Original Article

Medication Errors Made by Nursing Students in Turkey

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Abstract

Background: Medication errors are a serious problem in the world and one of the most common medical errors that threaten patient safety. Current studies on medication errors focuses on nurses, there is insufficient data available concerning the type of medication errors committed by nursing students.

Objectives: The purpose of this study is to determine the types of medication errors made by the nursing students through a web-based medication error reporting system, and to explore the causes of these errors, their frequencies, categories and the factors that contribute to their occurrence.

Design: A descriptive study.

Setting: A faculty of nursing in Turkey

Participants: All 2nd, 3rd and 4th year nursing students (1156 students) in the faculty of nursing

Methodology: The study was conducted in a faculty of nursing between the years of 2016 - 2017. We developed a web-based medication error reporting system for nursing students to use during their clinical practices. All students (1156 students) who were in clinical practice were invited to participate. The students used the "Medication Error Reporting System" to submit their medication errors.

Results: A total of 1156 students reported 72 medication errors over the course of 28 weeks. The most common type of medication error to be reported was "treatment delay" at a rate of 76.4% and the most common cause of medication errors was "poor communication" at a rate of 38.7%.

Conclusions: Although the reporting rate is quite low, we have suspected that the number of medication errors involved nursing students may be probably more than the reported. The medication errors made by nursing students are generally due to a lack of knowledge and experience, poor communication and carelessness. Therefore, patient safety issues should be integrated throughout the courses offered in the nursing program in order to develop the culture of safety.

Keywords: Medication errors, nursing, students.

Introduction

Medication errors are the most common types of medical errors to affect a patient's safety (Bourne, et al. 2018; Hajibeglou, et al. 2018). The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) defined medication error as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer"

(Cohen, 2007, p.514; Vaismoradi, et al. 2014;). Preventing errors before they have a serious and harmful impact can be made possible through the use of notification systems and by identifying errors, preventing their repetition, and defining ways of problem-solving (Akgun & Al-Assa, 2007; Hewitt, et al. 2015).

Research Questions:

• Which type of medication errors made by nursing students in Turkey and how often?

• What are the factors that contribute to these medication errors?

Background

Medication errors lead to rises in healthcare costs and increases in morbidity and mortality rates as well as to serious legal consequences (Roughead & Semple, 2009). In order to ensure prevention, it is extremely important to understand why medication errors occur. The literature indicates that there are two main components that form the basis of medical errors—human error and system error—and points to the fact that more attention must be paid to system errors (Adams & Garber, 2007). In Turkey, for instance, medication errors generally occur as a result of factors such as shortages in the number of healthcare providers, excessive working hours, working in shifts, the inordinately high number of patients, fatigue, stress, the rapid increase in the number of available medications, insufficient knowledge of drugs, and interruptions (Akalin, 2005; Unver, et al. 2012; Alemdar & Aktas, 2013;).

Preventing medical errors before serious consequences occur may be made possible with the use of reporting systems. On the other hand, because of the shortcomings in the culture of reporting in Turkey, there is a lack of sufficient knowledge about errors that have been made. Rates of reporting error among nursing students are also quite low (Vaismoradi, et al. 2014). When student nurses work in the clinical setting with nurses who do not report errors, the failure of their mentors to act as role models in this respect may inevitably become a barrier to the students' internalization of the practice of reporting (Pauly-O'Neill & Prion, 2013). It is vitally important that nursing curriculums include patient safety and that the culture of patient safety finds room to develop, starting from the beginning of the school program (Butterworth, et al. 2011; Reid & Catchpole,

2011; Vaismoradi, et al. 2011; Cronenwett, 2012; Cooper, 2013).

Reporting and error analysis are the most effective methods used in identifying errors made in healthcare services in the effort to prevent patients from being harmed and reduce the number of errors that occur (Intepeler & Dursun, 2012). The Turkish Ministry of Health set up a Safety Reporting System aiming to standardize medication error reporting in Turkey, create a common vision and aspire to a more systematic system of report analysis. Despite this, however, in 2017, only 4.6% of the 157,929 errors reported around the country were medication errors (Turkish Ministry of Health, 2018).

As can be seen, this rate of medication error reporting is very low. Due to the lack of a functional culture of reporting in the country, there are no reliable data in Turkey on medication error rates. Nurses in particular fear being criticized or punished and avoid reporting due to the difficulties in the reporting process and also because of their belief that the error was harmless (Blegen, et al. 2004; Mayo & Duncan, 2004).

Generally, student nurses can experience stress when administering a drug and the patient can also feel understandably uncomfortable. In such a situation, fear of making an error is one of the main stressors for nursing students during hospital practice. It may be that a stressful situation may consequently lead to medical errors (Bodur, et al. 2012).

In studies conducted in this context, it has been found that medical students as well as nursing students are hesitant to divulge any errors they made because they believe they will be met with accusations and punishment and for this reason, they are less likely to report errors (Karadeniz & Cakmakci, 2002; Mayo & Duncan, 2004; Koohestani & Baghcheghi, 2009).

The aim of this study, with the help of an anonymous web-based reporting system, is to determine the type of medication errors, near-miss errors the causes of these errors, their frequencies, and the factors that contribute. Also, this study aims to categorize medication errors made by nursing students based on the eight categories from the National Coordinating Council for Medication Error Reporting and Prevention Index.

Methodology

Design and Setting: This descriptive study was conducted in a faculty of nursing of a university over the period October 1, 2016 - December 31, 2017.

Participants:

All 2nd, 3rd and 4th year nursing students (1156 students) in the faculty of nursing in a university who were engaging in clinical practice were included in the study. No sample selection was therefore performed. The clinical practice included internal and surgical nursing units and the emergency room, the pediatrics, public health and psychiatric departments. Over the course of their practice, the students had access to a web-based notification system. All students were informed about the study and the system.

Data collection: The research was conducted in three stages. The first stage was the development of a "Medication Error Reporting Form" to be used in the web-based medication error reporting system. In the second stage, the web-based medication error reporting system was designed to be accessed via any computer or mobile phone with Internet access and to capture both medication errors and near- misses using this form. Students could access the Web-based system via any computer or mobile phone with an Internet connection. In the last stage, each week the students were sent a reminder e-mail with a link to the website and the system was also available via the School of Nursing website. The students received training for using the Web-based system via a demonstration in class explaining medication error and near-miss reporting, and they received one-on-one or e-mail support if necessary. Researchers mentioned the importance of error reporting during each training activities.

Instruments: It is reported in the literature that simple, convenient, web-based, non-punitive reporting systems based on volunteer participation and anonymity are effective and conducive to increasing the rate of reporting (Capucho, et al. 2013; Okafor, et al. 2015). Accordingly, in drawing up the reporting form, statements were based on the resources in the current literature and all other medication error-reporting forms were reviewed (Capucho, et al. 2013; Lederman, et al. 2013; Okafor, et al. 2015). The devised form had three subfactors: category of event, types of error, causes of medication errors and factors contributing to error. First of all, to define the level of severity of the outcome of medication errors, errors were classified according to the eight categories outlined in the "National Coordinating Council for Medication Error Reporting and Prevention Index" (NCC MERP, 2001). Table 1 has shown categories defined in this classification. Another section of the form contains a total of 18 statements that delineate the most common types of medication errors, such as wrong dose, wrong patient, wrong route, etc. The American Society of Health-System Pharmacists' "Guidelines on Preventing Medication Errors in Hospitals" was consulted in determining the types of errors (ASHP, 2018). Another section of the form consists of a total of 24 statements on the causes of medication errors and 15 items on the factors contributing to error. At the same time, if the student would like to clarify the nature of the error, there is an optional space on the form to fill out to explain the way in which the error was made and how it was discovered.

The "Expert's Evaluation Form" was sent out to 10 experts in the field for content validity so that they could comment on the 57 statements. The form was drawn up according to Lawshe's rules to ensure that each item was comprehensible and relevant. After statements with a negative or "0" content validity index (CVI) were added to the form, a calculation was made to determine whether the positive statements were significant according to the CVI. After an examination of the content validity of the 57-item form, five items under the minimum CVI value of 0.60 (Wynd, et al. 2003) were removed, yielding a form of 52 items.

To ensure the comprehensibility of the items, 10 students who were not included in the study were asked to review the form and provide their comments. On the basis of these comments, no revision was made in any of the statements and the questionnaire was given its final form.

Data analysis: The IBM SPSS 22 Statistical Package Program (Chicago, IL, USA) was used in the data analysis. Categorical variables were shown as numbers and percentages.

Ethical Considerations: Study approval was obtained from the Committee on Scientific Research and Publication Ethics (Permission number: 2016-189 Date: 26.05.2016) and the Faculty of Nursing. The students were also asked for their informed consent. When the students first logged into the webpage, they were confronted with a message that informed them that any reporting on the page would be anonymous and they would have to indicate in

the appropriate field that they agreed to file a report. They were given the option of not participating if they did not wish to do so and were further informed that only those who confirmed their agreement would be able to complete the report.

Results

In total, 72 medication errors were reported over the course of 28 weeks. However, there is no data on the number of students who made errors. The students classified half of the medication errors they made as Category C (An error that reaches the patient but does not cause the patient harm) (Table 2). In the other common error categories, 20.8% were near-misses, 19.4% reached the patient and caused no harm but required monitoring afterwards or an intervention to prevent harm. Of the students, 9.7% reported a circumstance in the clinical setting that caused an error. Error reports were not submitted in the other harm categories (Table 2).The most reported (76.4%) medication error by the nursing

students was "treatment delays", 9.7% reported "wrong medication", 5.5% specified "wrong dose," and 4.2% indicated "incorrect medication administration period", meaning that the medication took longer or shorter a time to administer (Table 3).The students stated that inadequate communication was the most common cause of errors (38.7%). They said that in particular, the lack of communication between the pharmacist, nurse and faculty member was an important cause of delay in administering the medication and in procuring the medication from the pharmacy on time. A minority (16.4%). reported that errors stemmed from verbal orders. Another cause of error was inadequate monitoring at 13.4% and deficiencies of performance at 10.5% (Table 4). The study revealed that 20.8% of medication errors originated from absent-mindedness or inexperience, 18.8% from work overload and 6.6% from factors such as fatigue (Table 5).

Table 1. Harm Categories of Medication Errors

Name of Category	
Category A	Encountering circumstances or events that have the capacity to cause error
Category B	An error that does not reach the patient
Category C	An error that reaches the patient but does not cause the patient harm
Category D	An error that reaches the patient but results in no harm to the patient, requiring however monitoring or an intervention to prevent harm
Category E	An error that occurred that resulted in temporary harm to the patient and requires intervention
Category F	An error that occurred that resulted in temporary harm to the patient and requires prolonged hospitalization
Category G	An error that occurred that resulted in permanent patient harm
Category H	An error occurred that resulted in the patient's death

Table 2. Harm Categories of Medication Errors Made by Nursing Students

Name of Category	Number	Percentage
Category A: Encountering circumstances or events that have the capacity to cause error	7	9.7
Category B: An error that does not reach the patient	15	20.8
Category C: An error that reaches the patient but does not cause the patient harm	36	50
Category D: An error that reaches the patient but results in no harm to the patient, requiring however monitoring or an intervention to prevent harm	14	19.4
TOTAL	**72**	**100**

Table 3. Medication Error Types

Type of Error	Number	Percentage
Treatment delay	55	76.4
Wrong Medication	7	9.7
Wrong Dose	4	5.5
Incorrect medication administration period	3	4.2
Wrong Route	1	1.4
Wrong Patient	1	1.4
Patient Safety not Ensured during Care	1	1.4
TOTAL	**72**	**100**

Table 4. Causes of Medication Errors

Causes of Error	Number	Percentage
Poor communication	40	38.7
Verbal order	17	16.4
Inadequate Monitoring	14	13.4
Deficient Performance	11	10.5
Insufficient knowledge	9	8.7
Wrong/Deficient Recording	4	3.8
Medication Shortage	3	2.9
Look-Alike Drug	2	1.9
Miscalculation of Drug Dose	2	1.9
Sound-Alike Drug	1	0.9
Uncertain Order	1	0.9
TOTAL	**103**	**100**

Table 5. Contributing Factors to Medication Errors

Factors Contributing to Error	Number	Percentage
Absent-mindedness	19	20.8
Inexperience	19	20.8
Overload	17	18.8
Fatigue	6	6.6
Work hours	5	5.5
Change of shift	5	5.5
Inadequate knowledge of medications	5	5.5
Stress	4	4.4
Emergency	3	3.3
Inadequate materials	3	3.3
Tiredness	2	2.2
Not being able to reach the patient's data	2	2.2
Duties that are not the responsibility of a nurse	1	1.1
TOTAL	**91**	**100**

Discussion

In schools of nursing, medication administration procedures are taught to nursing students from a theoretical perspective in classrooms and laboratories. However, students need to practice in a clinical setting, which allows them the opportunity to employ their medication administration skills with real patients (Schneidereith, 2014). The literature has mostly focused on examining the medication errors committed by nurses (Kahriman & Ozturk, 2016; Alemdar & Aktas, 2013) and few studies have analyzed errors made by nursing students (Asensi-Vicente, et al. 2018). Students may be at risk of making errors in medication administration due to their limited clinical experience (Asensi-Vicente, et al. 2018). Accordingly, Koohestani and Baghcheghi (2009) have warned that the rate of medication errors involving nursing students is high and that such errors occur more frequently than suspected. In the present study, 72 medication errors were reported by nursing students during a 28-week period. In contrast, many studies in the literature found higher reporting rates of medication errors made by nursing students. Cebeci et al. (2015) indicated an error rate of 28.3% among the nursing students participating in their study. Similarly, others found slightly higher error rates of 32.1% (Greenfield, 2007) and 30% in the case of Koohestani and Baghcheghi (2009). Valdez et al. (2013) reported the lowest medication error rate, at 18.8%. We cannot present data on the reporting rate since error reporting was handled on a voluntary basis in this study. However, the number of reported medication errors among large student group in such a long term course suggests that results may not be reflecting all errors despite many supportive activities. Koohestani and Baghcheghi (2009) as well as Cebeci et al. (2015) stated that medication errors made by nursing students are usually underreported. Research conducted has revealed that among the factors that act as barriers to the reporting of errors by students are the students' fear that they will be given a low grade, that the instructor will be angry or the student will be labeled as incompetent, the negative attitudes of the patient and the patient's family, the belief that an error is not important enough to be reported, unclear instructions about administering a medication, and forgetfulness (Koohestani & Baghcheghi, 2009). Effectively preventing medication errors can only be possible through a

system of medication error reporting. Furthermore, medication error reporting is of great importance in achieving improvements in patient safety as it provides an opportunity to create a system to stop the same errors from reoccurring. In the efforts to increase rates of medication error reporting, it is imperative that students are encouraged to report errors, that they are not made to feel threatened by the possibility of grade cuts and that they feel the presence of a non-punitive reporting culture.

In this study, the most commonly reported medication error was "treatment delay". Among the medication errors, 38.7% stemmed from "poor communication." At the same time, "absent-mindedness and inexperience" constituted 41.6% of the factors that contributed to medication errors. Similar to these results, studies in the literature have pointed to "wrong time" medication errors as being among the most common errors made by nursing students (Mayo & Duncan, 2004; Wolf, et al. 2006; Fisun, et al. 2014). Medications must be administered at the right time in order to attain therapeutic serum levels. Medications administered at the wrong time constitute 31% of all medications administered (Elliott & Liu, 2010). Medication administration guidelines advise that medications are administered at the closest possible time that was prescribed and that no more than a half-hour pass after the recommended time (ISMP, 2011). In clinical practice, however, students prepare medications under the supervision of faculty members and due to their inexperience, students may take longer than 30 minutes in medication preparation, which may cause treatment delay. The delay in the administration of the medications did not take longer than an hour in the study and there was no change in the general condition of the patients. About half of the students said that insufficient experience contributed to this error. In the literature, the most frequently identified contributing factors are inexperience and distractions (Asensi-Vicente, et al. 2018). Similarly, Harding and Petrick (2008) showed that students' medication errors are associated with distractions and workload.

It was found in this study that nursing students submitted the greatest number of reports of medication errors in Category C (errors that reached the patient but did not cause any harm). This was consistent with the literature, where it can be seen that most medication errors reported by nursing students are in Category C (Wolf, et al. 2006; Currie, et al. 2009; Wolf, et al. 2009). Every medication error made by healthcare personnel may not cause harm to the patient but this does not eliminate the reality that medical errors are being made (Cebeci, et al. 2012). It was seen in our study that "near-miss" errors (Category B) were at a lower percentage (19.5%). It is reported in the literature that near-miss errors are very widespread (Elwahab & Doherty, 2014) and it is important that these are notified. It is further recommended that providing healthcare personnel with information about what defines a near-miss error should be one of the main policies of healthcare providers in their efforts to prevent the repetition of medical errors (Bairami & Taleghani, 2016). The results of our study have suggested that errors reaching the patient are more frequently reported due to their visibility and that students have a low level of perception, knowledge and awareness of "near-miss" errors.

Errors made by nursing students in administering medication have the potential of having a major impact on students' perception of their own professional competence, as well as on the quality of healthcare and patient safety (Reid-Searl, et al, 2010). It is therefore imperative that each error is subjected to root cause analysis so that errors are not repeated. It is our belief that medication error rates may be more effectively reduced through the adoption of a clear and open environment of communication. It is important that this culture is instilled in individuals from the beginning of their school career. In general, it can be seen from the literature that the culture of error reporting among healthcare professionals has not yet fully developed (Kagan & Barnoy, 2008; Intepeler & Dursun, 2012; Kagan & Barnoy, 2013; Jegathesan, et al. 2016). Because of this, it is imperative in terms of reducing potential errors that may be made in the future that nursing students develop and adopt a culture of reporting before they begin their professional careers. It is important that nursing students receive refresher courses on the medication error reporting system at intervals and that their awareness is raised about reporting medication errors that reach or do not reach the patient (near-misses). Moreover, the faculty of nursing should be included in the formulation of institutional policies, a non-punitive culture of reporting should be adopted with protective regulations to safeguard reporting individuals so that they can

be safely encouraged and expected to report errors.

Study Limitations: Major limitation of this study is that we do not have data how many of the students reported errors because of our anonymous reporting system. Also, since the error reporting system is based on anonymous input, there are no fields in the system from which the students' demographic data can be collected. Because of this, we were unable to gather information about when and in which year of their education the nursing program students reported the most errors. Furthermore, since the available error reporting system covers only medication errors, we have no data on other types of medical errors. During the data collection stage of the study, the faculty members taking part in the project made a concerted effort to encourage students on their clinical floors to report any errors made. The results therefore cannot be generalized.

Conclusion: Although the reporting rate is quite low, we have suspected that the number of medication errors involved nursing students may be probably more than reported. The medication errors made by nursing students are generally due to a lack of knowledge and experience, poor communication and carelessness. The safe administration of medication is a crucial skill for nursing students to learn during their hospital practice. In some manner, patient safety issues should be integrated throughout the courses offered in the nursing program in order to develop the culture of safety. Future studies are needed to determine the most useful strategies for early detection and prevention of medication errors made by nursing students. In addition to effective supervision of students in clinical practice, the use of information technologies for medication errors could also contribute to patient safety.

Implications for Nursing: Ensuring that nurses develop a culture of adherence to patient safety and error reporting can only be possible if nursing students are provided with an adequate level of knowledge and awareness during their undergraduate years. In view of the results of our study, it can be recommended that nursing students are trained in the subject of recognizing the importance of medication errors and reporting and that they are encouraged to report all medical errors. The data stored in the medication error reporting system should be shared with students on a yearly basis and time should be allotted for feedback and finding joint solutions.

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