

Nursing students' medication errors and their opinions on the reasons of errors: A cross-sectional survey

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Abstract

Objective: To determine number and type of medication administration errors made by nursing students, and to explore the rate of reportings, emotions after the errors and the causes of errors.

Methods: The cross-sectional study was conducted at the two schools of nursing, Akdeniz University, Antalya, Turkey, in February 2009, and comprised students having worked in hospital settings for a minimum of one semester and who had been involved in administering medications. SPSS 13 was used for statistical analysis.

Results: Of the 324 subjects in the study, 124(38.3%) had made an error in clinical/field applications. Overall, 402 medication administration errors had been reported of which 155 (38.6%) were detected and corrected by academic nurses. The most common error reported was deviation from aseptic technique in 96(23.8%) cases. Most common emotions resulting from errors were fear in 45(28.8%) and anxiety in 37(23.5%). Most common cause was performance deficit in 141(43.4%) cases and the most common contributing factor was workload declared by 179(55.2%).

Conclusions: The error rate among nursing students was high whereas reporting of errors was low.

Keywords: Contributing factors, Errors, Medication errors, Nursing education, Nursing students. (JPMA 65: 457; 2015)

Introduction

There is an increasing interest in patient safety in Turkey in recent years. Nurses have an irreplaceable role in providing healthcare. The error reporting system is not well-established in Turkey, and there are only guesses and estimations about the number of medical errors. Existing literature reveals limited number of published studies on medical errors in Turkey.^{1,2} One study found that 20% nurses make at least one error during their working hours.¹ Another study found that 25% cases in courts about nurses have been due to some medication error.² For healthcare professionals' effective practice, assuring quality of undergraduate training plays an essential role.

It is observed that number of errors and distribution of errors might vary in different settings. It has been reported that experts believe at least one medication error occurs per hospital patient every day.³ The consequences for the patient might also vary according to the nature of error. It might range from minor inconvenience to temporary disability or even death. A possible billion of dollars' cost of medication errors to healthcare organisations is also discussed as a different dimension.⁴

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Besides, 10-18% of all reported hospital injuries have been attributed to medication errors. One study reported 500% rise in drug errors over the previous decade.⁵ It was found that 24% of reported adverse events were drug-related or fluid-related.⁶ A study reported improper medication administration as the most frequently occurring unsafe patient-care event (56.49%),⁷ while another reported a 19% prevalence of medication administration errors arising from oral medications.⁸

Another study reported change in healthcare education as necessary for moving toward a patient safety culture,⁹ and another suggested that a change in medical curriculum would promote culture of safety among undergraduate medical students.¹⁰ There is limited discussion in Turkey related to the promotion of patient safety culture during the training phase of healthcare professionals. Few studies have been observed in the literature on nursing students' errors in clinical settings.^{7,11}

Johnstone and Kanitsaki emphasised that determination of errors is not only the requirement of compliance with the professional and ethical standards of practice about patient safety, but it is also about protection of the reputation of the profession of nursing.¹² Others have also noted that medication errors have an impact on nursing students' perceptions of their professional competence.¹³⁻¹⁵

The current study was planned to determine the number and type of medication errors committed by nursing

students, and to explore the rate of reportings, emotions of the students after errors and the causes of errors.

Subjects and Methods

The cross-sectional study was conducted at the Antalya School of Nursing and Akseki School of Nursing in Akdeniz University, Antalya, Turkey, during the 2008-09 academic year. The sample size was not calculated as the target was to reach all students in the two schools. To that end, purposive sampling method was used.

All students who had worked in hospital settings for a minimum of one semester and had been involved in administering medications were included.

The questionnaire was similar to those used in other countries in order to facilitate global comparisons.

The questionnaire was composed of three sections: background data, like gender, age and semester; three open-ended questions related to medication administration errors and reporting of errors; and finally errors in clinical application, reasons of errors, contributing factors and the participants' emotional reaction after the errors. We modified the questionnaire after pilot-testing with five students, and used the final version between February 20 and 26, 2009. The reliability coefficient of the questionnaire Cronbach's alpha was 0.90.

Data was analysed using SPSS 13. Error rates between students from different semesters were compared using Pearson chi-square statistics. The mean age of participants was expressed as mean±Standard deviation (SD). Medication error rates in semesters were calculated by Odds Ratio (OR) with 95% confidence interval (CI). The second semester was based for the computation of OR. Medication errors declared by students were grouped by MEDMARX category which is an error reporting system administered by US Pharmacopeia Hospitals. Health systems can subscribe annually to MEDMARX and voluntarily report and track adverse drug reactions and medication errors. The results of MEDMARX have been validated and used in many publications.^{11,16}

The study was approved by the ethical committee of the university, and necessary written approval was obtained from the directors of the two schools. Informed consent and written permission from the nursing students was duly obtained.

Results

At the time of the study there were 513 students on the roll. Of them, 480(93.5%) students were from the Antalya School of Health, and 33(6.5%) from the Akseki School of Health. Seven (1.4%) students were absent during the

Table-1: Medication Administration Errors (n=402).

Type of Error	Number of error (%)	Number of correction (%)
Deviation From Aseptic Technique	96 (23.8)	60 (62.5)
Improper dose/quantity preparation	90 (22.8)	65 (72.2)
Not reporting the drug given	73 (18.1)	0 (0)
Wrong patient	35 (8.8)	0 (0)
Not following up the effects	35 (8.8)	0 (0)
Wrong administration technique	23 (5.7)	0 (0)
Wrong drug	22 (5.5)	22 (100)
Wrong Route	7 (1.8)	0 (0)
Omission error (ordered drug not given)	6 (1.5)	0 (0)
Adding wrong drug to fluid	6 (1.5)	6 (100)
Wrong time	5 (1.2)	0 (0)
Extra dose	2 (0.5)	0 (0)
Adding wrong electrolyte to fluid	2 (0.5)	2 (100)
Total	402 (100.0)	155 (38.6)

study, 150(29.2%) did not volunteer, and 32(6.2%) did not meet the inclusion criteria. The final study sample comprised 324(63%) students who completed the questionnaire. The mean age of the participants was 21.1±1.7 (range: 18-34 years). Overall, 86(26.5%) participants belonged to the second semester, 76 (23.5%) the fourth semester, 72(22.2%) to the sixth semester, and 90(27.8%) to the eighth semester.

A total of 124(38.3%) subjects declared having made an error in clinical/field applications. There was no statistically significant difference in error rates ($p=0.797$) among students from different semesters.

The total errors reported in the questionnaire were 402, and 155 (38,6%) of them were detected and corrected by academic nurses. The most common medication error was deviation from aseptic technique in 96(23.8%), followed by improper dose and quantity in 90(22.8%) and not recording the medication administered in 73(18.1%). Besides, 60(62.5 %) errors about deviation from aseptic technique and 65(72.2%) improper dose and quantity errors were corrected.

All errors related to administering wrong drug (n=22; 5.5%), wrong drug in fluid (n=6; 1.5%) or wrong electrolyte in fluid were corrected (n=2; 0.5%) (Table-1).

In terms of MEDMARX category, there were no errors under category G (contributed to or resulted in permanent patient harm), category H (required intervention necessary to sustain life) or category I errors (occurred that may have contributed to or resulted in the patient's death) (Table-2). Errors in categories E and F, which caused harm to patients were 8(1.9%) (), whereas

Table-2: Medication Administration Errors by MEDMARX Category* (n=402).

Category	Description	Errors n (%)**
No Error		
A	Circumstances or events that have the capacity to cause error	108 (26.9)
Error No Harm		
B	Error occurred, but the error did not reach the patient	155 (38.6)
C	Error occurred that reached the patient but did not cause patient harm	27 (6.7)
D	Error occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient or required intervention to preclude harm	104 (25.9)
Error, Harm		
E	Error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention	5 (1.2)
F	Error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization	3 (0.7)

*Categories as defined by the National Coordinating Council for Medication Errors Reporting and Prevention [Santell JP, Hicks RW, McMeekin J, Cousins PD & Cousins D D (2003), Hicks RW, Cousins DD & Williams RL (2004)]

** Percentages are taken over the number of drug errors.

Table-3: Causes of Errors and Contributing Factors (n=324).

Cause and Contributing Factor		
Cause	n**	%*
Performance deficit	141	43.4
Knowledge deficit	133	41.0
Communication deficit	123	38.0
Violation of rights	122	37.6
Transfer work to someone else	79	24.0
Documentation deficit	73	22.5
Incorrect Labelling	47	14.5
Workflow disruption	43	13.3
Lack of written procedure and protocol	28	8.6
Material deficiency / insufficiency	27	8.3
Contributing Factors		
Workload	179	55.2
Stress	158	48.8
Fatigue	140	43.2
Overload of the circulation of patients	86	26.5
The similarities between names of patients	7	2.1
The similarities between drug packages	1	0.3

*Percentages are taken over the number of students who participated in the study

**The 'n' number increased because of more than one opinion.

the remaining 394(98.1%) errors did no harm to the patients. Among the errors causing harm, 1(12.5%) was due to administering the drug to the wrong patient, 4(50%) were due to improper dose/quantity, 2(25%) were due to administration via wrong route, and 1(12.5%) was due to administering an extra dose to the patient.

Officially, 247(61.4%) medication errors were reported; 20(8%) to the academic nurse, 1(0.4%) to hospital administration, 139(56.3%) to the registered nurse, and 87(35.3%) to the doctor. The most common emotions resulting from errors were fear in 45(28.8%), anxiety in

37(23.5%), guilt in 27(17.2%) and sadness in 24(15.3%). Less common emotions were panic/worries in 13(8.3%), loss of self-confidence in 9 (5.7%) and anxiety about loss of patient's trust in 2(1.2%).

The most common causes cited by the students for their errors and contributing factors were performance deficit by 141(43.4%), knowledge deficit by 133(41.1%) and communication deficit by 123(38%), violation of rights by 122(37.6%) (Table 3). Workload as the most common contributing factor was declared by 179(55.2%), stress by 158(48.8%) and fatigue by 140(43.2%).

Discussion

The study is one of the limited number of researches related to patient-safety approach to practice by nursing students in Turkey, and identifies the frequency of medication administration errors in this group as well as the causes of errors, emotions of students after errors and error reportings.

The study can be compared to surveys done in other countries. There have been several studies with a focus on medication errors done by nursing students.^{4,11-17}

Among the 324 students who participated in the current research, 124(38.3%) declared to have made an error in clinical/field applications. No statistically significant difference was found in error rates between students from different semesters. In a study, it was found that 30% of the students made at least one error during their academic period.¹⁸ Another study reported that medication errors were mostly seen at 2nd and 3rd grades.¹⁹

In studies, it is observed that medication administration

errors and their rates vary among countries and hospitals.^{7,11,20-23}

Studies from different settings have reported different causes of errors. Most common causes of errors are wrong dose,²¹ missing a dose¹¹ and errors related to time.⁷ A study reported that wrong administration rate was the most common cause of errors about intravenous (IV) fluid administration (79.3%).²⁴ Our study revealed that the highest number of errors were related to deviation from aseptic technique (23.8%). At least one-time deviation from aseptic technique during IV drug administration were found 100% in United Kingdom, 19% in France and 21% in Germany in an observation-based study.²⁰

Another common error type in our study was improper dose/quantity preparation (22.8%). Literature shows that improper dose/quantity preparation error is one of the most common errors (17.1-51.4%).¹¹ It is observed that in the MEDMARX categorisation of our study results, 4 of 8 errors that did harm to patients were caused by improper dose/quantity preparation. This finding suggests that concrete problems that can arise from improper dose/quantity preparation errors should take a larger place in curriculum.

Our study shows that errors of students that caused harm to patients were found to be 1.9% of all errors. Fortunately, the vast majority of medication errors (98.1%) did not result in patient harm. Errors of nursing students that caused harm to patients were reported as 3% by one study.¹¹ In our study one-third of errors were detected and corrected by academic nurses in the process of drug preparation. Ensuring direct supervision at all times must become an urgent priority for undergraduate nursing education.²²⁻²⁴ In a study of medication administrations, direct observation was associated with the highest detection rate of medication errors (12%), allowed by chart review (0.7%), and finally incident reports (0.04%).⁸

It is determined that errors causing harm to 5 of 8 patients were done by students practising under the supervision of a registered nurse. It is assumed that registered nurses give authority to nursing students. This situation may lead to very serious mistakes and may put both the student and registered nurse in a difficult legal responsibility.

Our study reveals that rate of reporting an error was low among nursing students. More than half of the nursing students (56.3%) reported their errors to the registered nurse, whereas reports to academic nurse was only 8%.

In the institution where this study is held, the evaluation of nursing students is made by academic nurses. Fear of getting low degrees may discourage students from reporting their errors to academic nurses.¹⁹ Reporting rates of errors to the hospital administration was also dramatically low (0.4%), probably due to lack of an error report system in clinical fields. Another reason for low reporting might be the fact that the errors did not cause a permanent disability or death, or patients and their relatives did not complain about it. As a study emphasised, it is important to have necessary feedback about errors in order to decrease error rates.¹⁸ One study noted that hiding errors might increase potential of harm to the patients.¹⁹ Turkey must develop its own policy in order to increase error reportings. As noted by a study, a clear policy about reporting errors might facilitate reporting errors in health institutions.²²

The second important finding in this category is that emotions of students after an error might vary from person to person. Most of the feelings when students commit an error are found to be fear, anxiety, guilt and sadness. These findings are similar to those of other studies.^{3,19} Unwanted feelings may cause an increase in the errors of nurses and decrease their career satisfaction.

Similar to findings of our study, common causes of errors are reported as performance deficit, knowledge deficit and communication deficit. Lack of knowledge and lack of communication are also suggested as most common causes of errors in various studies.^{18,21,22,25} Many medication errors arise from miscommunication among health professionals.

Our study showed that documentation deficit is one of the leading causes of medication errors. Lack of a good recording system and careful follow-ups might cause such errors and correction of this deficiency might prevent a huge amount of errors in practice. Computerised support and standardised treatment protocols have also been suggested to potentially limit these types of errors.^{20,26}

Another finding is that interruption was the reason of 13.3% errors. This result is similar to other studies done with nursing students and nurses.^{3,18,21,25} Preventing interruptions during medication administrations is essential and measures should be taken to ensure that.¹¹

In various studies done with nursing students and health workers, workflow disruption,^{3,18,21,22,25} right violations,^{18,22} lack of written procedure and

protocol,^{3,18,22} incorrect labelling¹⁸ are commonly suggested as causes of errors. However, delegation of job to someone else, documentation deficit, material deficiency/insufficiency are the original findings of our study. One study noted that the lack of written standard measure and procedures, caused 79% of medication administration errors.¹⁸

Nursing students indicated that more than half of the factors that contributed to medication errors was workload increase (55.2%). Other studies also suggested that workload of the nurse is one of the important factors that increase the risk of error in medication administration.^{3,18,21,22,25}

Our study shows that stress, fatigue and overload of patient circulation were among the factors that contributed to medication errors.

There are a number of possible limitations of our study. The survey was conducted by an academic nurse who was not responsible for the students' behaviour. However, the students were assured of confidentiality of their answers and they would have gained no advantage or disadvantage by giving untrue answers. Second, the survey was basically voluntary self-reports that have several disadvantages,²⁵ the biggest of them being serious under-reporting. Third, there was no database where one could have contact details of all nursing students in Turkey. So a selection of participants that would reflect the practice all over the country could not be taken. Nursing students were selected in two nursing schools. A multi-centre study has not been possible due to limited time, funding and human resources.

However, the strength of the study was its large sample size which gave a good representation of the target group.

The findings of the current study suggest that undergraduate nursing students are at risk of making errors when administering medications to patients in a clinical setting. Adequate supervision is an essential component for safe medication administration. Not only this is important for quality of learning experiences of students, but it has significant implications for the delivery of safe and effective healthcare. Further research to investigate the extent to which these findings are indicative of a more widespread problem is recommended. In addition, nurse academics and educators need to consider the extent to which high-quality supervision is provided in their programmes and to introduce strategies to ensure the required standards

are met.

Conclusions

Based on the findings, the study underlines the need of a planned and coordinated training regimen of nurses in order to avoid errors during medication administration.

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References

1. Asti T, Kivanc MM. Agiz Yolu ile Ilac Verilmesine Ilişkin Hemsirelerin Bilgi ve Uygulamaları (Nurses information and application related to the administration of oral medication). Atatürk Üniversitesi Hemsirelik Yüksekokulu Dergisi 2003; 6:1-9. (Article in Turkish)
2. Gündoğmuş ÜN, Özkara E, Mete S, Nursing and Midwifery Malpractice in Turkey Based on the Higher Health Council Records. Nurs Ethics 2004; 11: 489-98.
3. Anderson P, Townsend T. Medication errors: Don't let them happen to you. Am Nurse Today 2010; 5: 23-7.
4. Reid-Searl K, Moxham L, Walker S, Happell B. Shifting supervision: implications for safe administration of medication by nursing students. J Clin Nurs 2008; 17: 2750-7.
5. Scott H. Increasing number of patients are being given wrong drugs. Br J Nurs 2002; 11: 4
6. Baker GR, Norton PG, Flintoft V, Blais R, Brown A, Cox J, et al. The Canadian Adverse Events Study: the incidence of adverse events among hospital patients in Canada. Can Med Assoc J 2004; 170:1678-86.
7. Gregory D, Guse L, Davidson Dick D, Davis P, Russell CK. What Clinical Learning Contracts Reveal about Nursing Education and Patient Safety. Can Nurse 2009; 11: 20-5.
8. Barker KN, Flynn EA, Pepper GA, Bates DW, Mikeal RL. Medication Errors Observed in 36 Health Care Facilities. Arch Int Med 2002; 9: 1897-903.
9. Milligan FJ. Establishing a culture for patient safety -the role of education. Nurs Educ Today 2007; 27: 95-102.
10. Singh R, Singh A, Fish R, McLean D, Anderson DR, Singh GA. Patient Safety Objective Structured Clinical Exam (OSCE). J Patient Saf 2009; 5: 55-60.
11. Wolf ZR, Hicks R, Serembus JF. Characteristics of Medication Errors Made by Students during the Administration Phase: A Descriptive Study. J Prof Nurs 2006; 22: 39-51.
12. Johnstone MJ, Kanitsaki O. The ethics and practical importance of defining, distinguishing and disclosing nursing errors: a discussion paper. Int J Nurs Stud 2006; 43: 367-76
13. Reid-Searl K, Moxham L, Happell B. Enhancing patient safety: The importance of direct supervision for avoiding medication errors and near misses by undergraduate nursing students. Int J Nurs Pract 2010; 16: 225-32.
14. Reid-Searl K, Moxham L, Walker S, Happell B. Supervising medication administration by undergraduate nursing students: influencing factors. J Clin Nurs 2010; 19: 775-84
15. Reid-Searl K, Moxham L, Walker S, Happell B. Nursing Students Administering Medication: Appreciating and Seeking Appropriate Supervision. J Adv Nurs 2010; 66: 532-41.
16. Santell JP, Hicks RW, McMeekin J, Cousins PD, Cousins DD.

- Medication errors: experience of the United States Pharmacopeia (USP) MEDMARX reporting system. *J Clin Pharmacol* 2003; 43: 760-7.
17. Kaldjian LC, Jones EW, Wu BJ, Forman-Hoffman VL, Levi BH, Rosenthal GE. Reporting Medical Errors to Improve Patient Safety A Survey of Physicians in Teaching Hospitals. *Arch Int Med* 2008; 168: 40-6
 18. Koohestani HR, Baghcheghi N. Barriers to the reporting of medication administration errors among nursing students. *Aust J Adv Nurs* 2010; 27: 66-74.
 19. Harding L, Petrick T. Nursing student medication errors: a retrospective review. *J Nurs Educ* 2008; 47: 43 7.
 20. Cousins D, Sabatier B, Begue D, Schmitt C, Hoppe-Tichy T. Medication errors in intravenous drug preparation and administration: a multicentre audit in the UK, Germany and France. *Qual Saf Health Care* 2005; 14: 190-5.
 21. Tang FI, Sheu SJ, Yu S, Wei IL, Chen CH. Nurses relate the contributing factors involved in medication errors. *J Clin Nurs* 2007; 16: 447-57.
 22. Brady AM, Malone AM, Fleming S. Literature review of the individual and systems factors that contribute to medication errors in nursing practice. *J Nurs Manag* 2009; 17: 679 - 97.
 23. Wright K. Do calculation errors by nurses cause medication errors in clinical practice? A literature review. *Nurse Educ Today* 2010; 30: 85-97.
 24. Han PY, Coombes ID, Green B. Factors predicative of intravenous fluid administration errors in Australian surgical care wards. *Qual Saf Health Care* 2004; 14: 179-84.
 25. Sanghera IS, Franklin BD, Dhillon S. The attitudes and beliefs of healthcare professionals on the causes and reporting of medication errors in a UK Intensive care unit. *Anaesthesia* 2007; 62: 53 61.
 26. Milch CE, Salem DN, Oauker SG, Lundquist TG, Kumar S, Chen J. Voluntary electronic reporting of medical errors and adverse events an analysis of 92,547 reports from 26 acute care hospitals. *J Gen Int Med* 2006; 21: 165-70.
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