Medication Incidents Associated with Outpatient Computerized Prescribing Systems

Kayamkani Abedulla Khan¹, Adel Ahmed Basaleh¹, Faisal Ahmed Alhothali¹, Ahmed Ibrahim Meashi¹, Nasser Talal Aljuhna¹, Aejaz A. Khan², S. M. Shakeel Iqubal², Muazzam Sheriff Maqbul³, Noorulla Khan Mayana⁴

¹Department of Clinical Pharmacy and Pharmacology, Ibn Sina National College of Medical Sciences, Jeddah, Kingdom of Saudi Arabia, ²Department of General Science, Ibn Sina National College of Medical Sciences, Jeddah 21418, Kingdom of Saudi Arabia, ³Faculty of Microbiology and Immunology, Ibn Sina National College of Medical Sciences, Jeddah 21418, Kingdom of Saudi Arabia, ⁴Department of Emergency Medicine, Yashoda Hospitals, Malakpet, Hyderabad, India

Abstract

Introduction: A medication incident is any avertable event that may lead or cause to improper medication use or patient harm while the medication is in the control of the health-care professional, consumer, or patient. Professional practice, procedure, drug products, and systems may be related to medicated incidents. **Objective:** The main purpose of this study is to investigate these incidents such as types of prescribing errors, evaluate the occurrence of drug-drug interactions, and assess the rationality of e-prescription orders of outpatient. **Materials and Methods:** A cross-sectional study conducted between September 2019 and December 2019, to report the causes, frequency, and types of errors associated with outpatient computer-generated prescriptions, and to develop a framework to categorize these errors to determine which strategies have immense potential for preventing them. Three hundred thirty-nine patient's prescriptions were included in the study over a period of 12 weeks and the data were collected from the outpatient pharmacy of different hospitals. **Results and Discussion:** It is observed that as an average, six drugs per prescription were prescribed. We observed 29 prescriptions are containing incomplete patient information that is 8.6% of prescriptions. We observed the majority of prescriptions were contain more than five drugs that are found in 159 prescriptions; around 47% of prescriptions are having more than five drugs. The current investigation focuses on the crucial character of the pharmacist in the prevention of medication errors or committed by physicians while ordering the e-prescriptions.

Key words: Drug-drug interactions, e-prescriptions, medication incidents, outpatient computerized prescribing systems

INTRODUCTION

A medication incident is any preventable affair that may lead or cause to irrelevant patient harm or medication use while the medication is in the control of the health-care professional, consumer, or patient. Medication incidents may be also linked to professional practice, systems, procedures, and drug products. As per National Coordinating Council for Medication Error Reporting and Prevention and Institute for Safe Medication Practices (ISMP) Canada, incidents involving prescription, product labeling, packaging, nomenclature, order communication, distribution, dispensing, compounding, dispensing, monitoring, administration, education, and its use.

Medication incidents can occur due to wrong routes or wrong doses of administration, drug mix-ups or interactions inducing harm, errors linked with drug labels or packaging, dispensing of medication to the wrong patient, or inadequate medication agreement.
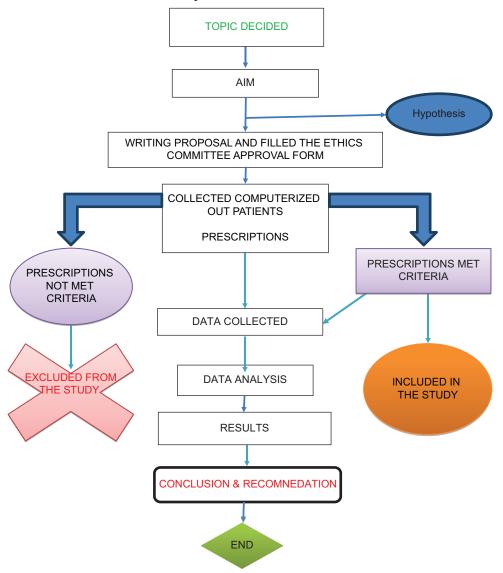
According to the American Geriatric Society, transitional care is defined as "a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of care within

Graphical Abstract

the same location."[1] Globally, for the patient's safety, the World Health Organization recognizes medication incidents at the transition of care to be a major concern.[2]

Medication errors and adverse drug events are common and often preventable in the ambulatory setting, and electronic prescribing (e-prescribing) has been highlighted by researchers, policymakers, and payers as an important strategy to prevent them. Moreover, there are many software systems can be used in electronic prescribing sittings, for example, Pharmaserve, PrimeRx, oracle, and human management systems.

Prescriptions resemble a double-edged blade the principal edge is that they are an imperative component in helping patients to defeat the impacts of their condition by maybe causing alleviation of the indications of their condition, while simultaneously attempting to change their sickness. The other edge to the blade is the potential damage brought

about by antagonistic occasions and prescription mistakes. No medication is totally protected, since any medication may cause adverse drug reactions (ADRs) in any event when utilized accurately. These ADRs are characterized as non-preventable errors which can and do happen during the medicine procedure.[3] The security of the patient is the obligation of a considerable number of individuals from a human services group, for instance – doctor, drug specialist, and medical caretakers. Regardless of their group and individual mastery and desires for quality, drug mistakes despite everything happen and here and there cause real human suffering.[4]

The probable errors have always existed from the period when drugs were first applied to treat patients. Due to very complex diseases and also more using a combination of medicines to alleviate such conditions, more people are suffering a lot.

The standard framework to classify prescription errors is explained in three areas such as prescribing, dispensing,

or administration. On the off chance that this framework is utilized, at that point, medicine blunders can happen in every one of the three phases of the drug use process by doctors, drug specialists, attendants, or patients where some type of destructive impact is delivered. It is guaranteed in several investigations that recommending mistakes comprise most of drug prescription errors which happen.[4,5]

When something goes wrong, medication incidents from community pharmacies can offer awareness into what happens on the receiving end of hospital discharge and the impact on patient safety. The aim of this study is to investigate these incidents to types of prescribing errors, evaluate the occurrence of drug-drug interactions (DDIs), and assess the rationality of e-prescription orders of outpatient clinics of tertiary care hospitals of Makkah Region Saudi Arabia.

MATERIALS AND METHODS

The present investigation was approved by Ibn Sina National College for Medical Sciences, Institutional Human Ethics Committee (Approval number H-13-14102019).

A cross-sectional study conducted between September 2019 and December 2019, to report the frequency, types, and causes of errors associated with outpatient computer-generated prescriptions and to develop a framework to classify these errors to determine which strategies have greatest potential for preventing them.

Sampling technique used is non-probability convenient and the sample size is 339 subjects. According to ISMP guidelines, the prescription and other data collected from the outpatient clinics were analyzed. Moreover, outcomes were the incidence of medication errors; defined as errors with potential for harm; and rate of prescribing errors by error type and by prescribing system. Based on the study's exclusion and inclusion criteria, the selection of prescriptions was used. The computerized discharge patient's prescriptions and outpatient prescription collected from tertiary care hospitals were included in this study and the inpatients' prescriptions and emergency patient's prescriptions were excluded from this study.

Data collection

Data were collected from each computerized prescription of outpatients and discharge patients. All information used was gathered using for this study; a well-designed patient data collection form was used to get all the information. All the information that was procured from the medical files of the patient includes Chief Complaints (primary diagnosis) and prescribed medications (physician orders).

Prescribing error detection

Prescribing error detection was done by a well-experienced pharmacist in prescribing errors. A list of up to 10 patients was elected during each observation for error reviewing using the chart review method at the pharmacy where medications were dispensed. The physician orders were assessed and the benchmark for recognition of medication flaws in this investigation was similar to that used.[6]

Resources utilized for the detection of prescribing error were as

- Medscape Drug Interaction Checker software (Version 4.4)
- Lexicomp Clinical Drug Information software
- Medscape database
- Average number of drugs per prescription: Average, calculated by dividing the total number of different drug products prescribed by the number of encounters surveyed. It is not relevant whether the patient actually received the drugs
- Percentage of drugs prescribed by generic name: Percentage, calculated by dividing the number of drugs prescribed by generic name by the total number of drugs prescribed, multiplied by 100.

Furthermore, prescriptions in the clinics analyzed to determine the most frequently prescribed drugs and parameters. All the statistical calculations were performed using Microsoft excel.

RESULTS AND DISCUSSION

It is observed that as an average, six drugs per prescription were prescribed. We observed 29 prescriptions were incomplete patient information, which is 8.6% of prescriptions [Figure 1].

Figure 1 shows that the patient demographical information was found; the 310 prescriptions had full information and only 29 prescriptions had missing information.
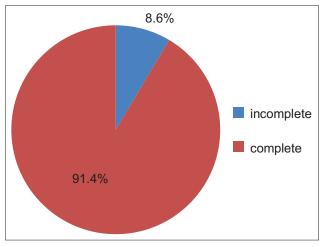

Figure 1: Patient demographic information in prescription

Figure 2 described the number of prescriptions department-wise distribution. The majority of the prescriptions were found from the pediatric department that is 114.

Figure 3 shows that the majority of the prescriptions contain more than five drugs that were 159 and only 27 prescriptions had only one drug.

Figure 4 shows that the 20 prescriptions contain brand name and 319 prescriptions contain only generic names.

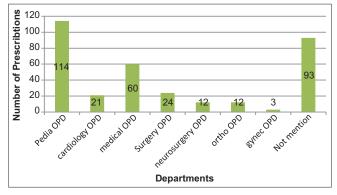Figure 5 shows 23 prescriptions found the wrong dose or not mentioned the dose and alarming for improvement.
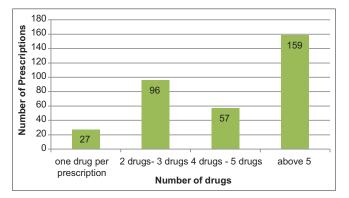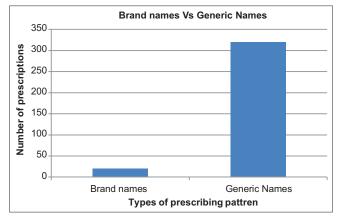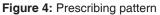
Figure 6 shows that six prescriptions were found the wrong duration and in eight prescriptions were found the duration of the drug treatment not mentioned.

Figure 7 shows the number of different prescription errors. It was find that 23 prescriptions found dosing errors and some of this prescription not mentioned the dose.

Figure 8 describes the DDIs found in different prescriptions. The 52 interactions were found were minor interactions, 15 interactions were moderate type, and three interactions were a serious type.

The total number of 339 prescriptions was collected from the outpatient hospital pharmacies. Among these, 119 prescriptions were belongs to male patients and 220 prescriptions were female patients.

A total number of 1209 drugs were prescribed for these patients as on average of around six drugs per prescription. In this study, we observed that there are 39 prescriptions were not the complete patient that is around 8.6% of prescriptions.

In our study, the patient demographic information was found; the 310 prescriptions had full information and only 29 prescriptions had missing information, as shown in Figure 1.
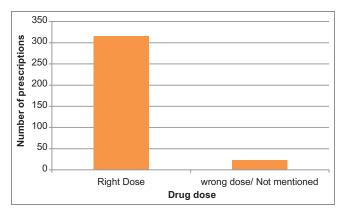

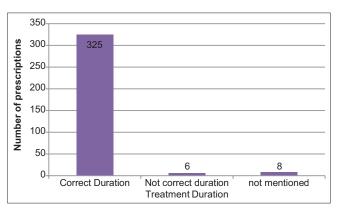
Figure 2: Patient distributions by department wise

Figure 3: Number of drugs prescribed per prescription

Figure 4: Prescribing pattern

Figure 5: Drug doses in prescriptions
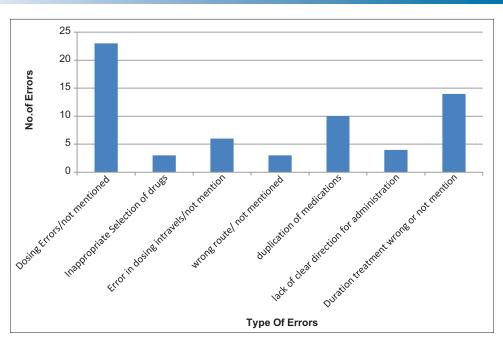

Figure 6: Treatment duration
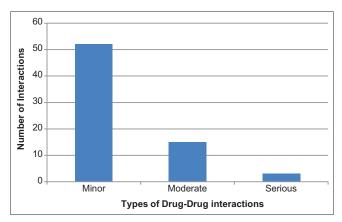
Figure 7: Types of prescribing errors

Figure 8: Drug-drug interactions

The maximum numbers of pediatric prescriptions are collected and 93 number of prescriptions not having the department name [Figure 2]. We observed that the majority of prescriptions were containing more than five drugs that are found in 159 prescriptions [Figure 3] around 47% of prescriptions are having more than five drugs. Only 20 (i.e., 6%) prescriptions having brand names, but more number of prescriptions were written a generic name of drugs [Figure 4] that are 94% of prescriptions are prescribed generic names. All the prescriptions were computerized. Figure 5 illustrates, 23 prescriptions found the wrong dose or not mentioned the dose and alarming for improvement. About 7% of prescriptions were found without dose and dosage error [Figure 6]. In 4%, prescriptions were not mentioned duration/wrong duration of treatment. In our study, we found the majority of prescribing errors are not written the dose/dose error (6.8%), lack of direction (1%), and also lack of duration of treatment (4%) [Figure 7].

DDIs were analyzed by using a Medscape drug interaction checker. Among 339 prescriptions, 52 prescriptions are find

with minor DDIs (15%), 15 prescriptions were identified with moderate interactions (4.5%), and three prescriptions were observed with serious DDIs (≅1%) [Figure 8].

Around the world, medication errors are a vital common complication in all health-care systems. This complication may lead, increased health costs, patient injury, and liability pleas. All health care professionals have a responsibility in eliminating risk factors, ensuring patient safety, and implementing strategies to prevent the occurrence of medication errors.[7,8]

Inappropriate selection of medicines is one of the most common prescribing errors. According to standard text and reference books, we differentiated between appropriate and inappropriate medicines. Based on that, we found that antibacterial was the most common inappropriately prescribed drug group. That may increase the chance of antibacterial resistance and also the cost of the treatment. Our study showed that the most common medication adverse events were inaccurate doses followed by the inaccurate dosing interval.

The risk of DDI was significant due to multiple drug therapy along with comorbidities in patients more than 40 years of age. Similar observations have been reported.[9-11] However, their potential to cause serious DDI has been neglected by prescribers. This calls for educating prescribers regarding DDI and undertaking prescription audits on a regular basis. Our study had few limitations such as we could not assess the actual impact of DDIs and while assessing the rationality and DDIs, the clinicians' viewpoint was not taken into account, which could have been different than ours.

The total numbers of medication errors were 63 that are 18.6% of prescriptions in some other studies shows 8.86%

and the total numbers of interactions were 70 that are 20.6%.

Pharmacists were utmost likely to interfere to avoid these flaws, as more investigations have also observed, and this aspect and the related works of clinical pharmacists.[12-16] Most of the medication flaws (11%–89%) were prevented only by pharmacists' interventions.[17-21] The present investigation features the substantial role of the pharmacist in the interception of medication flaws or committed by health practitioners while writing e-prescriptions.

There are several computerized prescribing errors that were conducted in Saudi Arabia which were found as a wrong drug prescribed (12.29%), wrong patient (2.05%), wrong quantity (2.73%), incorrect dose (24.39%), monitoring error (5.17%), wrong dosage form (5.56%), wrong strength (8.98%), and wrong duration (9.46%), which are high as compared to our findings.[18,22-24]

LIMITATIONS

The limitation of this study is the limited number of e-prescriptions from the discharge or outpatients. Despite this limitation, the present investigation has recorded relevant findings with regard to the pharmacovigilance of e-prescription medication errors and has known varieties of prescribing errors and recommends improving correcting, reporting, and decreasing the medication incidents, which are its strengths. For medication incidences, so many inventive approaches have been recommended and in the discussion part, this study has highlighted them.

Moreover, we faced some obstacles during the study, for instance: The short time period of the study and getting approval accessing patient records from the hospitals. In addition, these obstacles limit our capacity to perform a better research technique.

CONCLUSION

This random sample, detailed study, gives prime pharmacovigilance perceptions into e-prescribing medication incidence and the study shows the occurrence of medication incidence at the medication use cycle. Probably providing the drug formulary in the hospital may help the prescribers as a quick reference for drug dosage could help to reduce prescribing errors. In addition, drug use policy should be implemented and maintained to reduce the inappropriate use of drugs.

Future plans are to continue the complete medication error include dispensing and administration errors, along with invite representatives from each ward unit to all weekly METs meetings to increase awareness of medication errors

and solutions. METs will continue to utilize information collected from these reports to improve the rationality of treatment.

A medication incidence is an unintended affair that did not cause any damage to the patient. Anyhow, e-prescribing systems connected to the MEDI system required to be enhanced for apprehending and rectifying them to avoid the recurrence of authentic medication flaws correlated with compromised patient safety, elevated economic cost, morbidity, and mortality rate.

CONFLICTS OF INTEREST

No conflicts of interest. All authors have made a substantial contribution to the work and approved it for publication.

REFERENCES

1. Coleman EA, Boult C. Improving the quality of transitional care for persons with complex care needs. J Am Geriatr Soc 2003;51:556-7.
2. World Health Organization. Action on Patient Safety-High 5S. Geneva, Switzerland: World Health Organization; 2015.
3. Naylor R. Medication Errors: Lessons for Education and Healthcare. Ch. 7, 9, 281. England: Radcliffe Medical Press Ltd.; 2002. p. 81-91.
4. Cohen MR. Medication errors. Am J Pharm Educ 2007;71:59.
5. NCCMERP. The National Coordinating Council for Medication Error Reporting and Prevention, About Medication Errors: What is Medication Error; 2008. Available from: http://www.nccmerp.org/aboutmederrors.html. [Last accessed on 2008 Jun 19].
6. Dean BS, Barber ND, Schachter M. What is prescribing error? Qual Health Care 2000;9:232-7.
7. Lustig A. Medication error prevention by pharmacists-an Israeli solution. Pharm World Sci 2000;22:21-5.
8. Jennane N, Madani N, Oulderrkhis R, Abidi K, Khoudri I, Belayachi J, *et al*. Incidence of medication errors in a Moroccan medical intensive care unit. Int Arch Med 2011;4:32.

9. Patel PS, Rana DA, Suthar JV, Malhotra SD, Patel VJ. A study of potential adverse drug-drug interactions among prescribed drugs in medicine outpatient department of a tertiary care teaching hospital. J Basic Clin Pharm 2014;5:44-8.

10. Sepehri G, Khazaelli P, Dahooie FA, Sepehri E, Dehghani MR. Prevalence of potential drug interactions in an Iranian general hospital. Indian J Pharm Sci 2012;74:75-9.

11. Muñoz AB, Miguez AM, Pérez MP, Garcia ME, Saez M. Comparison of medication error rates and clinical effects in three medication prescription-dispensation systems. Int J Health Care Qual Assur 2011;24:238-48.

12. Fertleman M, Barnette N, Patel T. Improving medication management for patients: The effect of a pharmacist on post-admission ward rounds. Qual Saf Health Care 2005;14:207-11.

13. Buurma H, De Smet PA, Leufkens HG, Egberts AC. Evaluation of the clinical value of pharmacists' modifications of prescription errors. Br J Clin Pharmacol 2004;58:503-11.

14. Qureshi NA, Al-Habeeb TA, Al-Ghamdy YS, Magzoub MM, Schmidt H. Medication errors in primary care in Riyadh city, Saudi Arabia. East Mediterr Health J 2011;17:156-9.

15. Schmidt HG. Psychotropic drug prescriptions in primary care and general hospitals, in Saudi Arabia. Saudi Pharm J 2001;9:193-200.

16. Barach P, Small SD. Reporting and preventing medical mishaps: Lessons from non-medical near-miss reporting system. BMJ 2000;320:759-63.

17. Nanji KC, Rothschild JM, Salzberg C, Keohane CA, Zigmont K, Devita J, *et al*. Errors associated with outpatient computerized prescribing systems. J Am Med Inform Assoc 2011;18:767-73.

18. Al-Zaagi IA, Aldhwaihi KA, Al-Dossari D, Salem SO, Qureshi NA. Analysis of reported e-prescribing near misses in King Saud medical city, Riyadh. Integr Pharm Res Pract 2013;2:17-21.

19. Gildon BL, Condren M, Hughes CC. Impact of electronic health record systems on prescribing errors in pediatric clinics. Healthcare (Basel) 2019;7:57.

20. Yang J, Liao Y, Lin W, Wu W. Prescribing errors in electronic prescriptions for outpatients intercepted by pharmacists and the impact of prescribing workload on error rate in a Chinese tertiary-care women and children's hospital. BMC Health Serv Res 2019;19:1013.

21. Khan KA, ALkatsha AM, Sarhan MA, Abuhamar FM, Abdulrzaq R, Khan AA, *et al*. Evaluation of drug interactions with medications prescribed to ambulatory patients with metabolic syndrome in urban area. Adv Mater Lett 2020;11:20031487.

22. Khan KA, Al-Ghamdi SM, Al-Ghamdi NM, Al-Saqqa AR, *et al*. Evaluation of drug-utilization patterns based on World Health Organization drug use indicators at outpatients clinics. Adv Mater Lett 2020;11:20031489.

23. Khan KA. Drug utilization study in pediatric outpatients at OPD clinics in South Indian Metropolitan city. Indo Am J Pharm Res 2016;6:5196-201.

24. Khan KA. Drug utilization study of antihyperglycemic agents in outpatients at OPD clinics in South Indian metropolitan city. Int J Pharm Pharm Sci 2016;8:58-61.