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Examining Medication Administration Errors and Affecting Factors Among Emergency Healthcare Workers

Acil Sağlık Çalışanları Arasında İlaç Uygulama Hataları ve Etkileyen Faktörlerin İncelenmesi

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* This study was derived from the master's thesis of Merve Can Özcebeci, titled "Investigation of Medication Administration Errors and the Factors Affecting Them Among Emergency Healthcare Workers.".

ABSTRACT

Aim: *Medication administration errors are a significant problem in emergency departments, which are high-risk environments for medication safety. The study aimed to examine the factors affecting medication administration errors among emergency healthcare workers.*

Material and Method: *The descriptive cross-sectional study was conducted with 144 healthcare workers in the emergency departments of nine private hospitals in Istanbul. Data were collected through a self-administered questionnaire.*

Results: *In the last 12 months, 20.84% made a medication administration error. Compared with those having five or more years of professional experience, workers with six months to two years of experience (OR=199.31; 95% CI=20.93-1897.45; p<0.001) and those with two to four years of experience (OR=23.13; 95% CI=3.47-154.11; p=0.001) had significantly higher odds of making an error. Reporting a medication administration error was associated with lower odds of having made an error (OR=0.13; 95% CI: 0.02–0.61; p=0.010). Each one-point increase in the Medication and Transfusion Practices Subscale was associated with a 22% reduction in the odds of making an error (OR=0.78; 95% CI=0.70-0.86; p<0.001).*

Conclusion: *Greater professional experience, reporting medication administration errors, and lower error tendency in medication and transfusion practices were associated with reduced likelihood of errors. Developing new graduates' awareness of medication administration errors, improving patient safety culture, and implementing emergency department-specific regulations are recommended.*

Keywords*: Emergency nursing, Emergency medical technicians, Hospital emergency service, Patient safety, Medication errors*

ÖZET

Amaç: *İlaç uygulama hataları, ilaç güvenliği açısından yüksek risk taşıyan acil servislerde önemli bir sorundur. Araştırma, acil sağlık çalışanları arasında ilaç uygulama hataları ve etkileyen faktörleri incelemeyi amaçladı.*

Gereç ve Yöntem*: Tanımlayıcı-kesitsel tasarımlı araştırma, İstanbul'da dokuz özel hastanenin acil servislerinde görevli 144 sağlık çalışanıyla gerçekleştirildi. Öz bildirime dayalı bir anket formu ile veriler toplandı.*

Bulgular: *Son 12 ayda %20,84'ü ilaç uygulama hatası yapmıştı. Beş yıl ve üzeri mesleki deneyime sahip olanlara kıyasla, altı ay-iki yıl deneyime sahip olanların (OR=199,31; %95 GA: 20,93–1897,45; p<0,001) ve iki-dört yıl deneyime sahip olanların (OR=23,13; %95 GA: 3,47–154,11; p=0,001) hata yapma olasılığı anlamlı derecede yüksekti. İlaç uygulama hatasını bildirmek, hata yapma olasılığının daha düşük olmasıyla ilişkiliydi (OR=0,13; %95 GA: 0,02–0,61; p=0,010). İlaç ve Transfüzyon Uygulamaları Alt Boyutundaki her bir puanlık artış, hata yapma olasılığında %22 azalma ile ilişkiliydi (OR=0,78; 95% CI=0,70-0,86.; p<0,001).*

Sonuç: *Daha fazla mesleki deneyim, ilaç uygulama hatalarını bildirmek ve ilaç ve transfüzyon uygulamalarında düşük hata eğilimi, ilaç uygulama hatası yapma olasılığını azaltan faktörlerdi. Yeni mezun sağlık çalışanlarının ilaç uygulama hatalarına yönelik farkındalığının geliştirilmesi, hasta güvenliği kültürünün iyileştirilmesi ve acil servislere özgü düzenlemelerin oluşturulması önerilmektedir.*

Anahtar kelimeler: *Acil hemşireliği, Acil tıp teknisyenleri, Hastane acil servisi, Hasta güvenliği, İlaç hataları*

INTRODUCTION

According to the report published by the United States of America (USA) Institute of Medicine in 2000, an estimated 7,000 citizens lose their lives each year due to medication administration errors (MAEs) (Institute of Medicine, 2000). Since then, medication safety in hospitals has emerged as a critical issue and has become the focus of extensive research at both national and global levels.

In the USA, at least one person dies every day due to MAEs, and more than 1.3 million people are harmed annually (World Health Organization, 2017). In Australia, a five-year study identified 1,882 MAEs in a single hospital (Isaacs et al., 2021). National reporting systems in Spain and Norway indicated that 28% and 20% of all reported medical errors, respectively, were related to MAEs (Sanduende-Otero et al., 2020; Mulac, Taxis, Hagesaether, & Gerd Granas, 2021). In the United Kingdom, approximately 237 million MAEs occur each year, 66 million of which have potential to cause harm (Elliott, Camacho, Jankovic, Sculpher, & Faria, 2021). According to the National Safety Reporting System in Türkiye, MAEs ranked third among all reported medical errors (Ministry of Health, 2018). Previous self-report research among nurses indicated that 60% to 100% have encountered MAEs throughout their careers (Karagözoğlu, Otu, & Coşkun, 2019; Yıldız & Yıldız, 2020; Uzuntarla & Büyük, 2021). Additionally, 46.4% of nurses have reported making an MAE in the last year, approximately 49% have made an MAE throughout their careers, and approximately 72% have witnessed MAEs (Üstüner Top & Çam, 2016; Başer & Manav, 2018). These results demonstrate that MAEs remain a frequent and significant problem in the national healthcare system.

Emergency departments are complex and dynamic healthcare environments where effective and rapid performance is essential due to unpredictable healthcare needs, heavy workloads, the use of multiple medications, and the prevalence of verbal medication orders. However, MAEs are frequently observed in this setting (Miladinia & Nouri, 2022). Research examining MAEs in emergency departments demonstrates considerable variation in the international literature. An observational study conducted in Malaysia reported an MAE rate of 30.5%, with common errors including wrong time, unauthorised medication administration, negligence, and incorrect dosage (Shitu, Aung, Kamauzaman, & Ab Rahman, 2020). Similarly, a study in Iran revealed that 72% of nurses had made at least one MAE in the previous six months, 89% of which remain unreported. Most errors resulted from look-alike and sound-alike medications (Mosakazemi, Bastani, Marzaleh, & Pevravi, 2019). Furthermore, an analysis of 250 MAEs reported to the Pennsylvania Patient Safety Reporting System from emergency departments of 101 hospitals between 2011 and 2020 highlighted the alarming frequency of prescribing errors, particularly incorrect dosage errors, underscoring the urgent need for enhanced medication management strategies (Kukielka & Jones, 2022). A retrospective study examining 100 patient records in an emergency department in Jordan over one month found the frequency of MAEs to be 51%, with physicians responsible for 43.5% of errors. Common occurrences included prescription errors, missed doses, and incorrect dosages (Trawneh, Kashman, Taleb, Al Sharari, & Al Dalabeh, 2020).

In the national literature, research focusing on MAEs among emergency healthcare workers is limited, indicating a significant gap regarding medication safety in these high-risk and fast-paced environments. In a qualitative study, the MAEs most frequently made by emergency department nurses included wrong patient, wrong medication, and wrong administration technique (Bişkin & Cebeci, 2017). Similarly, a study conducted with 67 nurses in a training and research hospital reported that 13.4% had made an MAE, and 43.3% had witnessed an MAE (Aygin, Yaman, & Bitirim, 2020). The factors affecting MAEs among emergency department nurses working in training and research hospitals in Istanbul were rotating shifts, role incompatibility, and a higher tendency for medical errors related to medication and transfusion practices (Tarhan, Ersoy, Yılmaz, & Dalar, 2020). Another study conducted in a university hospital observed that seven out of 23 emergency healthcare workers made MAEs (Arslan, Fidan, Şanlıalp Zeyrek, & Ok, 2022).

No study in the national literature has examined MAEs in private hospital emergency departments. However, the contribution of the present study, conducted with emergency healthcare workers in a private hospital group, is substantial. It is expected to enrich the existing literature and provide crucial guidance for nurse managers,

thereby enhancing the quality and safety of healthcare services in private hospitals-an important competitive advantage. In this context, this study was conducted to examine the factors affecting MAEs of emergency healthcare workers.

Research Questions

1. What are the experiences of emergency healthcare workers regarding MAEs and their tendency for medical errors regarding medication and transfusion practices?

2. What factors have affected emergency healthcare workers' MAEs in the last 12 months?

MATERIALS AND METHODS

Research Type

The study was conducted using a descriptive, cross-sectional design between February and April 2022 in the emergency departments of nine hospitals affiliated with a private hospital group in Istanbul, located on both the European and Anatolian sides of the city. The emergency departments of these hospitals serve approximately 25 to 450 patients per day and include between 15 and 40 beds.

Study Population and Sample

This study included 204 healthcare workers employed in the emergency departments of the nine hospitals. The required sample size was calculated as 133 using a standard formula for sample size estimation. The inclusion criteria were working in the emergency department for at least six months and completing the questionnaire. Considering an anticipated non-response rate of 25%, 166 emergency healthcare workers were contacted, of whom 144 met the inclusion criteria and agreed to participate voluntarily, resulting in a participation rate of 86.74%.

Data Collection Tools

Data were collected using a self-administered questionnaire, which consisted of the Personal and Professional Characteristics Form, the Medication Administration Characteristics Form, and the Medication and Transfusion Practices Subscale of Nursing Medical Error Tendency Scale.

The Personal and Professional Characteristics Form: This form was developed to determine the personal and professional characteristics of emergency healthcare workers (Karagözoğlu et al., 2019; Shitu et al., 2020; Bişkin & Cebeci, 2017; Tarhan et al., 2020). These characteristics included age, gender, marital status, education level, professional and emergency department experience, work type, and weekly working hours, with open- and closed-ended questions. Healthcare workers also rated the two items on a scale from 0=not at all to 10=completely, including intention to leave nursing and organizational satisfaction. The intention to leave nursing closer to 10 is interpreted as the healthcare worker's intention to leave nursing. In contrast, organizational satisfaction closer to 10 is evaluated as a high level of healthcare workers' institutional satisfaction.

The Medication Administration Characteristics Form: This form was developed to assess healthcare workers' views and experiences regarding safe medication administration and MAEs (Karagözoğlu et al., 2019; Shitu et al., 2020; Bişkin & Cebeci, 2017; Tarhan et al., 2020). It included open- and closed-ended questions on participation in in-service training on medication administration, the availability of an updated institutional medication administration guide, the occurrence and reporting of MAEs in the last 12 months, and the professional groups in which MAEs occurred. In addition, emergency healthcare workers were asked to report the number and types of MAEs they had observed throughout their careers, providing further insight into their experiences with MAEs.

The Medication and Transfusion Practices Subscale: The Medication and Transfusion Practices Subscale is part of the Nursing Medical Error Tendency Scale developed by Özata & Altunkan (2009) and was used to assess emergency healthcare workers' tendency to make errors in medication and transfusion practices. The sub-scale comprises 18 items rated on a five-point Likert scale ranging from 1 (never) to 5 (always). There are no negatively phrased reverse expressions. Total score for this sub-scale is obtained by adding up the scores for each item, ranging from 18 to 90 points. Higher scores indicate a lower tendency for emergency healthcare workers to make errors in medication and transfusion practices. The Cronbach's alpha internal consistency coefficient was reported as 0.96 in the original development study and was 0.88 in the present study.

Data Collection

Data were collected during shift change periods in the emergency departments. Healthcare workers commencing their night or day shifts were informed about the purpose and procedures of the present study. Volunteers received a data collection tool and an informed consent form placed in a sealed envelope. Participants were asked to read and sign the informed consent form, complete the data collection tool, and return both documents in a sealed envelope at their earliest convenience. Those who were ready submitted their materials immediately, while others were given a two-day deadline. During the subsequent shift change, the completed data collection tool and informed consent form were retrieved from either the participants or the charge nurse in the emergency department. The mean completion time for the data collection tool was 15-20 minutes.

Ethical Consideration

The study protocol was approved by the Social Sciences Scientific Research Ethics Committee of the foundation university (Date: 07.10.2021, Approval Number: 100), and written permission for data collection was obtained from the participating hospitals. Before data collection, emergency healthcare workers were informed about the study and asked to read and sign the informed consent form. Additionally, permission to use the Medication and Transfusion Practices Subscale of the Nursing Medical Error Tendency Scale was obtained via email from the scale's corresponding author.

Data Analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS, version 25.0) with a significance level of $p<0.05$. Normality was assessed by examining the skewness and kurtosis coefficients of the scale. In this study, the skewness coefficient was -1.102, and the kurtosis coefficient was 0.179. Skewness and kurtosis coefficient values between -1.50 and +1.50 indicate a normal distribution; therefore, parametric tests were used in the statistical analysis (Tabachnick & Fidell, 2013). Personal and professional characteristics, safe medication administration characteristics, and the tendency to make medical errors related to medication and transfusion practices were reported using numbers and percentages for categorical variables and mean and standard deviation for continuous variables. These variables, along with making MAEs in the last 12 months, were compared using the chi-square test or Fisher's exact chi-square test. The comparative analysis was used solely for variable selection and not reported in the Results section. Variables showing statistically significant difference in these preliminary analyses were subsequently included in the multivariable regression model. Multicollinearity was evaluated using Variance Inflation Factor (VIF) values, which ranged between 0.40 and 0.85. All values were far below the threshold of 4, indicating no evidence of multicollinearity. Factors influencing MAEs among emergency healthcare workers were identified using binary logistic regression analysis with backward method.

RESULTS

Approximately half of emergency healthcare workers were 25 years or older (42.37%), most were female (78.47%), single (84.03%), and had an associate degree (72.91%). Of those, 38.19% had professional experience between six months and two years, and 42.37% had emergency department experience between six months and one year. More than half of them worked rotating shifts (57.65%) and between 51-60 hours per week (56.25%). About half evaluated their intention to leave nursing as moderate, scoring less than 5 out of 10, and their organizational satisfaction as high, scoring between 7 and 10 (55.56%) (Table 1).

Most participated in in-service training on medication administration (92.36%) and had an updated institutional medication administration guide (85.41%). In the last 12 months, 40.97% had never witnessed an MAE (n=59), 79.16% had never made an MAE (n=114), and 78.47% had never reported an incident related to an MAE (n=113). During their careers, 35.43% reported witnessing physicians (n=51), 43.08% of their colleagues (n=62), and 18.76% of pharmacists (n=26) making MAEs three or more times (Table 2).

The mean score of the medication and transfusion practices subscale among emergency healthcare workers was 83.42 ± 7.45 (range 64-90 points).

Table 1. Personal and Professional Characteristics of Emergency Healthcare Workers (N=144)

Personal and Professional Characteristics	Number	Percentage
Age groups		
22 years and younger	42	29.16
23-24 years	41	28.47
25 years and older	61	42.37
Gender		
Female	113	78.47
Male	31	21.53
Marital status		
Married	23	15.97
Single	121	84.03
Education level		
Vocational high school (Nurse Assistant)		
Associate degree (Emergency Medical Technician)	17	11.80
Bachelor's degree (Nurse)	105	72.91
Professional experience	22	15.29
≤Two years	55	38.19
2-4 years	49	34.02
≥ Five years	40	27.79
Emergency department experience		
≤ A year	61	42.37
1-2 years	38	26.38
>2 years	45	31.25
Working type		
Day	32	22.22
Night	29	20.13
Rotating	83	57.65
Weekly working hours	47	32.63
≤50 hours	81	56.25
51-60 hours	16	11.12
≥61 hours		
Intention to leave nursing	64	44.44
<5 scores	80	55.56
≥5 scores		
Organizational satisfaction		
<7 scores	64	44.44
≥7 scores	80	55.56

Table 2: Safe Medication Administration Among Emergency Healthcare Workers (N=144)

Safe Medication Administration	Number	Percentage
In-service training		
Yes	133	92.36
No	11	7.64
Updated guideline		
Yes	123	85.41
No/I don't know	21	14.59
Witnessing a medication administration error		
Never	59	40.97
A time	23	15.97
Two times	31	21.53
Three times and more	31	21.53
Making a medication administration error		
No	114	79.16
Yes	30	20.84
Reporting a medication administration error		
No	113	78.47
Yes	31	21.53
Witnessing a medication administration error		
Physicians		
Never	46	31.94
A time	23	15.97
Two times	24	16.66
Three times and more	51	35.43
Nurses		
Never	37	25.69
A time	33	22.90
Two times	12	8.33
Three times and more	62	43.08
Pharmacists		
Never	90	62.50
A time	12	8.33
Two times	15	10.41
Three times and more	26	18.76

Table 3 presents the results regarding witnessing, making, and reporting MAEs by emergency healthcare workers throughout their careers. The three types of MAEs most frequently witnessed by emergency healthcare workers were administering a medication at a rate different from the physician's prescription (11.63 ± 2.31), failure to comply with aseptic techniques and hand hygiene during medication preparation (8.16 ± 2.76) and administering a medication at a time different from the physician's prescription (7.79 ± 1.74). The three types of MAEs most frequently made

were administering a medication at a rate different from the physician's prescription (7.10 ± 1.91), administering a medication at a time different from the physician's prescription (5.48 ± 1.66), and failing to confirm the accuracy of the medication coming from the pharmacy or in stock with a physician's prescription (1.83 ± 0.52). The three types of reported MAEs were failing to verify patient identity or incorrect/incomplete verification before administering a medication (1.88 ± 1.00), recording a medication incompletely or incorrectly or not at all (1.73 ± 0.93), and failing to confirm the accuracy of the medication coming from the pharmacy or in stock with a physician's prescription (1.60 ± 0.51).

Table 3. The Number of Witnessing, Making, and Reporting Medication Administration Errors Among Emergency Healthcare Workers (N=144)

Types of Medication Administration Errors	Witnessing Mean ± S.D.	Making Mean ± S.D.	Reporting Mean ± S.D.
Administering medication at a rate different from the physician's prescription	11.63 ± 2.31	7.10 ± 1.91	0.72 ± 0.17
Failing to comply with aseptic techniques and hand hygiene during medication preparation	8.16 ± 2.76	0.97 ± 0.18	0.21 ± 0.07
Administering medication at a time different from the physician's prescription	7.79 ± 1.74	5.48 ± 1.66	0.93 ± 0.25
Failing to check the interaction of the medication on the physician's order with the diet or other medications	7.31 ± 2.99	1.26 ± 0.34	0.56 ± 0.18
Lack of knowledge of the indications or contraindications of the medications on the physician's prescription	6.37 ± 2.02	1.07 ± 0.17	0.37 ± 0.12
Failing to verify patient identity or incorrect/incomplete verification before administering a medication	4.62 ± 1.50	0.99 ± 0.28	1.88 ± 1.00
Recording a medication incorrectly, incompletely, or not recorded at all	4.57 ± 1.18	0.51 ± 0.11	1.73 ± 0.93
Failing to confirm the accuracy of the medication coming from the pharmacy or in stock with a physician's prescription	4.06 ± 1.11	1.83 ± 0.52	1.60 ± 0.51
Failing to confirm the accuracy of the active ingredient of the equivalent medication coming from the pharmacy or stock with a physician's prescription.	3.53 ± 1.05	1.66 ± 0.58	0.40 ± 0.11
Failing to assess the patient's condition before administering a medication	3.44 ± 1.03	0.35 ± 0.08	0.14± 0.07
Administering a medication without informing the patient or legal representative about the medication	2.74 ± 0.55	1.28 ± 0.40	0.19 ± 0.10
Improper dilution or reconstitution of a medication, mixing of physically incompatible medications	2.62 ± 0.46	0.92 ± 0.19	0.33 ± 0.10
Failure to monitor a medication's effectiveness or side effects	2.17 ± 0.61	0.41 ± 0.09	0.21 ± 0.06
Administering medication at a route different from the physician's prescription	2.03 ± 0.43	0.44 ± 0.09	1.09 ± 0.41
Administering medication at a dose different from the physician's prescription	1.62 ± 0.36	0.83 ± 0.19	0.43 ± 0.17
Administering one patient's medication to another patient	1.31 ± 0.25	0.53 ± 0.17	0.65 ± 0.17
Administering a medication with an incorrect technique	1.14 ± 0.20	0.63 ± 0.17	0.66 ± 0.18
Not administering a medication that is prescribed by a physician.	1.01 ± 0.16	0.58 ± 0.11	0.21 ± 0.06
Administering a medication that is nonprescribed by a physician	0.88 ± 0.13	0.03 ± 0.01	0.17 ± 0.06
Administering an expired or compromised medication to a patient	0.58 ± 0.11	0.63 ± 0.13	0.26 ± 0.09
Administering a medication even when the patient or their legal representative has refused it	0.12 ± 0.04	0.17 ± 0.05	0.00 ± 0.00

A binary logistic regression model was created based on the results of comparative analyses, using variables that reached a significance level of p<0.05. These variables included professional experience, weekly working hours, witnessing an MAE, reporting an MAE, and the professions of those whose errors were witnessed (nurse, physician, pharmacist). The final model accounted for 53% of the variation in log-odds (Nagelkerke R Square= 0.53). Having five or more years of professional experience was associated with lower odds of making an MAE compared with having six months to two years of experience (OR=199.31, 95% CI=20.93-1897.45; p<0.001) and with having two to four years of experience (OR=23.13, 95% CI=3.47-154.11; p=0.001). Additionally, reporting an MAE was associated with significantly lower odds of having made an MAE (OR=0.13; 95% CI: 0.02–0.61; p=0.010). A one-point increase in the Medication and Transfusion Practices Subscale was associated with a 22% reduction in the odds of making an MAE (OR=0.78; 95% CI=0.70-0.86; p<0.001) (Table 4).

Table 4. The Factors of Making Medication Administration Errors Among Emergency Healthcare Workers (N=144)

Personal and Professional Characteristics	β	SE	Wald	p	Odds	95% CI
Professional experience						
≤Two years (1)	5.29	1.15	21.21	<0.001	199.31	20.93-1897.45
2-4 years (2)	3.14	0.96	10.53	0.001	23.13	3.47-154.11
≥ Five years (ref)			21.21	<0.001		
Reporting a medication administration error						
No	-2.03	0.78	6.69	0.010	0.13	0.02-0.61
Medication and transfusion practices	-0.24	0.05	23.39	<0.001	0.78	0.70-0.86

DISCUSSION

In emergency departments, the majority of the participants consisted of emergency medical technicians with associate degrees or nursing assistants who graduated from health vocational high schools (Table 1). National research conducted by Aygin et al. (2020) and Tarhan et al. (2020) reported that the proportion of nurses with a bachelor's degree working in emergency departments was 65.70% and 40.50%, respectively. This percentage has gradually declined due to the rise in the number of graduates from emergency medical technician departments and the fact that these graduates are now employed exclusively in emergency departments.

Approximately one in five emergency healthcare workers had made an MAE, and 59.03% had witnessed an MAE in the last 12 months (Table 2). The literature focusing specifically on emergency healthcare workers remains limited. A study conducted in Istanbul reported that one in four made an MAE, and that more than half witnessed one (Tarhan et al., 2020). Another study reported that 13.40% had made, and 43.30% had witnessed MAEs (Aygin et al., 2020). An observational study demonstrated that approximately 30% of emergency healthcare workers made MAEs (Arslan et al., 2022). International research conducted in Spain, Ghana, Malaysia, and Iran reported MAE rates ranging from 25% to 68.50% based on observational methods (Vazin, Zamani, & Hatam, 2014; Acheampong, Tetteh, & Anto, 2016; Pérez-Díez et al., 2017; Shitu et al., 2020). Additionally, one study emphasized that MAE rates derived from observational methods tend to be higher than those obtained self-reporting (Alebachew, Tsegaye, Alem, & Tesema, 2020). This suggests that the frequency of MAEs witnessed by emergency healthcare workers may underestimate the true prevalence of such errors, which may be more accurately captured through direct observation.

In this study, 78.47% of emergency healthcare workers reported not having disclosed MAEs in the last 12 months (Table 2). In one study, nearly half of the nurses stated that they consistently reported an MAE when they witnessed one (Yıldız & Yıldız, 2020). In contrast, another study found that 80% of emergency department nurses fail to disclose MAEs (Aygin et al., 2020). Although the results of the present study are broadly aligned

with the literature indicating low reporting rates, this tendency may be attributed to the perception of incident reporting as punitive, which can inhibit transparency and hinder the cultivation of a robust patient safety culture.

In this study, MAEs witnessed by emergency healthcare workers were listed in order of frequency, with pharmacists having the lowest frequency, followed by physicians, and then nurses (Table 2). According to Tarhan et al. (2020), within the medication use process, physicians are responsible for prescribing medications, pharmacists for preparing them, and nurses for administering and monitoring them. The literature indicated that MAEs occurred most frequently during the administration and prescription stages and least frequently during the preparation stage (Sanduende-Otero et al., 2020; Elliott et al., 2021; Mulac et al., 2021). This result aligns with existing evidence and is not unexpected, given that the administration stage is the most visible and frontline component of the medication use process.

The most prevalent MAEs made or witnessed by emergency healthcare workers in this study were incorrect administration rate, failure to comply with aseptic techniques during medication preparation, wrong time, and failure to verify medication accuracy (Table 3). Bişkin & Cebeci (2017) reported that the most common MAEs among emergency room nurses were wrong patient, wrong administration technique, and wrong medication. Similarly, other research has highlighted wrong medication, wrong dose, and wrong patient as the most frequently encountered errors (Kıymaz & Koç, 2018; Aygin et al., 2020). Research conducted in Iran reported wrong administration rate, skipping doses, wrong time, and wrong dose as the most frequently witnessed MAEs in emergency departments (Izadpanah et al., 2018). Likewise, a study conducted in a Malaysian emergency department identified wrong timing, administering medication without a prescription, skipping doses, and wrong doses as primary MAEs (Shitu et al., 2020). These results are indirectly consistent with the existing literature, which reports wrong patient and wrong medication errors as common in emergency departments. However, these errors did not emerge as the most frequent in the present study. It is important to note that inadequate verification of patient identity and medication accuracy can contribute to wrong patient and wrong medication, which are widely reported in the literature.

Emergency healthcare workers demonstrated a notably low tendency for errors in medication and transfusion practices, with a mean score of 83.42 out of 90. Other research using the same scale has similarly reported low error tendencies among emergency healthcare workers (Tarhan et al., 2020; Arslan et al., 2022). This result can be attributed to heightened awareness of the risks associated with working in emergency departments, including the demanding physical environment and challenging working conditions.

Having five or more years of professional experience was associated with lower odds of making an MAE (Table 4). However, results from previous national research indicate a different pattern. A national study reported that nurses with five years of professional experience had an 83.4% higher error rate (Yüksel et al., 2015). Another study showed that emergency department nurses with five years of experience made 51.50% more MAEs (Tarhan et al., 2020). Additionally, a study concluded that nurses with five years of experience made at least one additional MAE compared with those who had more than five years of experience (Aygin et al., 2020). Collectively, these results suggest that newly graduated or less experienced healthcare workers may be at greater risk of making MAEs.

In this study, reporting an MAE was associated with lower odds of making an MAE (Table 4). A study emphasized that reporting MAEs at a rate of 47.50% played a critical role in preventing such errors (Karagözoğlu et al., 2019). Similarly, in Ethiopia, 58.90% of nurses stated that the immediate reporting of MAEs contributes to reducing their overall occurrence (Asefa et al., 2021). These results suggest that MAEs are likely to occur at lower rates in units where incidents are consistently reported and where a stronger patient safety culture is present.

This study determined that a one-point increase in the Medication and Transfusion Practices Subscale score was associated with a 22% reduction in the odds of making an MAE (Table 4). These results indicate that as healthcare workers' adherence to established safety protocols improves, their likelihood of making MAEs decreases proportionally. In parallell, Tarhan et al. (2020) reported that a one-point increase in the tendency to make errors in medication and transfusion practices increased the odds of making MAEs. Taken together, these results suggest that when healthcare workers within the same unit

have a low tendency to make MAEs, the overall error rates in that unit are likely to remain low.

Limitations of the Research

This study has several limitations. First, it was conducted in nine private hospitals affiliated with a foundation university. Second, the sample size was relatively small, and no probability sampling method was used. Third, the data were collected through self-reporting, which may have resulted in response bias. Finally, recall bias may have affected the accuracy of participants' reports regarding MAEs experienced in the past 12 months..

CONCLUSION

The study revealed that approximately one in five emergency healthcare workers had made MAEs in the past year. However, their overall tendency to make medical errors in medication and transfusion practices was low. The main factors influencing the probability of making MAEs in the past 12 months were having more than five years of professional experience, reporting an incident related to an MAE, and a low tendency to make medical errors in medication and transfusion practices.

Implementing targeted strategies to reduce or prevent MAEs among new graduates or less-experienced emergency healthcare workers is crucial. Nurse managers should actively monitor medication administration processes, experienced healthcare workers should provide mentoring support, and regular in-service training should be conducted throughout the year. Additionally, research incorporating simulation-based practices can raise awareness about MAEs, enable healthcare workers to recognize common errors, and contribute to improvement efforts. It is also important for emergency healthcare workers to understand that incident reporting is a critical component of improving a patient safety culture rather than a punitive or reward-based system. Finally, future research should include observational design with a larger sample size across various types of hospitals where both undergraduate and graduate nurses are employed.

Ethics Committe Approval

Ethics committee approval was received for this study from the İstanbul Medipol University Social Sciences Scientific Research Ethics Committee (Date: 07.10.2021, and Approval Number: 100).

Author Contributions

Idea/Concept: M.C.Ö., M.T.; Design: M.C.Ö., M.T..; Supervision/Consulting: M.T.; Analysis and/or Interpretation: M.C.Ö.; Literature Search: M.C.Ö..; Writing the Article: M.C.Ö., M.T.; Critical Review: M.C.Ö., M.T.

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Conflict of Interest

The authors have no conflict of interest to declare.

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