± .68	4.20 ± .43	1.25 ± .16
Statistics		****F=0.949 p=0.882	F=5.804 p=0.918	F=0.814 p=0.180	F=0.966 p=0.640	F=0.060 p=0.454	F=0.104 p=0.467	F=3.093 p=0.306
One-way Anova Test *Independent T-Test								

Nurses considering the medication education received during professional education to be sufficient were identified to have high points for general principles (3.72±.65), medication preparation (4.31±.60), medication administration (4.48±.40), assessment (4.02±.72), and total administration (4.34±.43) ($p<0.05$). Nurses who considered in-service training to be adequate were found to have higher general principles (3.87±.68), medication preparation (4.51±.62), assessment (4.29±.71) and total administration (4.42±.47) points compared to others. Additionally, nurses who participated in scientific activities related to medication administration were found to have higher points for general principles (3.55 ± .56), medication preparation (4.25 ± .54), medication administration (4.44 ± .35), assessment (3.86 ± .69) and total administration (4.26 ± .40) compared to others (Table 2).

Among practices nurses used to prevent medication administration errors, "willing to learn new skills related to

medication administration" was selected most in the general principle stage (3.99±.69). In the diagnostic stage, nurses stated they most commonly applied the "confirming records that are difficult to read" step (5.15±4.31). During the medication preparation stage, nurses mostly chose the "prepare medication card" (4.57±1.02), and "calculate medication dose" (4.57±.69) steps and chose the "compare clinician order with medication card" (4.30±1.04) step least. In the administration stage, nurses were identified to apply the "assess the region of medication administration for suitability" (4.86±.41) step most and the "administer medications prepared by others" (3.24±1.19) step least. In the assessment stage, nurses were determined to perform the "monitor behavioral response of patient to medication" (4.85±.47) step most and "report and tell clinician when side-effects specific to the medication, etc. develop" (2.11±1.63) least. The total points obtained by nurses for practices performed to prevent medication errors were 191.71 (Table 3).

Table 3: Distribution of points received by nurses about practices to prevent medication administration errors

Precautions taken by nurses	\bar{X}	SD
General principles		
1. Willing to learn new skills related to medication administration	3.99	.69
Diagnosis		
2. Confirming records that are difficult to read	5.15	4.30
Medication preparation		
3. Preparing medication card	4.57	1.02
4. Comparing doctor's orders with medication card	4.30	1.03
5. Calculating medication dose	4.57	.69
Medication administration		
6. Administering medication prepared by someone else	3.24	1.19
7. Assessing suitability of the region that medication will be administered to (disrupted skin integrity, ecchymosis, etc.)	4.86	.40
8. Correct identification of medication administration site (e.g., intramuscular regions)	4.73	.53
9. Administering the medication to the patient at the right time through the right route with the right technique	4.50	.59
10. Having adequate knowledge and skills about medication administration routes and methods	4.44	.67
11. Accurate and complete recording of information related to medication administration (administration time, administration region, etc.)	4.84	3.04
Assessment		
8. Monitoring patient's behavioral response to medication (anxiety level, awareness, restlessness)	4.85	.47
9. Reporting side-effects specific to medication, etc. If they develop and telling the doctor	2.10	1.63

Significance between opinions about individual precautions taken by nurses about preventing medication errors and institutional precautions was investigated with correlation analysis. When the correlation between opinions about precautions taken by institutions and individual precautions taken by nurses is examined, there were negative and moderate-level correlations for medication preparation, ($r=-.021$, $p=0.000$), medication administration ($r=-.385$ $p=0.000$) and assessment of patient response ($r=-.505$ $p=0.000$). As the precautions taken by institutions increased, the precautions taken by nurses to prevent medication errors were determined to reduce (Table 4).

medication compared to other nurses. A study of 585 nurses in Sweden found experienced nurses did not abide by procedures and standards created by institutions sufficiently and made errors (13). In the literature, some studies observed that as the total years of employment increased, nurses had reduced medication error rates and tendencies, while knowledge about medication administration increased (14). In our study, nurses with young age and less experience were determined to have high rates of taking personal precautions about preventing medication errors. This result is considered to be due to newly graduated nurses having current knowledge and

Table 4: Correlational analysis between individual precautions taken by nurses and institutional precautions to prevent medication administration errors

Precautions		General principles	Diagnosis	Medication preparation	Medication administration	Assessment	General scale	Institutional precaution
General principles	Pea.Co *r.	1						
	p.							
Diagnosis	Pea.Cor.	.137*	1					
	p.	.023						
Medication preparation	Pea.Cor.	.546**	.227**	1				
	p.	.000	.000					
Medication administration	Pea.Cor.	.467**	.340**	.643**	1			
	p.	.000	.000	.000				
Assessment	Pea.Cor.	.534**	.107	.647**	.486**	1		

Discussion

Medical errors are a serious public health problem and a leading cause of death in the world. It is a difficult problem as it is challenging to uncover a consistent cause of errors and, even if found, to provide a consistent viable solution that minimizes the chances of a recurrent event. By recognizing untoward events occur, learning from them, and working toward preventing them, patient safety can be improved (3).

In this study with the aim of determining nursing practices about preventing medication administration errors completed with 275 nurses, nurses aged from 23-30 years and employed for 0-1 year were found to pay more attention to general principles, medication preparation, medication administration and assessment of patient response to medication administration when administering

being more careful during medication administration as they are newly beginning to work in clinics. Nurses with master's degrees were found to receive significantly higher points for general principles, medication preparation, medication administration and assessment of patient response stages about preventing medication errors compared to nurses with other educational levels. Another study with 279 nurses by Chang and Mark (2009) found a significant correlation between medication errors and educational level (25). As the educational level of nurses increases, medication errors were identified to reduce.

In our research nurses were found to always check the patient's name, medication name, medication dose, medication administration route and patient allergies to the medication in the diagnostic stage to prevent medication errors. However, they occasionally took the precaution of learning the correct preparation and storage for the

medication. A study by Fisun et al. about safe medication administration including 150 nurses found 10% had poor levels of knowledge about side effects of medications, 17% had poor levels of knowledge about medication interactions and 6% had poor levels of knowledge about special situations (pregnancy, pediatrics) (15). A study by Wondmieneh (2020), it was stated that medication errors were made such as nurses not administering medications at the correct time, administering the medication in a different way than specified, and documentation and dosage violations (16). A study by Zhu et al. (2014) with 1343 nurses found 3185 effect factors about causes of medication errors (17). These factors were identified to be due to not performing routine checks like checking medication orders, knowing about side effects of medication and correct preparation according to medication properties.

Nurses were found to always prepare a medication card and calculate medication dose in the medication preparation stage. They were found to occasionally wash their hands before preparing medication, check whether it is the correct medication at least three times, check the order and prepare medications according to aseptic principles. In a study conducted in an intensive care unit, 5.8% of 237 medication errors occurred in the wrong drug administration, 19.2% in the wrong dose administration, 4.7% in the order but not in the order, and 5.3% in the following days. It was stated that mistakes were made such as not being included in the order (18). In this research, it was concluded that medication errors occurred in stages where nurses did not take precautions, and that medication administration errors would be prevented in the medication preparation stage if nurses took these precautions. In our research, nurses always monitored the patient's physical responses after medication administration during the assessment stage; however, they rarely reported the event if they made a medication administration error. A study (n=114) identified that 57.2% did not report medication errors (19). Cebeci, Karazeybek and Dağ (2014) performed a study of 324 students about medical errors witnessed in clinics and found 38% did not report errors and 23.1% reported to the responsible nurse (20). As understood from the results of the study, nurses may avoid reporting medication administration errors. Nurses may not make reports due to wanting to avoid being blamed, receiving punishments, and being perceived as an inadequate nurse (21, 22).

Increases in institutional precautions were determined to reduce individual precautions taken by nurses in our research. When the literature is examined, it was found that

medication administration errors are human-sourced errors (23,24). Many studies identified that precautions taken by institutions reduce medication error rates (4,24). As precautions taken by institutions to prevent medication administration errors increase, precautions taken by nurses reduce. It is thought that medication administration errors may be prevented or lowered to minimal levels by taking both institutional and individual precautions.

Conclusion

Precautions taken by nurses to prevent medication errors differ according to total years of employment, years of employment in their current unit and educational status. Nurses who were master's graduates were identified to have higher level of participation in precautions. In line with the results obtained from the study, it is recommended to organize working durations and types to prevent medication administration errors due to tiredness, inattention, etc. of nurses; that in-service training about medication administration and preventing medication administration errors be given or increased; that protocols be created in line with international guidelines about medication preparation, administration and storage conditions; and that technology be used to minimize medication errors in institutions.

Declarations

Declarations of Interest

The authors declare no conflict of interest.

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Conflict of Interest

The author declared that there is no conflict of interest

Ethical Approval

The study was approved by the Hacettepe University Ethical Committee (date 02.01.2018 and number 16969557-36)

Availability of Data And Material

Available.

Authors' Contributions

All authors have made substantial contributions to this article being submitted for publications. All authors critically reviewed the manuscript and approved the final form.

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