MEDICATION ERRORS: A PROSPECTIVE STUDY IN MOHAMED V MILITARY TEACHING HOSPITAL, RABAT, MOROCCO

Youssef Moutaouakkil, Zouhair El Allali, Samira Serragui, Mina Ait El Cadi, Jamal Lamsaouri, Rachid El Jaoudi, Yassir Bousliman

Pharmacology and Toxicology Department, Faculty of Medicine and Pharmacy, Rabat Institute University Mohamed V, Rabat, Morocco

ABSTRACT

Medication errors (MEs) are preventable events that may cause or lead to inappropriate medication use or patient harm. Annually 98,000 patients die because of avoidable MEs, and it is considered a financial burden on public health organizations. The purpose of our study was to examine the incidence rate, types, and causes of medication errors. We conducted a prospective, descriptive study from 1st November 2018 to 1st March 2019 at Mohammed V Military Teaching Hospital in Morocco. We performed prescriptions analysis for all patients, and the proper corrective measures were taken. We analyzed 19,200 prescriptions during the study period and made 2,152 (11.20%) pharmaceutical interventions (PI). We identified 752 medication errors (34.94%) of the total PIs) in 562 patients, with an incidence rate of 3.91%. The number of medication errors was higher in men than in women. The most frequent medication errors were: drug interaction errors, dosage or concentration errors, and dose errors. Bearing in mind the outcomes of our study, it is crucial to raise awareness among healthcare professionals of the significance of medication errors. Further investigations are required to fully understand and establish measures to reduce the prevalence rate of medication errors.

ARTICLE HISTORY

Received: September, 01, 2022
Revision: November, 10, 2022
Accepted: November, 21, 2022
Online: December, 01, 2022

doi:
10.20473/jcmphr.v3i02.38704

KEYWORDS
Medication Errors, Hospital, Incidence

Corresponding author
Youssef Moutaouakkil
youssefmoutaouakkil@yahoo.com
Pharmacology and Toxicology Department, Faculty of Medicine and Pharmacy, Rabat Institute University Mohamed V, Rabat, Morocco

INTRODUCTION

Medication errors (MEs) have not gained a lot of attention until the publication of *To Err is Human: Building a Safer Health System* in 1999[1], a report by the Institute of Medicine showed the significance and seriousness of medication errors on the healthcare systems and pointed out that every year 98,000 patients dies in hospitals because of avoidable medication errors. The report labeled medication errors as a factor of morbidity and mortality and a financial burden as well. MEs cost the European healthcare systems between €4.5 and 21.8 billion annually[2]. Another recent study estimated that yearly in England, 66 million potentially preventable adverse drug effects are committed, inducing and contributing to a longer hospital stay and the death of 1,081[3].

In healthcare institutes, MEs are more frequently observed in intensive care units where patients are more vulnerable, and the outcomes can be lethal [4]. According to the French Agency for the Safety of Health Products (AFSSAPS), a medication error is the omission or performance of an

unintended act involving a medication during the caregiving process. It may be the source of a risk or an adverse event for the patient[5]. The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) defines a 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 healthcare professional, patient, or consumer[6].

The main reasons for medication error are incomplete patient information, missing drug information, lack of drug history details from the patient's side, improper drug storage, illegible handwriting, drug interactions, improper training of nurses, etc.[7]. In Morocco, the incidence of medication errors are underestimated, and not enough data are available to evaluate the situation, despite its seriousness. The comparison with or the extrapolation of information from different publications is challenging because of the dissimilarities in the demographic parameters. The struggle with MEs is also worsened by the absence of a standardized taxonomy that characterizes an error, potential error, error cause, or contributing factor[8]. The aim of this study was to examine the incidence rate, types, and causes of medication errors In Mohamed V Military Teaching Hospital, Rabat, Morocco.

MATERIALS AND METHODS

We conducted a prospective and descriptive study on medication errors in a hospital pharmacy. We collected and analyzed prescriptions of various departments within the pharmacy department in Mohammed V Military Teaching Hospital over 4 months, starting the 1st of November 2018 to the 1st of March 2019. We collected the data using a patient follow-up sheet that was established in agreement with the pharmacy department and its staff. The sheet form contained different pieces of information related to the patient: Identity of the patient (first and last name, age, weight, height, BMI, city, and telephone number) also the type of error involved (risk of error, potential, proven) and the principal causes responsible for these errors. We analysed prescriptions and evaluated drug interactions using the database of the National Hospital Center for Drug Information (CNHIM)[9] and the 2016 ANSM thesaurus[10]. The inclusion criteria for this study included all personalized prescriptions of patients of all ages. The exclusion criteria included prescriptions for reagents, medical devices, and anti-tuberculosis drugs, and global prescriptions.

RESULTS

During the period of the study, we analyzed 19,200 prescriptions. The pharmacists made 2,152 pharmaceutical interventions (PI), which represent 11.20%. Among these PIs, 752 were related to MEs, representing 34.94% of the total PIs with an incidence rate of 3.91%. From the 752 MEs, we could identify 562 patients with a male predominance (80.60%), an average age of 62.5 ranging from 2 to 92 years old, and an average hospitalization length of 10 days. As much as 92.81% of the MEs were dominated by five categories (Table 1).

The drugs most repeatedly concerned (Figure 1) were: antibiotics (189 MEs), antithrombotics (156 MEs), analgesics (174 MEs), cardiovascular system drugs (153 MEs), blood substitutes

and infusion solutions (48 MEs), and laxatives (32 MEs).

Table 1. Types of medication errors detected

Types of error	Number	Percentage%
Drug interaction errors	360	47.87
Dosage or concentration errors	132	17.55
Dose errors	127	16.88
Errors of mission	79	10.50
Therapeutic and clinical follow-up errors	23	3.05
Drug errors	13	1.72
Galenic formulation errors	12	1.59
Administration time errors	4	0.53
Administration route errors	2	0.26
Total	**752**	**100**

Six causes backed 64.2% of these medication errors (Table 2).

Table 2. Causes of medication errors

Most frequent causes	Number	Percentage%
Prescribing the wrong dosage for a given drug	115	15.29
Unit errors	97	12.89
Drug prescriptions often with misspelling, no dosage	89	11.83
Failure to stop treatment	79	10.50
Prescription redundancy	62	8.24
Frequency error	41	5.45

The prevalence of drug interactions represented 47.87% of the total errors. As many as 360 interactions were identified in 94 patients, with the most common being acetylsalicylic acid/clopidogrel (12.22%), acetylsalicylic acid/heparin (8.33%), and furosemide/spironolactone (5.83%). As much as 11.11% of the drug interactions were serious interactions where the association was not recommended, 37.22% were moderate interactions, and 51.66% were minor interactions.

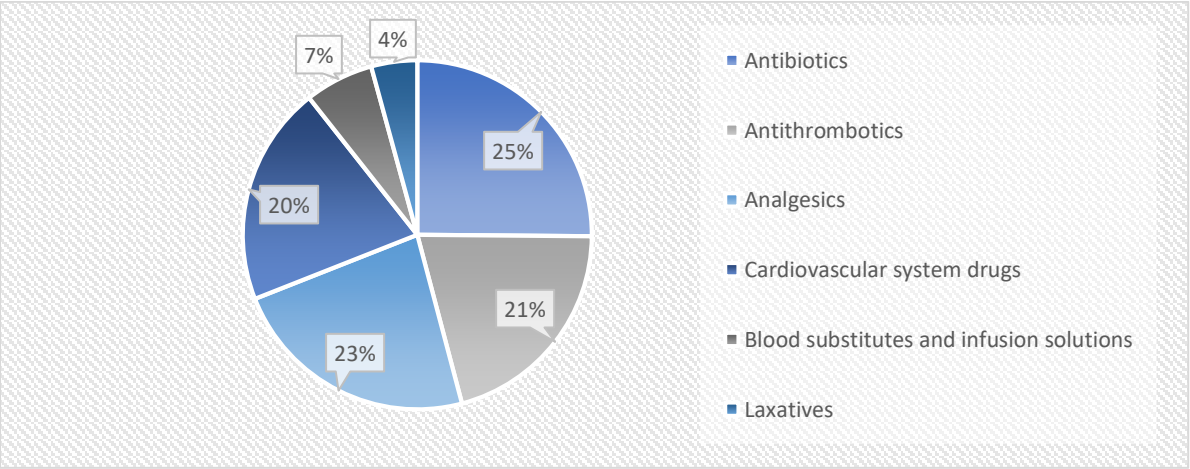

Figure 1. The drugs most repeatedly concerned with dication errors

DISCUSSION

MEs are a significant concern in healthcare. It can carry severe implications for patients and healthcare professionals as well, contributing to the extension of the hospital stay length. The main goal of this study was to determine the prevalence of medication errors in Mohammed V Military Teaching Hospital in Rabat, Morocco with patient safety as the target by establishing and reducing the major cause of medication errors where the human factor plays a significant role in medication errors[8].

Before all else, medication errors may occur at any step in the process, from prescribing, ordering, transcription, dispensing, and administration. Most of the available studies reviewed MEs at the prescription, transcription, and administration phases. Our work studied MEs at the prescriptions step. We ascertained that medication errors in Mohammed V Military Teaching Hospital were frequent, with the most frequent MEs being: drug interaction errors, dosage and concentration errors, and dose errors. In agreement with other studies, we found that MEs were more frequent with antibacterial drugs[11,12].

A voluntary reporting system, including the FDA, MedWatch, MEDMARX, and the medication error reporting program, introduced in 1998, to date has received over 1 million entries. The top 10 drugs repeatedly implicated in medication errors are insulins, albuterol, morphine, sodium chloride, heparin, cefazolin, furosemide, levofloxacin, and vancomycin[13].

Understanding MEs and determining their prevalence is the gateway to establishing measures and procedures to reduce their occurrence. Nonetheless, a prospective cohort study by Leaped et al[14]. declared that most MEs go unnoticed, and only significant events are reported.

According to the report "To Err is human" MEs cause the death of 1 in 131 outpatients and 1 in 854 inpatients[1]. Another two studies reported that the prevalence of MEs rates between 4.8% and 5.3% in inpatients[15,16]. Bats et al. studied the frequency of harm related to MEs. They examined over 10,000 medication orders identifying a prevalence of 5.3% errors. Yet, they deduced that only 0.9% of the errors resulted in adverse drug occurrences[16]. Most MEs can go unnoticed. However, a decline in the patient’s renal or hepatic function, patient's impaired cognition, advanced age, and other comorbidities can aggravate it[17]. The rate of MEs is influenced by numerous factors that fluctuate from one hospital to another, and sometimes from one department to another in the same hospital. In general, it includes drug interaction errors, dosage or concentration errors, dose errors, errors of omission, therapeutic and clinical follow-up errors, drug errors, galenic formulation errors, administration time errors, and administration route errors.

The WHO launched the third WHO Global Patient Safety Challenge in 2017 with the theme "Medication without Harm" which aims to reduce severe avoidable medication-related harm by 50%. Medication without harm is an approach that encourages all persons involved in the caregiving process (doctors, pharmacists, nurses, and patients) to take an active role to ensure safer medication practices[18].

Organizations like the Institute for Safe Medication Practices, The American

Society of Health-System Pharmacists, the American Society of Clinical Oncology with the US Oncology Nursing Society, and the Clinical Oncology Society of Australia have shared recommendations for a safe approach to enhance medication safeness[19,21]. The guidelines enclose: Using unambiguous packaging and labelling, using Tallman lettering to distinguish similar-looking or sounding drugs, using templated order sets with required fields, and the shifting from handwritten to pre-printed or electronic prescriptions

The guidelines also suggested additional safe practices, including the use of checklists, prohibition of verbal prescription, avoidance of ambiguous abbreviations, and the establishment of a no interruption rule during drug prescribing or dispensing.

Although retrospective reviews and studies can lead to spotting medication errors and taking corrective measures, prospective studies offer a tool for understanding and improving MEs. In addition, it provides the possibility of evaluating the effectiveness of the taken and rectifying actions[22].

Over the last decade, information technology and computerized prescription entry have grown extensively[23]. A meta-analysis reported that electronic prescribing significantly reduced MEs compared to no electronic strategy. Preventable adverse drug events were also reduced. However, other parameters, such as length of stay and mortality, were not altered. Nevertheless, the studies included in the meta-analysis were very heterogeneous[24].

A study by Liang et al.[25] also reported that using electronic prescription entry systems with advanced decision support could benefit oncology practices in particular, as well as the general population. Advanced decision support, namely drug allergy, interactions, dose limit warning, and calculation support for weight-based and body surface-based dosing, can limit medication errors and benefit the caregiving process. Another two studies by Pichon et al.[26] and Huertas Fernández et al.[27] additionally noted that electronic entry ensures complete prescriptions, reduces oversights related to legibility, and eliminates the necessity for transcription, which taken together reduces errors rate by 62% - 75%. Clifton-Koeppel[28] stated that the presence of a clinician pharmacist responsible for the prevention of global errors showed promising results in the process of reducing MEs, and a simulation experience by Hayes et al.[29] conducted in an Australian university reported that exposing nurses to clinical experiences improved their deduction reasoning and the analysis of the practical situation.

CONCLUSION

MEs have always been a sensitive subject and a burden on public health organizations considering their cost in terms of mortality and finance. In Morocco, insufficient information is available about the incidence rate of MEs. In our prospective study, we tried to determine the markers and the patterns of MEs to provide a deep understanding of the situation and direct the process of establishing measures to reduce them. Nevertheless, additional studies are needed to enhance the apprehension of the prevalence of MEs on the entire medication circuit.

ACKNOWLEDGMENT

The authors thank all parties involved in the making of this research.

CONFLICT OF INTEREST

All Authors have no conflict of interest regarding the publication of this article.

FUNDING

Self-funded

AUTHOR CONTRIBUTION

All authors have contributed to all processes in this research, including preparation, data gathering, analysis, drafting, and approval for publication of this manuscript.

REFERENCES

1. Kohn LT, Corrigan JM, Donaldson MS. Institute of Medicine (US) Committee on Quality of Health Care in America. To err is human: building a safer health system.
2. Reporting WH. Learning systems for medication errors: the role of pharmacovigilance centres. World Health organization. 2014.
3. Elliott RA, Camacho E, Jankovic D, Sculpher MJ, Faria R. Economic analysis of the prevalence and clinical and economic burden of medication error in England. BMJ Quality & Safety. 2021 Feb 1;30(2):96-105.
4. Escriva Gracia J, Aparisi Sanz A, Brage Serrano R, Fernández Garrido J. Medication errors and risk areas in a critical care unit. Journal of Advanced Nursing. 2021 Jan;77(1):286-95.
5. Agence francaise de securite sanitaire des products de sante afssaps. Guichet Erreurs Médicamenteuses: Présen-tation et bilan depuis la mise en place. Saint Denis, France. 2009.
6. NCCMERP. About Medication Errors [Internet]. NCC MERP. 2020 [cited 2022 Mar 7]. Available from: https://www.nccmerp.org/about-medication-errors.
7. Moudgil K, Premnath B, Shaji JR, Sachin I, Piyari S. A prospective study on medication errors in an intensive care unit. Turkish Journal of Pharmaceutical Sciences. 2021 Apr;18(2):228.
8. Escrivá Gracia J, Brage Serrano R, Fernández Garrido J. Medication errors and drug knowledge gaps among critical-care nurses: a mixed multi-method study. BMC health services research. 2019 Dec;19(1):1-9.
9. Thériaque. Banque de données sur le médicament, Système d'Information sur les Produits de Santé [Internet]. Available from: https://www.theriaque.org/
10. du Médicament AN. Thésaurus des interactions médicamenteuses.
11. Carayon P, Wetterneck TB, Cartmill R, Blosky MA, Brown R, Kim R, Kukreja S, Johnson M, Paris B, Wood KE, Walker J. Characterising the complexity of medication safety using a human factors approach: an observational study in two intensive care units. BMJ quality & safety. 2014 Jan 1;23(1):56-65.
12. Kuo GM, Phillips RL, Graham D, Hickner JM. Medication errors reported by US family physicians and their office staff. Qual Saf Health Care. 2008 Aug 1;17(4):286–90.
13. FDA. FDA Adverse Events Reporting System (FAERS) Public Dashboard - FDA Adverse Events Reporting System (FAERS) Public Dashboard | Sheet - Qlik Sense [Internet]. 2012 [cited 2022 Mar 9]. Available from: https://fis.fda.gov/sense/app/95239e26-e0be-42d9-a960-9a5f7f1c25ee/sheet/7a47a261-d58b-4203-a8aa-6d3021737452/state/analysis.
14. Leape LL, Bates DW, Cullen DJ, Cooper J, Demonaco HJ, Gallivan T, et al. Systems analysis of adverse drug events. ADE Prevention Study Group. JAMA. 1995 Jul 5;274(1):35–43.
15. Belén Jiménez Muñoz A, Muiño Miguez A, Paz Rodriguez Pérez M, Dolores Vigil Escribano M, Esther

Durán Garcia M, Sanjurjo Saez M. Medication error prevalence. Int J Health Care Qual Assur. 2010 Mar 23;23(3):328–38.
16. Bates DW, Boyle DL, Vliet MBV, Schneider J, Leape L. Relationship between medication errors and adverse drug events. J Gen Intern Med. 1995 Apr;10(4):199–205.
17. Wittich CM, Burkle CM, Lanier WL. Medication Errors: An Overview for Clinicians. Mayo Clin Proc. 2014 Aug;89(8):1116–25.
18. WHO. Medication without harm [Internet]. 2017. Available from: https://www.who.int/publications/i/item/WHO-HIS-SDS-2017.6.
19. Goldspiel B, Hoffman JM, Griffith NL, Goodin S, DeChristoforo R, Montello CM, et al. ASHP Guidelines on Preventing Medication Errors with Chemotherapy and Biotherapy. Am J Health Syst Pharm. 2015 Apr 15;72(8):e6–35.
20. Neuss M, Gilmore T, Belderson K, Billett A, Conti-Kalchik T, Harvey B, et al. 2016 Updated American Society of Clinical Oncology/Oncology Nursing Society Chemotherapy Administration Safety Standards, Including Standards for Pediatric Oncology. Oncol Nurs Forum [Internet]. 2017 Jan 1 [cited 2022 Mar 13];44(1). Available from: http://onf.ons.org/onf/44/1/2016-updated-american-society-clinical-oncologyoncology-nursing-society-chemotherapy.
21. Carrington C, Stone L, Koczwara B, Searle C, Siderov J, Stevenson B, et al. The Clinical Oncological Society of Australia (COSA) guidelines for the safe prescribing, dispensing and administration of cancer chemotherapy: Cancer medication safety guidelines. Asia Pac J Clin Oncol. 2010 Sep;6(3):220–37.
22. Bonnabry P, Cingria L, Ackermann M, Sadeghipour F, Bigler L, Mach N. Use of a prospective risk analysis method to improve the safety of the cancer chemotherapy process. Int J Qual Health Care. 2006 Feb 1;18(1):9–16.
23. Miller K, Mosby D, Capan M, Kowalski R, Ratwani R, Noaiseh Y, et al. Interface, information, interaction: a narrative review of design and functional requirements for clinical decision support. J Am Med Inform Assoc. 2018 May 1;25(5):585–92.
24. Roumeliotis N, Sniderman J, Adams-Webber T, Addo N, Anand V, Rochon P, et al. Effect of Electronic Prescribing Strategies on Medication Error and Harm in Hospital: a Systematic Review and Meta-analysis. J Gen Intern Med. 2019 Oct;34(10):2210–23.
25. Liang Y, Leung K-S, Mok TSK. A Novel Evolutionary Drug Scheduling Model in Cancer Chemotherapy. IEEE Trans Inf Technol Biomed. 2006 Apr;10(2):237–45.
26. Pichon R, Vodoz L, Zelger GL, Wacker P, Humbert J. Analysis and quantification of prescribing and transcription errors in a paediatric oncology service. Pharm World Sci. 2002;24(1):12–5.
27. Huertas Fernández MJ, Baena-Cañada JM, Martínez Bautista MJ, Arellano EA, García Palacios MV. Impact of computerised chemotherapy prescriptions on the prevention of medication errors. Clin Transl Oncol. 2006 Nov;8(11):821–5.
28. Clifton-Koeppel R. What Nurses Can Do Right Now to Reduce Medication Errors in the Neonatal Intensive Care Unit. Newborn Infant Nurs Rev. 2008 Jun;8(2):72–82.
29. Power T, Davidson PM, Daly J, Jackson D. Nurse interrupted: Development of a realistic medication administration simulation for undergraduate nurses. Nurse Educ Today. 2015 Sep;35(9):981–6