Original Article:

Evaluation of Medication Error Reports Sent to Food and Drug Deputy From Hospitals Affiliated to Mazandaran University of Medical Sciences, Mazandaran Province, Iran, 2015-2018

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ABSTRACT

Background: Medical errors are one of the most common threats to patient safety. Medication errors have several consequences, including the increase in patients' mortality, length of stay, and healthcare costs.

Objectives: This study was conducted in Food and Drug Deputy of Mazandaran University of Medical Sciences (MAZUMS) to evaluate medication errors.

Methods: This study was conducted by the Food and Drug Deputy of Mazandaran University on medication errors reported and received from affiliated hospitals during 2015-2018.

The analysis was performed based on the cause of the error, the frequency of the drugs, routs of administration, and the type.

Results: Out of 3033 reported cases, the results of data analysis indicated that the highest percentage of these errors was related to antibiotics (22.84%).

According to the results, the most common type of error belonged to the incorrect drug (44.18%), incorrect dose (25.65%), and drug omission (16.68%). The most common cause of the errors was related to neglect and insufficient care by the medical team (38.24%) and no or incorrect mention of the details of prescribed medications (in Kardex, HIS, etc.) by nurses (14.96%).

Conclusion: Regular in-hospital training for medical staff focused on teaching the standards required for the administration and use of various medications, and identification of common medication errors can prepare guidelines to reduce these errors in hospitals. Besides, providing measures such as electronic prescription and medication systems based on a unit-dose drug distribution system can also help reduce medication errors.

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1. Introduction

Patient safety and quality of care for inpatients are important in providing hospital services and must be considered by health care providers as one of the top priorities [1]. The World Health Organization (WHO) announced the third global patient safety challenge as "medication without harm" in 2017.

Medication errors are a leading cause of injury and avoidable harm in health care systems and globally generating costs around 42 billion US dollars annually. In February 2018, the report of the prevalence and burden of medication errors in England was published in response to the WHO challenge, estimating that 237 million medication errors at all stages of the medication process occur in England per year [2, 3]. Medical errors are one of the most common threats to patient's safety. About 1 out of 10 patients was harmed during hospitalization due to medical errors, 7% of them will end in a lethal outcome. The incidence of harm due to medical errors had increased from the eighth cause of death in 1999 to the third cause in 2008 [4].

Investigating the underlying causes of medication errors in hospitals and providing appropriate solutions can prevent or reduce the incidence of such errors. Medication errors can occur at various stages of the treatment process, including prescribing medications, transcribing the prescribed medications, providing and distributing medications to the hospital, and delivering the medication to the patient by the nurse [5, 6].

Medication errors have several contributing factors. Today, 10 laws are emphasized to reduce the incidence of medication error: right patient, right drug, right dosage, right time, right route, right to refuse (patient and nurse), right knowledge, right questions or challenges, right advice, and right response or outcome [7].

Medication errors have several consequences, including the increase in patient mortality, length of stay, and healthcare costs. Such errors result in the loss of trust and, consequently, patients' dissatisfaction with health care systems [1, 8, 9]. In Iran, few studies have been conducted on the type of medication errors, their extent, causes, and consequences. Given the lack of organized supervision and coherent and comprehensive research projects in this area, medication errors are expected to be much higher than what was reported [9, 10]. In recent years, medication error has justly received considerable attention, as it causes substantial mortality, morbidity, and extra healthcare costs [11].

Considering the different definitions of medication errors and error measurement tools, the type of error reporting system may vary in different countries and even in one country, which can have a significant impact on the reported outcome [12]. Among the most important barriers to reporting medication errors are legal issues in reporting, receiving negative feedback from managers, and focusing on the offender without considering other factors contributing to the error [13].

Given the importance of reducing medication errors in patient safety as one of the key indicators of health service quality control, this study was conducted by Food and Drug Deputy of Mazandaran University of Medical Sciences (MAZUMS), Mazandaran Province, Iran, on medication errors reported and received from affiliated hospitals during 2015-2018 to maintain the patient's health and safety by identifying the possible causes of errors and presenting effective and appropriate strategies to reduce these errors in these hospitals.

2. Materials and Methods

This is a retrospective cross-sectional study conducted after collecting medication error reports sent from the hospitals affiliated to MAZUMS during 2015-2018. The Medication Error Registration Form was designed by the Food and Drug Deputy and it collects the patient's demographic characteristics, incident information, drug information, person or persons involved in the error, type of error, cause of error, error description, post-error measures, and a reporting section. The form was sent to all affiliated hospitals and after completing the forms, they sent it back to Food and Drug Deputy each season. After collecting data, they were analyzed in SPSS v. 21 and Office Excel applications. In the end, the frequency and percentage of variables related to medication errors were extracted.

3. Results

From 2015 to 2018, the Food and Drug Deputy in Mazandaran received 3033 medication errors. Most of these errors (70.55%) were committed by nurses followed by personnel working in pharmacy/pharmaceutical warehouse (14.93%), other medical staff (7.12%), physicians (5.40%), midwives (0.8%), residents (0.62%), patient or patient companions (0.23%), and pharmacists (0.13%). In 6 cases (0.19%), unfortunately, the individual or persons involved in the error have not been mentioned. The results of data analysis indicated that the highest percent-

Table 1. Frequency distribution of different types of medication errors

Type of Medication Error	No. (%)
Incorrect drug	1340 (44.18)
Wrong dosage form	111 (3.66)
Wrong route	86 (2.84
Improper injection speed	35 (1.15)
Wrong time	17 (0.56)
Drug omission	506 (16.68)
Incorrect dose	778 (25.65)
Wrong patient	70 (2.31)
Wrong medical orders	34 (1.12)
Taking expired drugs	17 (0.56)
Unknown	39 (1.29)
Total	100 (3033)

PBR

age of these errors was related to antibiotics (22.84%), Cardiovascular Agents (8.74%); Large Volume Parenterals (LVPs) (7.55%), corticosteroids (4.31%), pantoprazole (2.86%), insulin and heparin (both 2.70%), aspirin (2.53%), acetaminophen (2.17%), ranitidine (2.04%), and furosemide (1.98%). A high percentage of the reported medication errors for antibiotics was related to cephalosporins (45.45%). Among the routes of administration, the most frequent medication error was related to the injectable drugs (64.59%) followed by oral drug administration (24.82%).

Table 1 presents the results based on the type of medication error. As can be seen, the most frequent type of error was related to incorrect medication (44.18%) followed by an incorrect dose (25.65%), and drug omission (16.68%). Regarding the incorrect dose type, 51.67% of errors were related to high-dose medication use and 32% to low-dose medication use. In 16.32% of cases, incorrect dose level (high/low) had not been mentioned.

The results reported that the most common causes of medication error were neglect and insufficient care by the medical team (38.24%), followed by no or incorrect mention of the details of prescribed medications (in Kardex, HIS, etc.) by nurses (14.96 %), the similarity of the drugs' pronunciation/written form/appearance (11.36 %), and fatigue/sleeplessness/excessive workload (10.20%) (Table 2). Since in some cases more than one cause of medication error had been reported, the total frequency of errors reported in Table 2 is greater (n=3196) than the total number of actual reports.

4. Discussion

A total of 3033 medication errors were reported to the Food and Drug Deputy of MAZUMS from 2015 to 2018. The actual number of medication errors that have occurred over these years was definitely higher than the reported number. In a study conducted in selected hospitals of Iran University of Medical Sciences in Tehran, Iran, the average number of medication errors committed by nurses in Internal Medicine, Surgery, Orthopedics, and Gynecology departments during three months was 19.5 errors per nurse [1].

In Iran, few studies have been conducted on the type of medication errors, their extent, causes, and consequences [9]. Reasons for not achieving the global standard can include unawareness of the reporting plan, shortage of human resources in the health service delivery system, no strict oversight of the pharmaceutical process, fear of legal and ethical issues in reporting, receiving negative feedback from managers, and focusing on the offender without considering other factors contributing to the error [1, 13].

The first reports of medication errors were made in 1940 and they drew attention [14]. Since 1991, many

Table 2. Frequency distribution of causes of medication errors

Cause of Medication Error	No. (%)
Poor knowledge and experience of the medical team	276 8.64
Neglect and insufficient care by the medical team	1222 (38.24)
Failure to keep the drug in the right place/Wrong drug-shelf arrangement	216 (6.76)
Fatigue/Sleeplessness/Excessive workload	326 (10.20)
Inappropriate environmental conditions (high noise, poor light, repeated accidents, etc.)	126 (3.94)
The similarity of the drugs' pronunciation/written form/appearance	363 (11.36)
Unusual and unreadable prescription or handwriting by a physician	126 (3.94)
Inadequate monitoring of patient	44 (1.38)
No or incorrect mention of the details of prescribed medications (in Kardex, HIS, etc.) by nurses	468 (14.96)
Wrong dilution	19 (0.56)
Total	3196 (100)

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studies have attempted to quantify iatrogenic errors, including medication errors, in the USA. All studies have found a substantial amount of injury to patients from medical management [15]. Medication errors are considered a threat to patient safety. In 2002, one-fifth of US lawsuits and complaints were related to medication errors [12].

In our study, the most frequent type of error was related to incorrect medication (44.18%) followed by an incorrect dose (25.65%) and drug omission (16.68%). Moreover, the most common cause of medication error was neglect and insufficient care by the medical team (38.24%) followed by no or incorrect mention of the details of prescribed medications (in Kardex, HIS, etc.) by nurses (14.96%), the similarity of the drugs' pronunciation/written form/appearance (11.36%), and fatigue/sleeplessness/excessive workload (10.20%). In a study conducted at the Anesthesiology Department of the Boston Pediatric Hospital from January 2008 to June 2016, the most frequent medication errors were incorrect dose (55%) and incorrect medication (28%) [16].

Kohestani et al. [17] also reported the incorrect dose (22.03%) and incorrect medication (20.33%) as the most frequently observed errors among nursing students. In the study of Fahimi et al. [18], the most common type of medication error was drug omission (52%). Furthermore, the most common causes of medication errors reported in other studies are fatigue due to high workload [14] and inappropriate environmental conditions (high noise, low light, and inappropriate temperature) [19].

In our study, the most common drugs causing medication error were antibiotics (22.84%), Large-Volume Parenterals (LVPs) (7.55%), corticosteroids (4.31%), pantoprazole (2.86%), insulin and heparin (both 2.70%), aspirin (2.53%), acetaminophen (2.17%), ranitidine (2.04%), and furosemide (1.98%). In other words, antibiotics (22.84%), cardiovascular drugs (8.73%), large-volume parenterals (LVPs) (7.55%), corticosteroids (4.31%), anticoagulant drugs (4.51%), proton pump inhibitor drugs (PPIs) (2.86%) and H2 receptor blockers (2.86%).

In a study conducted in a hospital in India, out of 200 patients, 40 patients suffered from medication errors. Also, the majority of the medication errors were observed with drug class of antibiotics (22.5%) and bronchodilators (22.5%). Omission error was the most frequently observed medication errors (77.5%) [20].

In another study conducted in England and Wales, the most common error category was omitted medicine or ingredient (31.4%, n=72); the most common drug groups were cardiovascular (20.1%) and nervous system (10.0%) [2].

Another study showed that the prevalence of incorrect medication error was 36.9%-51% and the prevalence of prescribing omissions was 36.9%-44.6%. Moreover, the

most common incorrect drug was proton-pump inhibitors, and the most common omission drug was vitamin D3 supplement [21].

Another study conducted from 2011 to 2014 in the southwestern United States examined the admitted patients. The most common drug class associated with medication errors was cardiovascular drugs (24.7%). Antimicrobials were the second most common drug class associated with errors (19.1%) and vancomycin was the most common antimicrobial that caused errors in this category (6.1%) [22].

In our study, most medication errors (70.55%) had been committed by nurses followed by personnel working in pharmacy/pharmaceutical warehouses (14.93%). Since giving medicine is probably one of the most important duties of nurses, it is one of the key criteria for nurses' competence, which nowadays has become more difficult and complex due to the variety of available medications [1]. On average, 40% of nurses spend time in the hospital giving medication to patients, and 42% of them make medication errors at least once during the medication process [23].

In a 6-month study at medical centers, 130 medication errors (39%) were due to incorrect prescription, 40 errors (12%) in transcribing the prescribed medications, 38 errors (11%) because of the problems in medication distribution at the pharmacy, and 126 cases (38%) in giving medication by nurses. In other words, 164 cases of errors (49%) were committed during medication distribution and delivery stages [24].

The results of our study indicated that, among the routes of administration, the most frequent errors were related to injectable drugs (64.59%) followed by oral drug administration (24.82%). Obviously, avoiding unnecessary use of injectable drugs can greatly reduce the incidence of medication errors and side effects.

5. Conclusions

Overall, the number of medication errors reported by affiliated hospitals appears to be less than the actual rate. Hence, some measures should be taken to allow reporting of errors without any fear or concern. Awareness about factors affecting medication errors and identifying and eliminating the risks of medication errors in hospital wards can reduce medication errors. Regular in-hospital training for physicians, nurses, pharmacists, and other medical staff focused on teaching the standards required for the administration and use of various medications, especially drugs that are more likely to cause an error (e.g. high-risk medications, antibiotics, cardiovascular drugs, etc.), defining the medication error, and the reporting the error can be helpful. Also, the identification of common medication errors can provide guidelines to reduce these errors in hospitals and use them in the wards. Besides, to reduce medication errors, it is possible to design appropriate measures including re-checking medication orders, calculating high-risk medications, and increase the focus. Providing tools such as the electronic prescription and medication systems based on a unit-dose (unit-of-use) drug distribution system can also help to reduce medication errors.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. This study was approved by the Ethics Committee of the University of Mazandaran (Code: IR.MAZUMS..REC.1398.5070).

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Authors' contributions

All authors equally contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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References

[1] Hajibabaee F, Joolaee S, Peyravi H, Haghani H. [The relationship of medication errors among nurses with some organi-

zational and demographic characteristics (Persian)]. Iranian Journal of Nursing Research (IJNR). 2011; 6(20):83-92. http://ijnr.ir/browse.php?a_id=804&sid=1&slc_lang=en

[2] Härkänen M, Vehviläinen-Julkunen K, Murrells T, Rafferty AM, Franklin BD. Medication administration errors and mortality: Incidents reported in England and Wales between 2007-2016. Research in Social and Administrative Pharmacy. 2019; 15(7):858-63. [DOI:10.1016/j.sapharm.2018.11.010] [PMID]

[3] Gates PJ, Baysari MT, Mumford V, Raban MZ, Westbrook JI. Standardising the classification of harm associated with medication errors: The Harm Associated with Medication Error Classification (HAMEC). Drug Safety. 2019; 42(8):931-9. [DOI:10.1007/s40264-019-00823-4] [PMID] [PMCID]

[4] Zaree TY, Nazari J, Jafarabadi MA, Alinia T. Impact of psychosocial factors on occurrence of medication errors among Tehran public hospitals nurses by evaluating the balance between effort and reward. Safety and health at work. 2018; 9(4):447-53. [DOI:10.1016/j.shaw.2017.12.005] [PMID] [PMCID]

[5] 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(1):53-61. [DOI:10.1111/j.1365-2044.2006.04858.x] [PMID]

[6] Farzi S, Farzi S, Alimohammadi N, Moladoost A. [Medication errors by the intensive care units' nurses and the Preventive Strategies (Persian)]. Anesthesiology and Pain. 2016; 6(4):33-45. http://jap.iums.ac.ir/browse.php?a_code=A-10-208-3&slc_lang=en&sid=1

[7] Edwards S, Axe S. The 10 'R's of safe multidisciplinary drug administration. Nurse Prescribing. 2015; 13(8):398-406. [DOI:10.12968/npre.2015.13.8.398]

[8] Izadpanah F, Nikfar S, Imcheh FB, Amini M, Zargaran M. Assessment of frequency and causes of medication errors in pediatrics and emergency wards of teaching hospitals affiliated to Tehran University of Medical Sciences (24 Hospitals). Journal of Medicine and Life. 2018; 11(4):299-305. [DOI:10.25122/jml-2018-0046] [PMID] [PMCID]

[9] Moghadasi H, Sheikhtaheri A, Hashemi N. [Reducing medication errors: Role of computerized physician order entry system (Persian)]. 2007; 10(27):57-67. http://jha.iums.ac.ir/browse.php?a_id=74&sid=1&slc_lang=en

[10] Ahangar N, ALa S. [Evaluation of medication errors in internal wards of Imam Sajjad Ramsar Hospital In 2017 Spring and Summer (Persian)]. Medical Journal of Mashhad University of Medical Sciences. 2019; 61(6):1314-22. http://mjms.mums.ac.ir/article_13486.html

[11] Guchelaar HJ, Colen HB, Kalmeijer MD, Hudson PT, Teepe-Twiss IM. Medication errors. Drugs. 2005; 65(13):1735-46. [DOI:10.2165/00003495-200565130-00001] [PMID]

[12] Ebrahimpour F, Shahrokhi A, Ghodousi A. [Patients' safety and nurses' medication administration errors (Persian)]. Iranian Journal of Forensic Medicine. 2014; 19(1-4):401-8. https://www.researchgate.net/profile/Fatemeh_Ebrahimpour2/publication/262972491_Patients'_Safety_and_Nurses'_Medication_Administration_Errors/links/0046353a84afc4fb5e000000/Patients-Safety-and-Nurses-Medication-Administration-Errors.pdf

[13] Mirzaei M, Khatony A, Faramani RS, Sepahvand E. Prevalence, Types of Medication errors and Barriers to Reporting Errors by Nurses in an Educational Hospital in Kermanshah. Hayat. 2013; 19(3):28-37. http://hayat.tums.ac.ir/article-1-613-en.html

[14] Gorgich EA, Barfroshan S, Ghoreishi G, Yaghoobi M. Investigating the causes of medication errors and strategies to prevention of them from nurses and nursing student viewpoint. Global Journal of Health Science. 2016; 8(8):54448. [DOI:10.5539/gjhs.v8n8p220] [PMID] [PMCID]

[15] Seeley CE, Nicewander D, Page R, Dysert PA. A baseline study of medication error rates at Baylor University Medical Center in preparation for implementation of a computerized physician order entry system. Proceedings (Baylor University. Medical Center). 2004; 17(3):357-61; discussion 361-2. Taylor & Francis. [DOI:10.1080/08998280.2004.11927993] [PMID] [PMCID]

[16] Leahy IC, Lavoie M, Zurakowski D, Baier AW, Brustowicz RM. Medication errors in a pediatric anesthesia setting: Incidence, etiologies, and error reduction strategies. Journal of Clinical Anesthesia. 2018; 49:107-11. [DOI:10.1016/j.jclinane.2018.05.011] [PMID]

[17] Kouhestani HR, Baghcheghi N, Khosravi S. Frequency, type and causes of medication errors in student nurses (Persian)]. Iran Journal of Nursing. 2008; 21(53):17-27. http://ijn.iums.ac.ir/article-1-405-en.html

[18] Fahimi F, Nazari MA, Abrishami R, Sistanizad M, Mazidi T, Faghihi T, et al. Transcription errors observed in a teaching hospital. Archives of Iranian Medicine (AIM). 2009; 12(2):173-5. [PMID]

[19] Kaboodmehri R, Hasavari F, Adib M, Khaleghdoost Mohammadi T, Kazemnejhad Leili E. Environmental Factors Contributing to Medication Errors in Intensive Care Units. Journal of Holistic Nursing and Midwifery. 2019; 29(2):57-64. [DOI:10.32598/JHNM.29.2.57]

[20] Sheikh D, Mateti UV, Kabekkodu S, Sanal T. Assessment of medication errors and adherence to WHO prescription writing guidelines in a tertiary care hospital. Future Journal of Pharmaceutical Sciences. 2017; 3(1):60-4. [DOI:10.1016/j.fjps.2017.03.001]

[21] Manias E, Maier A, Krishnamurthy G. Inappropriate medication use in hospitalised oldest old patients across transitions of care. Aging Clinical and Experimental Research. 2019; 31(11):1661-73. [DOI:10.1007/s40520-018-01114-1] [PMID]

[22] Muroi M, Shen JJ, Angosta A. Association of medication errors with drug classifications, clinical units, and consequence of errors: Are they related? Applied Nursing Research. 2017; 33:180-5. [DOI:10.1016/j.apnr.2016.12.002] [PMID]

[23] Yaghoobi M, Navidian A, Charkhat-gorgich EA, Salehiniya H. [Nurses' perspectives of the types and causes of medication errors. Iran Journal of Nursing (Persian)]. 2015; 28(93-94):1-10. [DOI:10.29252/ijn.28.93.94.1]

[24] Leape LL, Bates DW, Cullen DJ, Cooper J, Demonaco HJ, Gallivan T, et al. Systems analysis of adverse drug events. JAMA. 1995; 274(1):35-43. [DOI:10.1001/jama.1995.03530010049034] [PMID]