JOURNAL OF DRUG ASSESSMENT
2020, VOL. 9, NO. 1, 151–158
https://doi.org/10.1080/21556660.2020.1841495
Article 0010.R2/1841495

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ORIGINAL ARTICLE

Magnitude and associated factors of medication administration error among nurses working in Amhara Region Referral Hospitals, Northwest Ethiopia

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ABSTRACT

Introduction: Medication administration errors (MAEs) are common health problems that threaten patient safety and raise mortality rates, duration of hospital stay, and cost of services. It also influences healthcare professionals performing the procedure and healthcare organizations. Its prevalence in Ethiopia is high ranging from 51.8% to 90.8%.

Objective: This study aimed to assess the magnitude and associated factors of MAE among nurses at Northwest Amhara Region Referral Hospitals.

Methods: An institution-based cross-sectional study was conducted from February to March 2019. A simple random sampling technique was employed to select 348 nurses. Structured pretested self-administered questionnaires and an observational checklist were used to collect data. The data were entered in Epi-info version 7, analyzed using SPSS version 20 (SPSS Inc., Chicago, IL), and presented in tables and graphs. Bivariate and multivariable logistic regressions were computed to identify the factors associated with MAEs. p Values $<.05$ and adjusted odds ratios were used to declare the significance and strength of the association.

Results: One hundred and seventy-eight (54%) of the respondents made MAEs in the last 12 months. Only 10 (5%) of the 200 observed nurses were administered medications without any breach in any of the six rights of medication administration. Factors like poor knowledge (AOR = 5.98; 95% CI (2.39,14.94)), poor communication (AOR = 2.94; 95% CI (1.34, 6.46)), stress (AOR = 5.41; 95% CI (2.53, 11.57)), interruption during medication administration (AOR = 4.70, 95% CI (2.42, 9.10)), and night shift (AOR = 2.79, 95% CI (1.42, 5.46)) were significantly associated with MAE.

Conclusions: The magnitude of MAE was high. Poor knowledge, poor communication, stress, night shift, and interruption were significantly associated with MAEs. Strengthening institutional medication administration regulations and guidelines and minimizing interruption during medication administration would help minimize MAEs.

ARTICLE HISTORY
Received 3 April 2020
Accepted 21 October 2020

KEYWORDS
Magnitude; medication administration; medication administration error; nurse; Northwest Ethiopia

Introduction

Medication administration errors (MAEs) can be defined as a deviation from the prescriber's medication order as written on the patient's chart, manufacturers' administration instructions, or relevant institutional policies[1]. It is a medication error (ME) when one of the six rights of medication administration (time, patient, medication, dose, route, and documentation) is breached. It reaches patients and poses a threat to patient safety, increasing mortality rates, length of hospital stay, and related costs[2]. Medication errors most commonly occur during the administration step of the medication process[3]. Wrong time error, administering the drug to the wrong patient, wrong dose error, administering the wrong drug, and administering medication through the wrong route are the most prevalent administration errors[4]. Medication errors can occur by any member of a healthcare team, but errors committed by nurses are the most common because nurses spend most of their time administering medication in hospitals[5]. Medication administration errors are common in Middle Eastern countries which ranges from 9.4 to 80% of all MEs. Medication-related harm poses many disabilities to patients living in low-income countries than those living in high-income countries[6].

In African hospitals, 8.4% of patients reported having experienced any suspected adverse drug event at hospital admission and 2.8% of patients admitted to hospitals due to adverse drug events. Similarly, the mortality rate attributed to adverse drug events was 0.1%[7]. In Egypt, 0.77% of patients were harmed by MAEs and needed either extended hospitalization or intervention[8]. In Ethiopia, MAE is a common health problem with a magnitude ranging from 51.8% to 90.8%[9–12], and 1.5% of patients experienced actual adverse drug events associated with MEs[13]. Healthcare professionals are suffering from MEs, especially nurses who commit MAEs can suffer emotional distress and lack confidence,

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especially when the error results in significant patient harm. Health institutions also suffer from MEs through the increased cost of unplanned prolonged hospitalization and treatment of patients[14,15]. Failure to check the patient's identification before administration, the storage of similar preparations in similar areas, interruptions during medication administration, characteristics of the nurse (age, sex, work experience, year in the specific unit, nurse-to-patient ratio, and educational status), route, medication administration at night shift, and inaccurate documentation and inadequate communication during changes in shifts in hospitals are the most common factors associated with MAEs[16–19].

The WHO's third global patient safety challenge program develops a strategy to reduce severe, avoidable medication harms by half by 2022, especially by addressing harm results from errors due to weakness in the health system and by making improvements in the medication administration practices[6]. Although MAEs are well investigated throughout much of the developed world, the issue has only rarely been researched in developing countries, including Ethiopia. Therefore, this study was intended to assess the magnitude and associated factors of MAEs among nurses working in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia.

Methods and materials

Study design and period

An institutional based cross-sectional study was conducted from 19 February 2019 to 20 March 2019.

Study setting

The study was conducted in the Northwest Amhara Region Referral Hospitals. According to the 2007 Central Statistical Agency of Ethiopia, Amhara National Regional State has a total population of 17,221,976 of whom 8,641,580 are male and 8,580,396 females. Debre Markos, Felege Hiwot, and the University of Gondar are the three referral hospitals found in Northwest Amhara Region. Each referral hospital serves 3.5–5 million people. There are more than 906 (463 nurses) and 430 (222 nurses) healthcare professionals at the University of Gondar Comprehensive Specialized Referral Hospital and Debre Markos Referral Hospital, respectively, who are assigned in different units to offer health care services.

Study participants

Nurses working in Northwest Amhara Region Referral Hospitals during the study period who have at least a diploma qualification in nursing, a minimum of one-year work experience, and providing direct patient care were included in the study. Those nurses who were on annual leave, maternal leave, and seriously ill and attending external training courses off-site during the study period were excluded.

Sample size determination and sampling procedure

The sample size was calculated using Epi info version 7 stat cal by taking the estimated proportion of MAE among nurses: 71%, confidence level of 95%, and margin of error 5% for magnitude, while for factors associated with MAEs (assuming comparative cross-sectional; unexposed: exposed (1:1)). The final sample size was 348, after adding a 10% non-response rate. From three total referral hospitals, two hospitals were selected using the lottery method. A sampling frame was prepared for each hospital by taking lists of nurses from the hospital human resource management after the number of nurses was proportionally allocated to each hospital. Finally, each study subject was selected using a simple random sampling technique.

Data collection instruments and procedures

Data were collected using a validated structured pretested self-administered questionnaire that was adapted from previous studies. Separate tools were used to collect data regarding knowledge of nurses concerning medication and medication administration, the attitude of nurses toward medication administration, and communication of nurses with other nurses and physicians during medication administration adapted from previous studies and guidelines developed by recognized nursing associations. Stress and fatigue were also measured using separate stress and fatigue assessment scales. The Workplace Stress Scale from the American Institute of Stress which contains eight statements about how nurses usually feel was used to assess stress and participants who score 26 and above on the stress measurement scale were considered as having stress[20]. A validated 10-item fatigue assessment scale was used to assess fatigue and participants who score 22 and above the fatigue assessment scale were considered as having fatigue[21]. The scale's psychometric properties were analyzed and internal consistency of 0.90 was obtained. The observational checklist developed by reviewing different kinds of literature was used to gather data by observing nurses while medicating patients to assess whether they followed the six rights of medication administration or not before they were asked to fill the self-administered questionnaire. The questionnaire was collected with the help of six trained BSc nurse data collectors and two MSc nurse supervisors. A written guideline was given to data collectors to assure that every nurse received the same directions and information.

Data processing and analysis

All the collected data were checked for completeness, then compiled, coded, and finally entered into EPI-INFO version 7.2.1.0. Incomplete data were considered as a non-response. The entered data were exported to SPSS version 20 (SPSS Inc., Chicago, IL) statistical software for analysis. Frequencies and percentages were used to describe the descriptive statistics of the data, and tables and graphs were used for data presentation. To assess the association between independent

variables and the dependent variable, first bivariate relationships between each independent variable and outcome variable were investigated using a binary logistic regression model. Independent variables with a p value <.2 at the bivariate level were included in multivariable analysis to control for potential confounding factors. After adjusting for their effect on the outcome variable, those variables with a p value <.05 with a 95% confidence interval were regarded as factors significantly associated. The strength of association was determined using adjusted odds ratios with 95% confidence intervals. Model fitness was checked using the Hosmer and Lemeshow test, and the model was well fitted because the p value was >.05 (.83).

Data quality assurance

The data collection instruments were reviewed by four experts (two clinical nurses and two nurse academics). The tools were also tested with a pretest by taking 10% of the sample size two weeks before the actual data collection time at Debre Tabor Hospital. Amendments on the instrument, such as unclear questions and ambiguous words, were made accordingly. The resultant data were used to calculate Cronbach's alpha, which was 0.84 for the self-administered questionnaire and 0.72 for the observational checklist. The data collected in the pretests were not included in the final results. Data collectors and supervisors were recruited based on their experience in data collection and supervision, and one-day training was given regarding the objective of the study, instrument, and data collection procedures by the principal investigator. Supervision was conducted by the principal investigator and supervisors. Data were collected in a separate and quiet room. The observees were aware of the observation but unaware of when they were being observed.

Ethical consideration

Before conducting the study, ethical clearance was obtained from the Institutional Review Board of the University of Gondar on behalf of the ethical review committee of the School of Nursing. Written permission letters were obtained from the clinical directors of the hospitals. Participants were informed about the purpose of the study and verbal informed consent was obtained from them. Confidentiality was maintained by omitting direct personal identifiers on the questionnaire, by using code numbers, by storing data locked with a password, and not misuse or wrongfully disclose their information. Participants were also informed that participation was voluntary and they could withdraw from the study participation at any stage if they were not comfortable about the investigation. The nurses did not know who the data collectors and supervisors were because they were recruited from hospitals not included in the study. The investigator prepared a one-page information sheet regarding the purpose and nature of the study.

Results

Socio-demographic and work-related characteristics of the respondents

A total of 332 nurses participated in this study, with a 95.4% response rate. More than half (56.3%) of the respondents were male and nearly half (50.6%) of them were married. The median age of the respondents was 28.5 (27, 31) inter quartile range (IQR), and more than half (58.1%) of them fell in the age range of 25–29 years. Concerning the educational level, the majority of the respondents (81.9%) had a Bachelor of Science degree in nursing. The majority (83.7%) of the study participants were Orthodox, and 254 (76.5%) of them were Amhara in ethnicity. The median monthly salary of the respondents was 5294 Ethiopian birr (4446, 6179) IQR, and nearly half (53.3%) of them earned a monthly salary of 4000–5999 Ethiopian birrs (Table 1).

The median work experience of respondents was 4 (3, 6) IQR years, and most of them (91.3%) were working in the inpatient department. Concerning the duty shift, more than half (59.0%) of the respondents were working in the day shift. Nearly, two-thirds (65.0%) of nurses had worked for more than five months in their unit. More than three-fourths (77.7%) nurses worked in rotation. The majority (88.3%) of the participants were forced to work more than expected to do at a specified time and nearly half (50.3%) of nurses faced interruption during medication administration (Table 2).

Magnitude and types of medication administration errors

From a total of 332 study participants, 54% of nurses made MAE in the last 12 months with 95% CI (47.9, 59.3) based on the questionnaire. Among these, 29% of the participants

Table 1. Socio-demographic characteristics of nurses working in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 based on the questionnaire ($n = 332$ nurses).

Variables	Category	Frequency ($n = 332$)	Percentage (100%)
Age	20–24 years	11	3.3
	25–29 years	193	58.1
	30–34 years	99	29.8
	≥35 years	29	8.8
Sex	Female	145	43.7
	Male	187	56.3
Marital status	Single	147	44.3
	Married	168	50.6
	Others[a]	17	5.1
Educational status	Diploma	42	12.7
	BSc nurse	272	81.9
	MSc nurse	18	5.4
Religion	Orthodox	278	83.7
	Muslim	35	10.6
	Protestant	19	5.7
Ethnicity	Amhara	254	76.5
	Oromo	42	12.7
	Tigere	13	3.9
	Others[b]	23	6.9
Monthly salary (ETB)	2000 – 3999	49	14.8
	4000 – 5999	177	53.3
	6000 – 7999	96	28.9
	8000 – 9999	10	3.0

Abbreviation. ETB, Ethiopian Birr.
[a]Separated, divorced.
[b]Kimanit, SNNP, and Guragie.

made MAE only once during the specified period, while 17% and 8% of them made MAE two times and more than two times, respectively (Figure 1). Regarding the types of MAEs, documentation error was the most frequent one (55.1%), followed by the wrong time (54.2%), wrong dose (35.8%), wrong route (31.6%), wrong medication (30.1%), and wrong patient (28.3%) (Figure 2). From the total dosage errors, overdose accounted for 42.9%. Regarding the routes of medication administration, errors were most frequently committed by nurses when they administered medication through parenteral route 70.5% (Table 3).

Observational checklist results

To triangulate the results of self-administered questionnaires, observational data were collected by observing nurses during medication administration. Totally, 200 nurses were observed when they were administered medications. The results showed that only 10 (5%) of the 200 directly observed nurses administered medications without any breach in any of the six rights of medication administration. More than half (53%) of the observed nurses did not document administered medications and the patient's condition on the patient chart and failed to administer the right dose of medication. One hundred and three (51.5%) of them failed to administer the right medication at the right time. Ninety-two (46.0%) and 48.5% of the observed nurses did not give medication to the right patient and administer medication through the right route, respectively (Table 4).

Table 2. Work-related characteristics of nurses working based in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 on the questionnaire ($n = 332$ nurses).

Variables	Category	Frequency ($n = 332$)	Percentage (100%)
Work experience	≤5 years	226	68.1
	6–10 years	90	27.1
	11–15 years	12	3.6
	>15 years	4	1.2
Working unit	Medical ward	58	17.5
	Surgical ward	77	23.2
	Pediatrics ward	67	20.2
	Emergency	74	22.3
	ICU	26	7.8
	OPD	29	8.7
Duty shift	Day shift	196	59.0
	Night shift	136	41.0
Type of shift work	Rotating	258	77.7
	Fixed	74	22.3
Faced interruption	Yes	167	50.3
	No	165	49.7
Faced workload	Yes	293	88.3
	No	39	11.7
Duration in the present working unit	≤3 months	45	13.6
	4–5 months	71	21.4
	≥6 months	216	65.0

Factors associated with medication administration errors

Using bivariate logistic regression analysis, 10 variables were found to be significantly associated with MAEs based on the questionnaire. Stress, fatigue, nurse's knowledge, and attitude, communication with other nurses and physicians, follow guidelines, place where nurses earn an educational qualification, interruption during medication administration, duty shift, and availability of guidelines for medication administration. In multivariable logistic regression analysis, factors significantly associated with MAEs were nurse's knowledge, stress, communication with other nurses and physicians, interruption during medication administration, and duty shift. The odds of MAEs were nearly six times higher among nurses who had poor knowledge compared to those who had good knowledge (AOR = 5.98; 95% CI (2.39,14.94)). Similarly, the odds of MAEs were nearly three times higher among nurses who had poor communication as compared to nurses who had good communication with other nurses and physicians (AOR = 2.94; 95% CI (1.34, 6.46)). Nurses who were stressed were 5.4 times more likely to commit MAEs than those who were not stressed (AOR = 5.41; 95% CI (2.53,

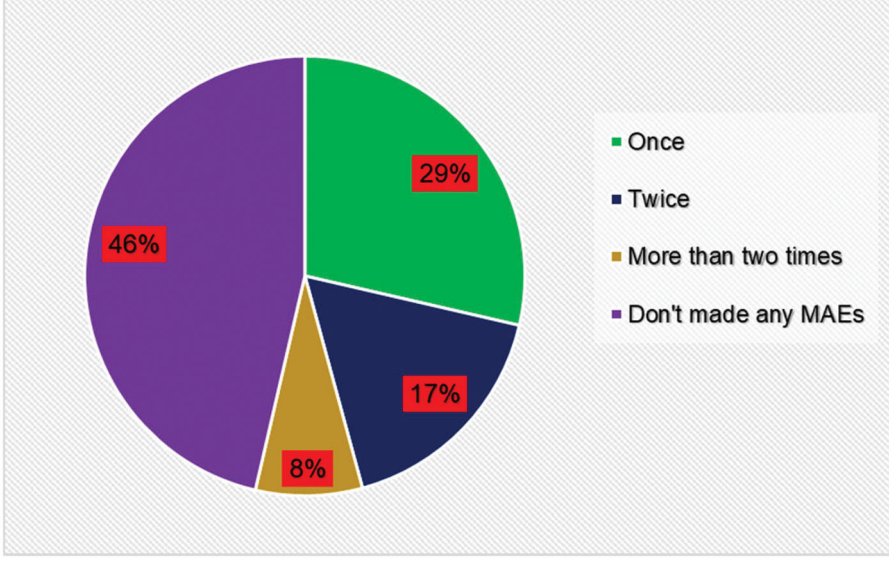

Figure 1. Frequency of medication administration errors in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 based on the questionnaire ($n = 332$ nurses).

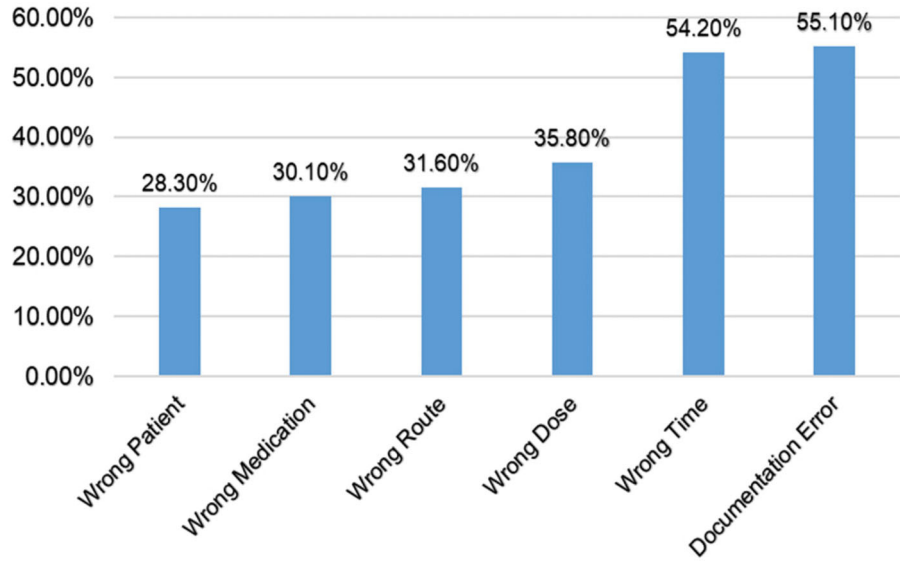

Figure 2. Types of medication administration errors in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 based on the questionnaire ($n = 332$ nurses).

Table 3. Distribution of dosage and route errors in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 on the questionnaire ($n = 332$ nurses).

Types of errors	Categories	Frequency	Percentage (100%)
Wrong dose ($n = 119$)	Over dose	51	42.9
	Under dose	49	41.1
	Both	19	16.0
Wrong route ($n = 105$)	Parenteral route	74	70.5
	Enteral route	19	18.1
	Topical route	12	11.4

Table 4. The level of adherence to the six rights of medication administration in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 based on the observation ($n = 200$ nurses).

Variables	Response	Frequency ($n = 200$)	Percentage (100%)
Give medication to the right patient	Yes	108	54.0
	No	92	46.0
Administer the right medication	Yes	97	48.5
	No	103	51.5
Administer the right dose	Yes	94	47
	No	106	53
Administer through the right route	Yes	103	51.5
	No	97	48.5
Administer medication at the right time	Yes	97	48.5
	No	103	51.5
Document necessary information	Yes	94	47
	No	106	53

11.57)). Nurses who were interrupted during medication administration were 4.7 times more likely to commit MAEs than nurses who were not interrupted (AOR = 4.70; 95% CI (2.42, 9.10)). Finally, the odds of MAEs were 2.8 times higher among nurses administering medication during the night time than those administering medication during the daytime (AOR = 2.79; 95% CI (1.42, 5.46)) (Table 5).

Discussion

This study aimed to assess the magnitude of MAEs and its associated factors among nurses working in Northwest Amhara Region Referral Hospitals. The findings of this study showed that the magnitude of MAEs was 54% based on the questionnaires. This means that the magnitude of MAEs in the study area was high because errors should not be committed at the time of medication administration. This finding was relatively consistent with studies conducted in Felege Hiwot Referral Hospital (56.4%), in the intensive-care unit of Jimma University Specialized Hospital (51.8%), and South Africa (51%)[9,11,22]. On the other hand, it was lower than studies conducted in two public hospitals in Southern Ethiopia (71%) and in Tigray, Northern Ethiopia (62.7%)[10,23]. The possible explanation for this difference might be due to variations in the type of hospitals and researched clinical units. Previous studies were conducted in general hospitals and a single unit. But the current study was conducted in referral hospitals and incorporated all working units in the hospital. This might be because of the difference in educational level, experience level, and training of health professionals and the more developed and equipped facilities and guidelines in referral hospitals than in general hospitals.

The finding of this study was also lower than a study conducted in Nigeria (64%)[24]. This might be due to differences in sample size and study participants. The previous study was conducted among 75 pediatrics nurses, and the high magnitude of MAEs might be because medication dosing in pediatric patients considers body weight, which needs dosage calculation and hence can result in miscalculation. Similarly, the findings of this study were lower than studies conducted in Tehran (64.5%) and South Korea (69.6%)[25,26]. The possible justification for the difference might be the difference in sample size and type of hospitals where the study was conducted. The findings of this study were higher than studies conducted in Egypt (25%), Ghana (27.2%), and Southern Iran (37.6%)[27–29]. This discrepancy might be due to differences in clinical units included in the study, constituents of MAEs, and mechanisms put in place to minimize the occurrence of MAEs. Previous studies were conducted in a

Table 5. Bivariate and multivariable logistic regression analyses of factors associated with MAEs among nurses working in Northwest Amhara Region Referral Hospitals, Northwest Ethiopia, 2019 ($n = 332$ nurses).

Variables	MAEs		OR with 95% CI		p value for AOR
	Yes	No	Crude	Adjusted	
Knowledge					
Poor	80	13	8.85 (4.67, 16.80)	5.98 (2.39, 14.94)[a]	<.001
Good	98	141	1	1	
Attitude					
Poor	92	44	2.67 (1.69, 4.22)	0.63 (0.29, 1.36)	.238
Good	86	110	1	1	
Communication					
Poor	110	28	7.28 (4.38, 12.11)	2.94 (1.34, 6.46)[a]	.007
Good	68	126	1	1	
Stress					
Yes	99	18	9.47 (5.34, 16.80)	5.41 (2.53, 11.57)[a]	<.001
No	79	136	1	1	
Fatigue					
Yes	93	59	1.76 (1.14, 2.73)	0.63 (0.31, 1.26)	.188
No	85	95	1	1	
Educational qualification					
From private institutions	38	10	3.91 (1.88, 8.15)	2.35 (0.71, 7.83)	.163
From gov't institutions	140	144	1	1	
Follow guidelines					
No	75	35	2.48 (1.53, 4.00)	1.02 (0.48, 2.17)	.956
Yes	103	119	1	1	
Interruption					
Yes	126	41	6.68 (4.13, 10.81)	4.70 (2.42, 9.10)[a]	<.001
No	52	113	1	1	
Availability of guidelines					
No	101	58	2.17 (1.40, 3.37)	1.58 (0.80, 3.10)	.186
Yes	77	96	1	1	
Duty shift					
Night	98	38	3.74 (2.34, 5.99)	2.79 (1.42, 5.46)[a]	.003
Day	80	116	1	1	

[a]Statistically significant at p value <.05.

single unit. This might also be a consequence of the gap in the quality of health care.

In this study, a total of 200 nurses were observed. Of these, only 5% of the administered medications were administered without a breach of the six rights of medication. Similar findings were reported from studies conducted in the Felege Hiwot referral hospital (98.1%) and two public hospitals in southern Ethiopia (99.7%)[10,11]. The finding of this study was higher than studies conducted in the pediatric ward of Jimma University Specialized Hospital (89.9%) and two medical units of a tertiary teaching hospital in Madrid, Spain (86.6%)[12,30]. The difference might be due to variation in the study settings, in which the above studies were conducted in a single hospital and department. However, this study was conducted in two hospitals of entire wards that nurses are working. As the findings from both self-report (54%) and observation (95%) highlighted that the magnitude of MAE was high in the hospitals incorporated in the study. This might be because most of the participants made MAE but they do not report the errors they made.

Poor knowledge, poor communication with other nurses and physicians, interruption during medication administration, stress, and night shift were significantly associated with MAEs.

The odds of MAE were nearly six times higher among nurses who had poor knowledge compared to those who had good knowledge. This finding was supported by systematic reviews conducted in Australia and African hospitals as well as studies conducted in London and Tehran[7,17,18,31]. This might be because knowledge provides a base on which decisions are made and implemented, lack of which results in poor decision making and poor performance. Lack of familiarity with drugs' generic and brand names, doses, and pharmacological properties of drugs can create confusion[32]. Medication administration is a complex procedure requiring significant intellectual activity and critical thinking, which involves a range of interrelated considerations, like correct dosage regime, side effects, and service user's health presentation. Inadequate pharmacological knowledge, and inability to transfer that knowledge into clinical practice results in an error during medication administration[33]. To maintain medication administration safety, make good clinical decisions, and perform a professional role in managing drug therapy and reducing adverse effects and common drug errors, nurses need to have good pharmacological knowledge[34]. Poor communication with other nurses and physicians was also significantly associated with MAEs. The odds of MAE were nearly three times higher among nurses who had poor communication as compared to nurses who had good communication. This finding was supported by systematic reviews conducted in the United Kingdom and Australia as well as studies conducted in Tehran, London, Saudi Arabia, and Rwanda[1,17–19,31,35]. This might be due to incomplete exchange of information between team members and physicians regarding medications to be administered leads to incorrect treatment procedures, treatment delays, and

delivery of incorrect medication to the patient. Miscommunication happens during the change of shifts when one caregiver transfers partial patient-related information[36]. Lack of patient and drug information and miscommunication of drug orders are dimensions of poor communication, which leads to MAEs[37]. The instances of poor communication may be reduced by increasing the transparency during information sharing between team members and physicians, setting predetermined roles for each department, and ensuring clear channels of communication between them[36]. Similarly, nurses who were interrupted during medication administration were 4.7 times more likely to commit MAEs than nurses who were not interrupted. This finding was supported by systematic reviews conducted in the United Kingdom, Australia, and African hospitals as well as studies conducted in Felege Hiwot referral hospital, Southern Ethiopia, Rwanda, Nigeria, and London[1,7,10,11,17–19,24]. This might be due to the medication administration process is serious and needs a nurse's full attention. When nurses are interrupted while administering medication, they become distracted, their attention is diverted, and they lose their concentration which creates the risk of committing an error[38]. Interruptions involve anything that disturbs an individual from the current task by averting one's attention. Noise (alarms, ringing phones, and other clinicians) and other people, or electronic devices (text messages, e-mails, or other communication technologies) are considered sources of interruptions[39]. Interruptions are part of every nurse's daily routine. However, it is better if nurses have professional attentiveness during the medication administration process to ensure patient safety. When due attentiveness is missing, errors happen[40]. Additionally, nurses who were stressed were 5.4 times more likely to commit MAEs than those who were not stressed. This finding was supported by a systematic review conducted in the United Kingdom and a study conducted in Saudi Arabia[1,35]. This might be because stress can have a significant impact on individual nurses and their ability to accomplish tasks specifically, poor decision making and lack of concentration which impair job performance and increase the chance of committing an error[41]. When nurses are suffering from stress, they can easily make mistakes in their judgment, decisions, and behavior, and result in errors. Stress can also result in suboptimal care, increased rates of safety breaches, and higher frequency of errors in everyday clinical practice[42]. In professional nursing, stress may result from work overload, shortage of staff, conflicts with physicians or coworkers, pressure from family members, life and death situations, and prolonged duty hours[43]. There are some simple common methods used by nurses to reduce and manage stress like relaxation, exercise, altering the situation, expressing feelings instead of bottling them up, and better time management[44]. This study also showed that the time of medication administration was significantly associated with MAEs. Nurses who administered medication at night time were 2.8 times more likely to commit MAEs than nurses administering medication during the day time. This finding was supported by studies conducted in the Felege Hiwot referral hospital of Ethiopia and London[11,18]. This might be due to sleep deprivation, loss of concentration, and exhaustion experienced by nurses during the night time. Night-shift nurses who work during night time are at greatest risk of sleep deprivation as they have the challenge of their work schedules going against their body's natural circadian rhythm[45]. This can result in MAEs due to impaired mathematical skills as a result of mental fatigue or decreased observational skills due to fatigue[46].

This study has some limitations. The study was based on self-reported information and observation that may be prone to reporting bias because of the respondent's interpretation of the questionnaire or desire to report their feelings and observer bias. There might also recall bias because a 12-month recall for the questionnaires is a long period.

Strength of study: The response rate was high.

Conclusions

The magnitude of MAE was high in the Northwest Amhara Region Referral Hospitals. Poor knowledge, poor communication with other nurses and physicians, interruption during medication administration, stress, and night shift were significantly associated with MAEs. Strengthening institutional medication administration regulations and guidelines and minimizing interruption during medication administration would help minimize MAEs. This finding is an essential first step toward the safe and appropriate administration of medication which in turn improves patient safety. The finding will also provide necessary information for health policy-makers to design and implement effective interventions to reduce the negative impact of MAEs on patients and the healthcare system.

Transparency

Declaration of funding

No funding has been received for the conduct of this study and/or preparation of this manuscript.

Declaration of financial/other relationships

The contents of the paper and the opinions expressed within are those of the authors, and the authors decided to submit the manuscript for publication.

Acknowledgements

The authors are grateful to the University of Gondar, Debre Markos, and the University of Gondar hospital clinical directors and nursing coordinators, data collectors, and study participants.

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