Original Article

Reducing Missed Medication Doses in Intensive Care Units: A Pharmacist-Led Intervention

Mukhtar Jawad Alomar[1], Sohail Ahmad[2], Yahya Moustafa[1], Lafi Salim Alharbi[1]

[1]Department of Pharmacy Administration, King Fahad Medical City, Riyadh, Kingdom of Saudi Arabia

[2]Department of Clinical Pharmacy, MAHSA University, Kuala Langat, Selangor, Malaysia

ABSTRACT

Objective: The objectives of this study were to investigate the frequency and reasons for missing doses and impact of a pharmacist-led intervention to reduce the missed doses in intensive care units. **Methods:** This study was completed in two phases. In the first phase, a retrospective quality assurance audit was conducted to quantify the problem of missed doses from the pharmacist/nurse communication slip record. The frequency and potential reasons for missing dose occurrences were identified and listed, and respective solutions were finalized by a joint health-care team. In the second phase of the study, post-intervention analysis was done for a period of 1 month to check the impact of intervention. The data were recorded from pharmacy/nursing communication forms for medication, dosage form, route of administration (ROA), frequency of missed doses, and underlying reasons for missing doses. **Findings:** There was a substantial reduction in the number of incidences of missed doses in post-intervention phase. The number of events decreased from 190 (pre-intervention; 2 months) to 11 (post-intervention; 1 month), 389 to 87, and 133 to 12 for automatic stop order, unknown reason, and late mix medication, respectively. No missed dose event was recorded secondary to order overseen and inactive patient status in post-intervention phase. Moreover, identified reasons, ROA, frequency, and the system status were the significant predictors of missing doses. **Conclusion:** The findings of this study emphasized the need to introduce better documentation procedures and continuous surveillance system to decrease the number of missing doses and further improve already established drug distribution service.

KEYWORDS: *Clinical, intensive care unit, intervention, medication error, missed doses, pharmacists*

INTRODUCTION

The incidences of medication errors are frequent and often more serious in intensive care units (ICUs).[1,2] The missed doses of medicines in hospitalized patients have the potential to delay the recovery from disease, increase the length of hospital stay, and cause significant patient harm.[3] Medications that are prescribed but not administered are one form of medication error, known as overdue doses leading to missed doses.[4] A rapid response alert by the UK National Patient Safety Agency had raised the issue of overdue doses and subsequent adverse consequences.[5] Missed and delayed medicines were the second largest cause of medication error incidents, as reported in the year 2007 by the UK National Reporting and Learning System.[6] Moreover, in another review, 15.6% of all (n = 5437999) medication incidents reported from 2005 to 2010 across the National Health Service (NHS) were due to missed or delayed medication.[7] For many decades, missed doses among hospitalized patients have been associated with various adverse events.[8]

A variety of reasons are associated with overdue and missed dose administrations,[9] but clinically

Address for correspondence:
Dr. Mukhtar Jawad Alomar, E-mail: mjalomar@kfmc.med.sa

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inappropriate omissions are a vital concern. Ridge *et al.* conducted a study in six wards in an NHS hospital to examine the nature and rate of drug administration errors.[10] The average rate of drug administration errors across six wards was 3.5% among 3312 drug administrations observed, of which 68% were categorized as overdue dose errors. In another study conducted by Rodriguez-Gonzalez *et al.*, a record of total 2314 medication administrations were observed and 509 (22.0%) incidences of medication errors were recorded. Majority of the errors (*n*=441, 86.6%) occurred at administration phase followed by in preparation phase (*n*=68, 13.4%). The most frequently cited errors were use of wrong administration techniques (13.9%), wrong reconstitution/dilution (1.7%), omission (1.4%), and wrong infusion speed (1.2%).[11] Moreover, other studies have reported the missed dose rates between the two extremes of aforementioned published studies[12-14] and have examined overdue doses in specific drug classes or in particular circumstances, with differing rates of dose omission at the administration stage.[15,16] Some other reasons have also been identified that may lead to missing doses.[17] For instance, physician had intention to prescribe but medicine was not prescribed, new medication or doses for a set course of medication, drug not available either during normal working hours or out of hours, medicine was not administered by the nurse, patient was not on ward, unfamiliar preparation, administration, method, or device, route of administration (ROA) not available, medicine administered to wrong patient, and discharge medicine not supplied.[18] Missed doses of medicines, especially critical medicines, may cause harm or have the potential to cause harm to hospitalized patients. Therefore, the incidences of missed doses of medicines should be avoided wherever possible.[5]

The clinical pharmacists' role in improving the care of hospitalized patients has evolved over time. These imperative roles proved helpful in reducing medication errors, rationalizing the therapy, reducing the cost of treatment, and collaborating effectively with other health-care team members. Hence, these outcomes guarantee the utmost possible quality of patient care.

Moreover, the pharmacist led interventions can be helpful to identify and recover the medication errors. Such interventions ensure the patient safety in all hospital settings, especially in ICUs. The studies have found the effectiveness of pharmacist-led interventions in hospital settings by ensuring patient safety and decreasing the incidents of adverse drug events.[19] Similarly, the active participation of a clinical pharmacist in introducing and implementing interventions in

ICUs effectively and efficiently reduced the number of medication errors and related patient harm.[20] The reported reduction in medication errors in ICUs found to be threefold to fivefold consider the clinical pharmacist as an essential member of ICU health-care team,[21,22] In another study, Sanghera *et al.* had found that majority of the medication errors were identified and rectified by the pharmacists (10 of 13 errors), whereas nurses recovered the remaining three errors.[23] Therefore, a clinically trained pharmacist in the ICU allows for multiple layers of patients' protection, reducing the potential for errors to occur or to reach the patient.[24]

Despite the evident fact that 50% of medical incidents are made during the medication administration stage, the failure to physically administer the drugs when scheduled for patients has received less attention previously.[7] Therefore, this study was conducted to investigate the frequency and reasons of missing doses and impact of a pharmacist-led intervention to reduce the missed doses in ICUs of King Fahad Medical City (KFMC), Saudi Arabia.

METHODS

The study protocol was approved by the Institutional Review Board (IRB Log Number: 15-222), KFMC, Saudi Arabia.

This study work was carried out in two stages. The first stage of the study was a retrospective audit of patients' records for a period of 2-month duration (5 days/week), whereas in the thin second stage, a pharmacist-led intervention was implemented for a 1-month period and the impact of intervention was reported.

In Saudi Arabian health-care system, hospitals can be classified as either governmental or private. The governmental hospitals can further be classified as either the Ministry of Health or non-Ministry of Health hospitals. In rural areas of Saudi Arabia, health-care services are provided mainly by the Ministry of Health which runs more than a total of 220 hospitals in all regions. Moreover, the National Guard Hospitals, Security Forces Hospitals, Armed Forces Hospitals, and specialized hospitals are also categorized as governmental hospitals. Over the past few years, private sector hospitals have increased in number and size, particularly in the major cities of Saudi Arabia.

The present study was conducted in a tertiary care hospital: KFMC. KFMC has an electronic prescribing and administration system, which was used throughout this study. The patients' records of (~1400) medications were used by patients in the emergency department. In KFMC, a clinical information system is used for

the purpose of prescribing. The prescribers entered all drugs to the system that can be accessed in the form of electronic patient records for nurses to administer the prescribed medications.

In present study settings, the critical feature of the electronic system was the provision of all relevant information about prescriptions as well as the dose administrations was exported for a comprehensive audit database for subsequent investigation and analyses. In particular, the informatics department was able to generate regular, as well as *ad hoc*, reports to provide information on specific issues for managers and clinical staff within the KFMC.

Using an audit sheet, which was blinded to the identification of the patients, the demographics details along with the number of missed medications on the charts and the reasons given for their omissions were identified and recorded. The data were then analyzed, quantified, and classified according to the types of medication, as determined according to the British National Formulary (BNF). The clinical relevance of the implicated drugs was decided by the lead author, who looked for omissions of medications.

Before this project, in the regular practice, the nurse used to bring the physician order in the pharmacy in order to get the medication. Mostly, the order was valid for 7 days unless specified by the physician. The current study setting is a tertiary hospital with a total ICU capacity of 30 beds. Because of daily discharge and new admission of the patients, the physicians usually forget to reorder the medications. This malpractice resulted in delayed medication delivery to the patients and increased load to the pharmacy. In regular practice, the medicines are delivered to the unit on a daily basis, but if there is no re-order, the system automatically will discontinue the medications after 7 days known as the automatic stop order (ASO). In this case, a nurse will need to fill a form as the drug is missed. This lengthy process leads to delay the delivery of the medicines in ICUs because of the inconsistency of the re-order time. To solve this issue, it was suggested to unify the reorder date that can help to reduce ASO.

The second identified problem was a lack of double-checking. Previously, the nurse used to collect the medications from the pharmacy without double-checking. Hence, the nurse could only discover the missing dose event at the time of administering. As a result, to get the medication again, she needed to fill the form to the pharmacy one more time to prepare the remedy. At this moment, it was not clear whether the dose was really missed from the pharmacy or the

drug was administered to the patient, not documented by the nurse, or the medicines were mixed with another patient's prescription. Hence, to prevent such incidents, the nurse was asked to double-check the drug in the pharmacy and sign on a form. This intervention reduced the missing order and emphasized on the double-checking. Another reason for missed doses, especially the intravenous medications, was late mix medications. To solve this issue, a nurse working in the ICU agreed to inform satellite pharmacy just half-hour before the administration of medicines so that late mix medication could be prepared before the time of administration. There was no documentation involved for this process as it was a mere collaboration between the pharmacy and the nurse without official latter like other interventions.

In the pre-intervention phase, the data were collected to identify the missing doses from the pharmacist/nurse communication slip record. For missed doses, the data were entered in the Excel sheet and SPSS for the variables of medical record number, date, medication name, dosage, frequency, status in the hospital system, and underlying reason of missing. All potential reasons for missing dose occurrences were identified and listed by a team of pharmacists. The pre-intervention phase was carried out for a period of 2 months.

In the pre-intervention phase, the respective aforementioned solutions were addressed by a joint team of senior pharmacists and nurses. The main identified reasons for missing doses included the ASO: automatic stop order, order overseen: the medicine was ordered but not processed by the pharmacist, and late mix medication (LM): the medications that have short stability. For some missing doses, error could not be traced; all such errors were categorized as an unknown reason for missing.

After analyzing the reasons for missing the first phase, we start to suggest a recommendation to solve the missing order. For ASO, the panel recommended unifying the reorder day. For medicines that were active in the system and the nurses were still sending a missing form for unknown reasons. The panel suggested to take signature by the nurse on the list of the items to make sure the nurse double-check the medications at the time of receiving.

After applying the intervention, similar to Phase 1, data were collected and entered in the same Excel sheet to compare the number of missing doses.

The identified medicines from the list of missed doses were classified based on the BNF classification system. In addition, some drugs that cannot be directly categorized

using the BNF classification system were grouped into a new category of miscellaneous medications. The extracted data were analyzed descriptively using number and percentage (*n*, %), where appropriate. Moreover, the comparisons were made between pre- and post-intervention phases using the bar chart. In inferential statistical analyses, multinomial logistic regression analysis was carried out.

RESULTS

Table 1 shows the complete list of medicines identified as missed doses in the pre-intervention phase. Majority of the missed medicines belonged to gastrointestinal system (*n* = 186, 25.3%) and cardiovascular system (*n* = 175, 23.8%). Moreover, a total of 140 (19%)

incidences of missed doses of antibacterials were recorded. Similarly, Table 2 shows the post-intervention missed doses. Figure 1 depicts a comparison of total number of missed doses in each group of drugs during pre- and post-intervention phases. After identifying the reasons of missed medication doses and implementing the intervention, the incidences of missed doses were reduced across all categories of drugs, as shown in Table 2.

The number of incidences of missed doses was decreased from 190 (pre-intervention; 2 months) to 11 (post-intervention; 1 month), 389 to 87; and 133 to 12 for ASO, unknown reason, and late mix medication, respectively. No missed dose event was recorded secondary to order overseen and inactive patient status

Table 1: List of missed doses during the pre-intervention study (2 months)

Number	Name of drug	*n* (%)	Number	Name of drug	*n* (%)	Number	Name of drug	*n* (%)
1	Gastrointestinal system	186 (25.3)	3.7	Valproic acid	2 (0.3)	7.3	Hydrocortisone	9 (1.2)
1.1	Omeprazole	130 (17.7)	3.8	Levetiracetam	7 (1)	7.4	Prednisolone	5 (0.7)
1.2	Ranitidine	34 (4.6)	3.9	Lamotrigine	15 (2)	7.5	Dexamethasone	2 (0.3)
1.3	Magnesium oxide	16 (2.2)	3.10	Pregabalin	1 (0.1)	7.6	Fludrocortisone	4 (0.5)
1.4	Docusate	2 (0.3)	4	Antibacterial drugs	140 (19)	7.7	Octreotide	10 (1.4)
1.5	Simethicone	3 (0.4)	4.1	Amoxicillin/clavulanic acid	23 (3.1)	8	Nutrition and blood	90 (12.2)
1.6	Bisacodyl	1 (0.1)	4.2	Tazocin	36 (4.9)	8.1	Albumin	8 (1.1)
2	Cardiovascular system	175 (23.8)	4.3	Meropenem	26 (3.5)	8.2	Sodium bicarbonate	2 (0.3)
2.1	Digoxin	3 (0.4)	4.4	Imipenem	6 (0.8)	8.3	Phosphate Sandoz	8 (1.1)
2.2	Dopamine	4 (0.5)	4.5	Cephalexin	1 (0.1)	8.4	Sevelamer	1 (0.1)
2.3	Furosemide	2 (0.3)	4.6	Ceftazidime	1 (0.1)	8.5	Calcium carbonate	11 (1.5)
2.4	Spironolactone	2 (0.3)	4.7	Azithromycin	6 (0.8)	8.6	Vitamin B complex	34 (4.6)
2.5	Bisoprolol	23 (3.1)	4.8	Clindamycin	1 (0.1)	8.7	Vitamin D	9 (1.2)
2.6	Atenolol	1 (0.1)	4.9	Vancomycin	11 (1.5)	8.8	Vitamin K	12 (1.6)
2.7	Metoprolol	2 (0.3)	4.10	Linezolid	2 (0.3)	8.9	Multivitamin	5 (0.7)
2.8	Perindopril	3 (0.4)	4.11	Cotrimoxazole	13 (1.8)	9	Musculoskeletal and joint diseases	21 (2.9%)
2.9	Lisinopril	7 (1)	4.12	Metronidazole	4 (0.5)	9.1	Allopurinol	1 (0.1)
2.10	Amlodipine	9 (1.2)	4.13	Ciprofloxacin	5 (0.7)	9.2	Baclofen	14 (1.9)
2.11	Nimodipine	4 (0.5)	4.14	Moxifloxacin	4 (0.5)	9.3	Hydroxychloroquine	2 (0.3)
2.12	Lercanidipine	1 (0.1)	4.15	Silver sulfadiazine	1 (0.1)	9.4	Zinc oxide cream	2 (0.3)
2.13	Norepinephrine	1 (0.1)	5	Antifungal drugs	10 (1.4)	9.5	Moisturizing cream	2 (0.3)
2.14	Midodrine	3 (0.4)	5.1	Fluconazole	4 (0.5)	10	Miscellaneous drugs	22 (3)
2.15	Enoxaparin	43 (5.9)	5.2	Miconazole	1 (0.1)	10.1	Eltrombopag	4 (0.5)
2.16	Heparin	49 (6.7)	5.3	Caspofungin	5 (0.7)	10.2	Darbepoetin	2 (0.3)
2.17	Aspirin	14 (1.9)	6	Antiviral drugs	16 (2.2)	10.3	Acetylcysteine	2 (0.3)
2.18	Atorvastatin	4 (0.5)	6.1	Tenofovir	2 (0.3)	10.4	Refresh eye drops	3 (0.4)
3	Central nervous system	39 (5.3)	6.2	Oseltamivir	10 (1.4)	10.5	Solifenacin	2 (0.3)
3.1	Risperidone	3 (0.4)	6.3	Truvada	2 (0.3)	10.6	Natural tears	1 (0.1)
3.2	Mirtazapine	1 (0.1)	6.4	Efavirenz	1 (0.1)	10.7	Diphenhydramine	3 (0.4)
3.3	Escitalopram	4 (0.5)	6.5	Interferon-alpha	1 (0.1)	10.8	GCSF	3 (0.4)
3.4	Metoclopramide	1 (0.1)	7	Endocrine system	36 (4.9)	10.9	Hydroxychloroquine	1 (0.1)
3.5	Granisetron	2 (0.3)	7.1	Insulin	1 (0.1)	10.10	Propylthiouracil	1 (0.1)
3.6	Phenytoin	3 (0.4)	7.2	Thyroxine	5 (0.7)			

GCSF=Granulocyte colony stimulating factor

Table 2: List of missed doses during the post-intervention study (1 month)

Number	Name of drug	n (%)
1	Gastrointestinal system	4 (5.6)
1.1	Omeprazole	4 (5.6)
2	Cardiovascular system	25 (32.5)
2.1	Digoxin	2 (2.8)
2.2	Furosemide	3 (4.2)
2.3	Bisoprolol	1 (1.4)
2.4	Metoprolol	2 (2.8)
2.5	Lisinopril	1 (1.4)
2.6	Midodrine	5 (7)
2.7	Enoxaparin	3 (4.2)
2.8	Heparin	4 (5.6)
2.9	Aspirin	2 (2.8)
2.10	Clopidogrel	1 (1.4)
2.11	Levetiracetam	1 (1.4)
3	Antibacterial drugs	30 (42.3)
3.1	Amoxicillin/clavulanic acid	6 (8.5)
3.2	Tazocin	6 (8.5)
3.3	Meropenem	2 (2.8)
3.4	Imipenem	1 (1.4)
3.5	Cephalexin	1 (1.4)
3.6	Vancomycin	2 (2.8)
3.7	Cotrimoxazole	3 (4.2)
3.8	Caspofungin	5 (7.0)
3.9	Amphotericin B	1 (1.4)
3.10	Voriconazole	1 (1.4)
3.11	Dexamethasone	2 (2.8)
4	Nutrition and blood	6 (8.5)
4.1	Albumin	1 (1.4)
4.2	Sodium bicarbonate	1 (1.4)
4.3	Phosphate Sandoz	1 (1.4)
4.4	Vitamin B complex	1 (1.4)
4.5	Vitamin D	1 (1.4)
4.6	Vitamin K	1 (1.4)
5	Miscellaneous drugs	6 (8.5)
5.1	GCSF	5 (7)
5.2	Paracetamol	1 (1.4)

GCSF=Granulocyte colony stimulating factor

Figure 1: The comparison of incidences of missed doses during pre-intervention (2 months) and post-intervention (1 month)

Figure 2: The comparison of underlying reasons for missed doses during pre-intervention (2 months) and post-intervention (1 month)

Figure 3: The impact of the intervention in reducing the incidences of missed doses during pre-intervention (week 1–8) and post-intervention (week 9–12)

in the post-intervention phase, as shown in Figure 2. Moreover, the impact of intervention in reducing the incidences of missed doses during pre-intervention (week 1–8) and post-intervention (week 9–12) in time series is shown in Figure 3.

Moreover, a multinomial regression model was developed to assess the predictors of missing doses from the extracted data for pre- and post-intervention phase. In pre-intervention data, from the selected study variables, the overall model was significant [Table 3] and identified reason for missing doses, ROA, frequency of administration, and the system status all showed a significant predicting power, as shown in Table 4. Similarly, using the same study variables, the
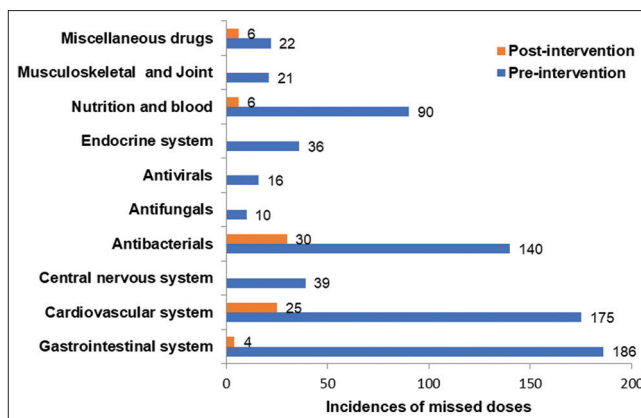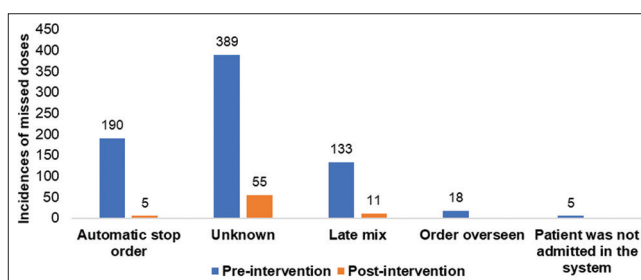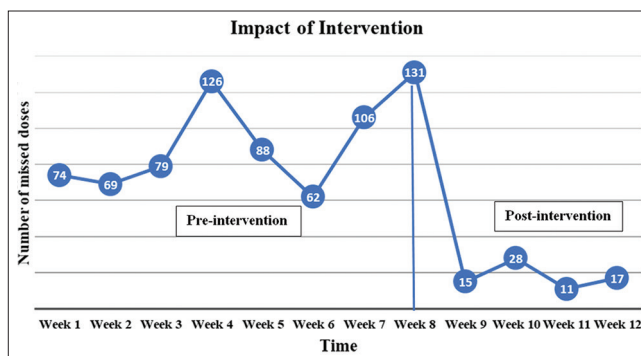
multinomial regression model was built using data extracted during post-intervention phase. The overall model was significant, as shown in Table 5, and all variables retained their significance predicting power except the ROA [Table 6].

DISCUSSION

In the present study, the significant reduction in the incidences of missed medication doses proved the effectiveness of intervention led by the clinical pharmacist in the ICU of KFMC. Similar to the findings of the present study, previous studies have shown the

Table 3: The model fitting information for multinomial regression analysis (pre-intervention)

Model	Model fitting criteria−2 log likelihood	Likelihood ratio tests		
		χ^2	df	P
Intercept only	433.580	96.097	24	0.000*
Final	337.482			

*P<0.05

Table 4: The likelihood ratio test for multinomial regression analysis (pre-intervention)

Effect	Model fitting criteria−2 log likelihood of reduced model	Likelihood ratio tests		
		χ^2	df	P
Reason	359.086	21.603	6	0.001*
ROA	356.938	19.456	6	0.003*
Frequency	388.374	50.891	6	0.000*
System status	355.839	18.357	6	0.005*

*P<0.05. ROA=Route of administration

Table 5: The model fitting information for multinomial regression analysis (post-intervention)

Model	Model fitting criteria−2 log likelihood	Likelihood ratio tests		
		χ^2	df	P
Intercept only	129.418	38.044	15	0.001*
Final	91.374			

*P<0.05

Table 6: The likelihood ratio test for multinomial regression analysis (post-intervention)

Effect	Model fitting criteria−2 log likelihood of reduced model	Likelihood ratio tests		
		χ^2	df	P
Intercept	100.129	8.755	3	0.033*
Reason	98.974	7.599	3	0.055
ROA	97.034	5.659	3	0.129
Frequency	109.219	17.845	3	0.000*
System status	92.014	0.639	3	0.887

*P<0.05. ROA=Route of administration

effectiveness of clinical pharmacists in health-care settings in improving patient safety. Various studies have been conducted to determine the frequency of different types of medication errors,[25-28] causes and outcomes of medication errors,[29] and willingness to report the medication errors.[30] Limited studies were conducted that identified the missed doses.[31] A study conducted in Iran reviewed a total of 287 charts with 558 opportunities for error. Of those opportunities for error, 167 (29.9%) resulted in an error. Missed doses were the highest (52%) transcription error type reported.[32] Moreover, in another study, pharmacist-led interventions proved effective in minimizing the prescription errors in ICUs in Dutch hospitals where the incidences were reduced from 190.5 to 62.5 in 1000 monitored days. The findings of their study emphasized the need for proactive role of hospital pharmacists in the development and implementation of intervention programs onward where patient care is very complex, and medication use is error-prone.[20] Another study, conducted in Ethiopia, cited wrong timing 200 (30.3%), omission due to unavailability 192 (29.0%) and missed doses 121 (18.3%) as main reasons of medication errors.[33]

As it was the first study to the best of our knowledge that had identified the reasons for missing doses and assessed the impact of pharmacist-led intervention in Saudi Arabia. Therefore, the direct comparison of present study could not be drawn with other studies. For instance, in a study conducted in general pediatric ward and pediatric ICU (PICU) at King Abdulaziz Medical City, Saudi Arabia, the incidence of medication errors in PICU was 33.9%. In this study, majority of the medication errors were observed from prescribing electrolytes (17.2%), antibiotics (13.7%), bronchodilators (12.9%), narcotic analgesics (11.6%), and gastrointestinal medications (6.9%).[25] In this study, all types of medication errors were grouped together; hence, the comparison of relevant prevalence across different drug categories cannot be made. Another KSA-based study aimed to detect the incidence of prescribing errors for admitted patients, classify, and evaluate the clinical significance of such errors. Furthermore, the impact of inpatient practicing pharmacist intervention was measured, and a well designed program was introduced to minimize such errors in a 1200 bed tertiary university teaching hospital, King Khalid University Hospital at King Saud University, Riyadh, KSA.[34]

To the best of our knowledge, this is the first study that has focused on the impact of clinical pharmacist-led intervention in reducing the missing doses in KSA. This study was a part of the initiative to improve the overall performance and care while optimizing a safer and more productive environment for all patients and members of the health-care team in KFMC. Such initiative accompanying dedicated and persistent follow-up is the essence of professional teamwork and fosters the collaboration of clinical pharmacists with other health-care staff working in ICUs. In the future, researchers should focus on the development and subsequent assessment of economic benefits as a result of such interventions provided by pharmacists in emergency care. Notwithstanding the above strengths, the present study also has some limitations. For instance, the time of post-intervention phase (1 month) was less than that during the pre-intervention phase (2 months). No economic benefits of interventions were recorded. In the future, such periodic audits while ensuring the

improved practices may help to maintain the balance between the quality of services and continuous improvements in the existing system.

Before the interventions, the omission of prescribed medications remains a problem throughout the ICU stay of the patients in KFMC. The findings of this study emphasized the need to introduce better documentation procedures and continuous surveillance systems to decrease the number of missing doses and further improve already established drug distribution services. The effective and frequent communication among the health-care team members with a view of reducing medication omission will go a long way in order to entirely avoid this problem. Being the preliminary study in the KFMC setting, this study suggests conducting more research-based projects to bring awareness among health-care professionals regarding medication errors, including the missing doses and devising effective strategies to avoid such problems in the future. The improved documentation system and effective collaboration of pharmacists with other health-care professionals can be helpful for the provision of optimized patients' care.

AUTHORS' CONTRIBUTIONS

The contributions of each author are as follow:
- Conceived and designed the experiments: Mukhtar Jawad Alomar, Yahya Moustafa, and Lafi Salim Alharbi
- Analyzed the data: Mukhtar Jawad Alomar and Sohail Ahmad
- Wrote the paper: Sohail Ahmad and Mukhtar Jawad Alomar
- Designed search strategies: Mukhtar Jawad Alomar, Sohail Ahmad, Yahya Moustafa, and Lafi Salim Alharbi
- Critically reviewed the manuscript for important intellectual content: Mukhtar Jawad Alomar, Sohail Ahmad, and Yahya Moustafa.

Conflicts of interest

There are no conflicts of interest.

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