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Research Article

Assessment of Medication Errors Among Anesthesia Clinicians in Saudi Arabia: A Cross-Sectional Survey Study

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ABSTRACT

Introduction: Anesthetic drugs are prepared and administrated without referral to the pharmacy or other medical departments. We aimed to assess the occurrence of anesthetic drug errors in Saudi Arabia. We also determined the contributing factors, reporting strategies, and clinicians' opinions of the preventive measures. **Methods:** We conducted a cross-sectional web-based survey study using a validated tool. A total of 300 anesthesia clinicians completed the survey (146 anesthesiologists and 154 anesthesia technology specialists). We measured descriptive statistics to describe the demographic characteristics and performed inferential statistics to examine associations and differences. **Results:** Sixty-nine percent of respondents had experienced an anesthetic drug error at least once in their career. The two primary factors that caused drug errors were haste (60.3%) and heavy workload (60.3%). On syringe labeling, 56.3% withdrew the drug then labeled the syringe, and 43.7% labeled the syringe then withdrew the drug. The chi-square test revealed that clinicians who labeled the syringe first then withdrew the drug made errors more frequently ($p = 0.036$). The test also showed that clinicians with less experience had committed more errors ($p = 0.015$). On reporting drug errors, 77.7% of respondents identified the fear of medicolegal issues as the most common barrier to reporting errors. Respondents believed that double-checking the medication and color-coded syringe labels were the most effective strategies to reduce errors (82% and 64%, respectively). The Mann-Whiney *U* test revealed significant differences between the two specialties about their opinions of the preventive measures. **Conclusions:** There was a high occurrence rate of anesthetic drug errors in Saudi Arabia. Policymakers need to unify the syringe-labeling practice, and future research needs to focus on what makes a nonpunitive culture to encourage reporting errors.

Keywords: drug errors, adverse events, patient safety, anesthesiology

INTRODUCTION

Medication errors are among the most common errors in medicine, leading to increased morbidity and mortality.[1] Medication errors are incorrect use of medication that causes patient harm, although the healthcare provider controls the administered medication.[2] The types of errors include wrong medication, wrong dose, dose omission, wrong administration route, and wrong administration rate.[3] Adverse events such as cardiorespiratory depression may result from medication errors, which leads to increased hospital length of stay and associated costs.[4] The World Health Organization (WHO) estimated that preventable adverse events from medication errors occurred in 6–7% of hospital admissions.[5]

In the United States of America (USA), the economic burden of medication errors was estimated to cost $20 billion a year.[3] In the United Kingdom (UK), the total cost of medication errors reached £1.1 billion a year.[6] Medication errors are among the 3 leading causes of death in the USA[7] and the top 10 causes of death worldwide.[8] In the Kingdom of Saudi Arabia (KSA), medication errors accounted for one-fifth of total errors in primary care settings alone.[9] These errors ranged from different phases of the medication process: prescribing, dispensing, and administering.[10–12] The operating theater (OT) is more critical than primary care settings.[1] The OT is a stressful and time-sensitive

environment, which carries a high risk of exposing the patient to medication errors.[13] Anesthesia clinicians prepare, administer, and monitor potent anesthetic medication without approval from the pharmacy or referral to other staff.[14,15] Studies in anesthesia had reported a high frequency of medication errors worldwide.[1,16–23] However, there is a lack of studies to address the occurrence of anesthetic medication errors in Saudi Arabia.

Literature originating from KSA investigated medication errors from different perspectives. Several studies assessed the frequency of medication errors in primary care settings.[24–28] Some described medication safety by characterizing the types of errors and their phase of occurrence during the medication process,[29] and others explored healthcare providers' knowledge about medication safety.[9] More studies have investigated the legal actions associated with medication,[30,31] and others discussed the medication incident reporting systems.[28,32] This study aimed to assess the occurrence of anesthetic medication errors in KSA. We also examined the factors contributing to anesthetic medication errors, described the incident reporting strategies, and determined the opinions of anesthesia clinicians about the preventive measures.

METHODS

Study Design and Procedure

We conducted a cross-sectional web-based survey study using a validated tool with permission from the authors.[20] After obtaining ethical approval from our institution, the survey was created by using Google Forms then distributed among anesthesiologists and anesthesia technology specialists through social media platforms: WhatsApp and Twitter. The responses were collected over 4 months between June and September 2020. The institutional review board waived the requirements to obtain informed consent; taking the survey meant that the participant agreed to participate in the study. We presented to the participants an information sheet containing the study objectives and the contact details of the principal investigator before taking the survey. We maintained the anonymity of the study participants and protected their information.

Although web-based questionnaires can be completed quickly and without cost,[33] they have certain limitations to be addressed. Selection bias is one of the main limitations, where there is no guarantee that the respondents represent the chosen population.[34] To avoid selection bias, we defined the requirements of the target population and ensured that the study objectives were clear to the participants before taking the survey. Another limitation is social desirability bias, where respondents answer less truthfully to be socially acceptable.[35] We ensured anonymity to the respondents; given the nature of web-based questionnaires (absence of the researcher), respondents were encouraged to answer more truthfully. The survey required 3–5 minutes to complete to avoid response bias—respondents lose interest and answer in a specific manner regardless of the question.[35]

Study Participants and Sampling

The target population consisted of anesthesiologists and anesthesia technology specialists from general and private hospitals in KSA. A sample size of 377 was estimated for a population of 20,000, using the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html) with a 5% margin of error and 95% confidence interval. We used convenient sampling, which means that available and willing clinicians participated in completing the survey.[34] A total of 300 anesthesia clinicians completed the questionnaire making the response rate to be 79.6%. We included anesthesia clinicians who worked in the OT and were involved in the medication preparation and administration process.

Survey Content

The survey consisted of four sections (Supplemental Material). The first section described the demographics, including the specialty, years of experience, and fields of practice besides anesthesia. The second section asked about the anesthesia profile: anesthetic medication preparation, the practice of color-coded labels, the frequency and severity of medication errors, and the causes of medication errors. The third section enquired about the reporting measures for medication errors, the frequency of auditing errors, and the factors that hinder reporting errors. The last section addressed clinicians' opinions of the preventive measures. The preventive measures included color-coded labels, reducing the daytime working hours and night shifts, restraining the drug preparation and administration to the concerned anesthesiologist, double-checking the medication, and the use of prefilled syringes. This last section was measured by using a 5-point Likert scale ranging from 5 "strongly agree" to 1 "strongly disagree" to address the level of agreement among participants.

Data Analysis

Data were analyzed with the Statistical Package for Social Science (SPSS) for Mac version 23 (IBM Corp, Armonk, NY). The findings of the descriptive statistics for nominal categorical variables are summarized as frequencies and percentages. Ordinal categorical variables (Likert Scale data) are displayed as median scores, IQR, and mean ranks. We used nonparametric tests for inferential statistics. We performed the Pearson chi-square test to examine the association between nominal variables among the two groups and the Mann-Whitney U test to analyze differences between groups. A p-value < 0.05 was considered statistically significant. We used SPSS and Microsoft Excel to generate charts.

Table 1. Demographic characteristics of the study participants ($N = 300$)

Characteristic	Participants, *n* (%)
Specialty	
Anesthesiologist	146 (48.7)
Anesthesia technology specialist	154 (51.3)
Total	300 (100)
Anesthesia practice (years)	
< 5	134 (44.7)
5–9	57 (19)
10–14	42 (14)
15–19	27 (9)
≥ 20	40 (13.3)
Workplace region	
Eastern	161 (53.7)
Central	79 (26.3)
Western	35 (11.7)
Southern	23 (7.7)
Northern	2 (0.7)
Hospital	
Governmental	271 (90.3)
Private	29 (9.7)

Table 2. Experience of anesthetic medication errors ($N = 207$)

Item	Participants, *n* (%)
Experience of drug administration error	
Anesthesiologists	
Yes	116 (56)
Anesthesia technology specialists	
Yes	91 (44)
Total	207 (100)
Approximate frequency of errors	
Few times a month	5 (2.4)
Once a month	11 (5.3)
Once every 3 months	17 (8.2)
Once a year	62 (30)
Only once to date	112 (54.1)
Time of experiencing drug errors	
Daytime	39 (18.8)
Night shift	40 (19.3)
Not related to any time of work	128 (61.9)
Experience of associated drug error adverse event (cardiac arrest, permanent neurological damage, etc)	
Yes	21 (10.2)
No	175 (84.5)
Not willing to give information	11 (5.3)

RESULTS

A total of 300 anesthesia clinicians completed the survey (146 anesthesiologists and 154 anesthesia technology specialists). Table 1 presents the demographic characteristics of the study participants. The findings show that 44.7% of respondents have had less than 5 years of experience, and 13.3% have had more than 20 years of experience. Half of the respondents (53.7%) worked in the eastern region, and the other half (46.3%) worked in other regions of KSA. Most respondents (90.3%) worked in a governmental hospital.

We asked respondents about the practice of anesthetic medication preparation and administration. It was found that loading the anesthetic drug into the syringe and administering it to the patient was regularly done by the anesthesiology consultant (56%, $n = 168$) and the anesthesia technology specialist under supervision (75.7%, $n = 227$). Most respondents (85%, $n = 255$) always read the drug name on the syringe before administering it to the patient, 12.7% ($n = 38$) read the name of the drug most of the time, and only 2% ($n = 6$) infrequently or never read the drug name. The practice of color-coded labels for syringes was used by most respondents (84.7%, $n = 254$). Table 2 presents the experience of anesthetic medication errors. Two-thirds of the total respondents (69%, $n = 207$) had committed a drug error in their practice. Half committed one error to date (54.1%, $n = 112$), and the other half (45.9%, $n = 95$) committed more than one error. For most respondents (84.5%, $n = 175$), these errors did not cause patient harm, nor were they related to a specific time of occurrence (61.9%, $n = 128$).

We conducted the chi-square test to examine the association between demographic characteristics and the occurrence of medication errors. Although there was no statistical association between specialty and the occurrence rate of errors, the test revealed that experience and the occurrence of errors were associated: Clinicians with less experience had committed more errors than clinicians with more experience (Fig. 1). (Pearson chi-square value χ^2 (4) = 12.301, $p = 0.015$). The association was moderately strong, Cramer V = 0.202. There was no association found between the occurrence of errors and the time of experiencing errors or the occurrence of major morbidities to patients.

When we asked about the labeling process of syringes, 169 respondents (56.3%) preferred to withdraw the drug then label the syringe, and 131 respondents (43.7%) preferred to label the syringe then withdraw the drug. The chi-square test discovered an association between the frequency of errors and the labeling process of

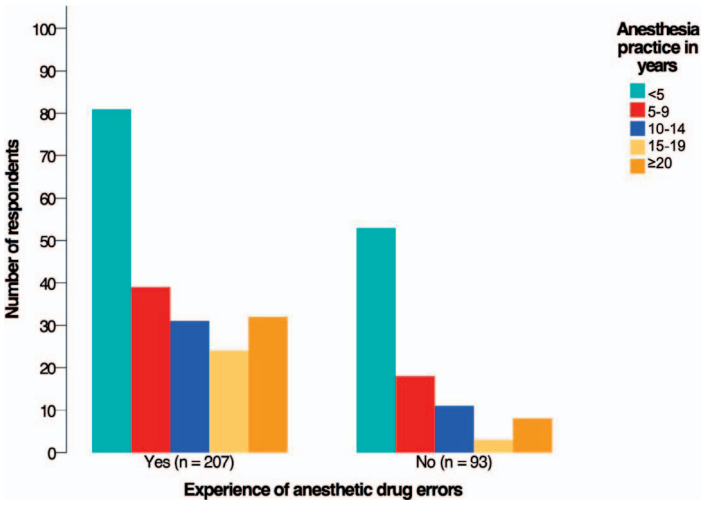

Figure 1. Association between experience and the occurrence of errors ($N = 300$).

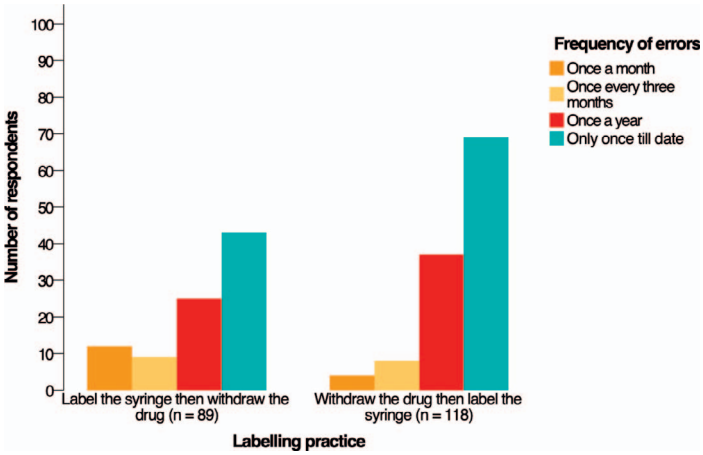

Figure 2. Association between the frequency of errors and syringe labeling practice ($N = 207$).

syringes. From the clinicians who committed errors ($n = 207$), those who labeled the syringe then withdrew the drug ($n = 89$) committed errors more frequently than those who withdrew the drug then labeled the syringe ($n = 118$) (Fig. 2) (Pearson chi-square value χ^2 (3) = 8.522, $p = 0.036$). The association was moderately strong, Cramer V = 0.203.

The factors that respondents believed had caused most errors were heavy workload and haste (60.3%, $n = 181$), followed by poor labeling of syringes (55%, $n = 165$), poor communication with peers (48%, $n = 144$), fatigue and lack of sleep (46%, $n = 138$), unfamiliarity with medication (42%, $n = 128$), inadequate experience (36%, $n = 108$), and the least reported was dependency on peers (33%, $n = 99$).

Regarding reporting medication errors, 269 respondents (89.7%) had an incident reporting system at their hospital. The remaining 31 respondents (10.3%) either reported errors to a senior anesthesiology consultant (8%, $n = 24$) or did not disclose any errors during their work experience (2.3%, $n = 7$). When we asked about the frequency of auditing errors, 146 respondents (48.7%) did not know how often their hospital audited the drug error registry. For the remaining 154 respondents (51.3%), errors were audited monthly (26.7%, $n = 80$), once every 3 months (5.7%, $n = 17$), once every 6 months (5.3%, $n = 16$), or only once a year (3.3%, $n = 10$). Most respondents (85.7%, $n = 257$) advocated having a national reporting system for anesthetic medication. Figure 3 shows the barriers to reporting medication errors, with the fear of medicolegal issues being the most reported (77.7%, $n = 233$), followed by fear of judgment (55%, $n = 165$).

We asked participants six questions to give their opinions about the preventive measures of medication errors (Fig. 4). Most respondents (82.3%) strongly agreed that the most important measure was double-checking the medication before administration and 64.3% strongly agreed with the use of color-coded syringe labels. Forty-two percent of respondents agreed that loading

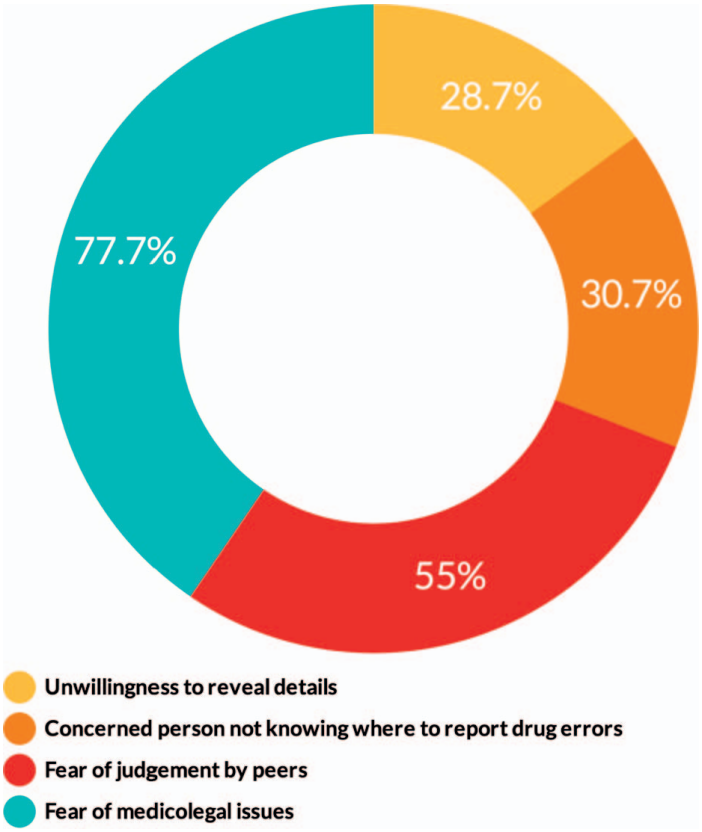

Figure 3. Barriers to reporting medication errors ($N = 300$ participants, 576 responses).

and administering the medication by the concerned anesthesiologist would reduce medication errors. Thirty-six respondents held neutral opinions about the value of using prefilled syringes to reduce medication errors. Additionally, 30% of respondents were neutral that reducing daytime working hours or night shifts would reduce errors.

We performed the Mann-Whiney *U* test to analyze the differences in the opinions between the two specialties. Distributions of the preventive measures between the two groups were similar, as assessed by visual inspection.

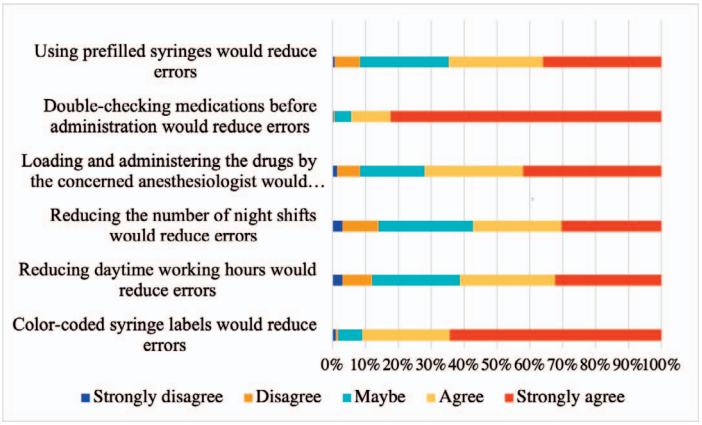

Figure 4. Preventive measures of medication errors ($N = 300$).

Table 3. Differences in the opinions of preventive measures between anesthesiologists and anesthesia technology specialists based on the results of the Mann-Whitney *U* test ($N = 300$)

Preventive Measure	Anesthesiologists ($n = 146$)	Anesthesia Technology Specialists ($n = 154$)	Mann-Whitney *U*	Z	*p*-value
Color-coded syringe labels would reduce errors					
Median (IQR)	5.00 (1)	5.00 (1)			
Mean rank	152.20	148.89	10,994.00	–0.391	0.696
Reducing daytime working hours would reduce errors					
Median (IQR)	4.00 (2)	4.00 (2)	11,076.00	–0.230	0.818
Mean rank	151.64	149.42			
Reducing the number of night shifts would reduce errors					
Median (IQR)	4.00 (2)	3.00 (1)	8065.50	–4.392	**0.006**
Mean rank	172.26	129.87			
Loading and administering the drugs by the concerned anesthesiologist would reduce errors					
Median (IQR)	5.00 (1)	4.00 (2)	7838.00	–4.802	**0.012**
Mean rank	173.82	128.40			
Double-checking medication before administration would reduce errors					
Median (IQR)	5.00 (0)	5.00 (0)	10,891.50	–0.704	0.482
Mean rank	152.90	148.22			
Using prefilled syringes would reduce errors					
Median (IQR)	4.00 (2)	4.00 (2)	11,129.50	–0.157	0.875
Mean rank	151.27	149.77			

Boldface values are statistically significant ($p < 0.05$).
Z: standardized test statistic;.

The results revealed a significant difference between the two groups in two items of the preventive measures. Anesthesiologists believed that administering the medication by the concerned anesthesiologist would reduce errors ($p = 0.012$). They also favored reducing the number of night shifts ($p = 0.006$). Table 3 presents further details about the results of the Mann-Whitney *U* test, calculating z-values and the approximate statistical significance. The differences between the groups are reported as median scores, IQR, and mean ranks.

DISCUSSION

The Occurrence of Anesthetic Medication Errors

This study aimed to assess the occurrence and causes of medication errors among anesthesia clinicians in Saudi Arabia by using a survey questionnaire. We also determined the error reporting strategies and examined clinicians' opinions of the preventive measures. Our results showed that 69% of respondents committed at least one medication error during their anesthesia practice. Several survey studies had reported the occurrence rate of anesthetic medication errors.[19,20,23,36] The occurrence was high and ranged from 70 to 95%. Nanji et al[1] conducted a prospective observational study to assess medication errors and adverse events. They observed 277 surgeries with 3671 administered drugs, and they discovered 1 error in every 20 administered drugs. It is worth noting that the reported medication errors are higher than our findings. Observational research detects a higher rate of errors owing to the presence of an expert observer,[37] whereas self-reporting survey studies underestimate the actual occurrence of errors owing to the potential of unreported or undetected errors.

In our study, less experienced clinicians made more errors than experienced clinicians. Similarly, Cooper et al[38] and Alshammari et al[29] reported that medication errors were associated with less experience. These findings suggest that clinicians become more familiar with medication management as they become more experienced. We also found that most respondents believed that medication errors had no specific time of occurrence. However, Amponash et al[22] identified more errors occurring during night shifts, and McCawley et al[18] and Erdmann et al[19] reported more errors occurring during daytime working hours. One of our key findings is that most respondents reported no patient harm resulting from medication errors, consistent with other studies.[19,20,32,36]

Factors Causing Medication Errors

Most respondents identified heavy workload and haste as the most common factors leading to medication errors. This finding builds on existing evidence of Alshammari et al[29] who reported that heavy workload was the primary cause of errors in their study and had contributed to 31.6% of 71,332 errors in 265 governmental hospitals in Saudi Arabia.

Respondents of this study cited poor labeling of syringes as the third most important factor causing medication errors following heavy workload and haste. Incorrectly labeled syringes lead to an unintentional administration of the wrong drug, known as "syringe swap."[39] Anesthesia clinicians must select the medication by reading the syringe label.[40] Nevertheless, anesthesia practice exists in an environment of multi-

tasking, and clinicians might misidentify medication while simultaneously doing other tasks.[40] Misidentifying syringes because of poor labeling is common in the literature.[41,42]

In addition to poor labeling, our respondents identified poor communication to have contributed to 48% of errors. Leonard et al[43] analyzed 2400 adverse events and found that ineffective communication contributed to 70% of them. Noise and distraction in the OT can cause poor communication among clinicians.[44] Our respondents also indicated fatigue as a contributing factor for errors. Fatigue results from a heavy workload, which reduces the ability of clinicians to make optimal decisions.[19] Salam et al[45] revealed that clinicians with heavy workloads were two times more likely to commit at least one drug error per month than clinicians with an adequate workload, although not statistically significant ($p = 0.081$).

Anesthetic Medication Preparation and Administration

This study revealed that anesthesiologists and anesthesia technology specialists were regularly involved in preparing and administering anesthetic medication. In Saudi Arabia, the anesthesiology consultants are responsible for providing anesthesia services to the patient, including anesthetic medication.[46] Anesthesia technology specialists assist the anesthesiology consultants and work under their direct supervision as competent anesthesia team members, as defined by the American Society of Anesthesia Technologists & Technicians (ASATT).[47] Most of the respondents "always" read the drug name before administration and used color-coded syringes. In contrast, Orser et al[36] found that most anesthesiologists read the drug label "most of the time," and only a few believed that reading the label was necessary to identify the drug. Another study reported that 42% of respondents admitted not reading the drug label most of the time, which is common in emergencies.[48] Some argue that anesthesia clinicians are familiar with the color of the syringe label: They use color as an indicator of the medication without reading the name.[49,50] Nevertheless, a landmark publication by Radhakrishna[51] stresses that anesthesia clinicians must always read the syringe label before use and not only rely on color.

Our findings suggested a correlation between the frequency of errors and the labeling process of medication: Labeling the syringe before withdrawing the medication had led to errors more frequently than withdrawing the medication then labeling the syringe. The literature shows conflicting views: Some encourage labeling before withdrawing medication, and some suggest that medication should be drawn up before labeling.[42] However, the National Patient Safety Agency[52] recommends filling out the syringe first, then follow it by labeling (one medication at a time) to promote the safe use of drugs. Labeling an empty syringe is never correct, and it can only be valid if the syringe is labeled after withdrawing the medication.[22] Our findings show that syringe labeling among respondents varied, suggesting a lack of standardized labeling of anesthetic medication. Standardized labeling is an essential component of patient medication safety.[53] Alkhani et al[54] reported that noncompliance with the labeling protocols in Saudi Arabia had led to many medication errors.

Reporting Medication Errors

Most respondents were aware that their hospital had an incident reporting system. However, their hospitals audited the reported errors differently, and some respondents did not know how or when errors were audited. This finding might indicate that clinicians lacked information about their hospital error-reporting policies. The findings also show that some respondents were not willing to report their errors. There is concern about this finding, but it is consistent with previous research. Alsulami et al[9] found that 44.8% of healthcare providers (62 physicians and 303 nurses) did not report a single drug error throughout their careers. It is argued that some clinicians decide not to report errors if they believed they did not cause patient harm.[9] Another study revealed that 23.9% of respondents (117 physicians) had committed medication errors, but only 6% were willing to disclose their errors.[26] Clinicians feel embarrassed, guilty, or blamed after disclosing errors, which might stop them from reporting errors.[18,32]

Some of our respondents (10.3%) said their hospital did not have a reporting system. The lack of having a clear policy is a well-known barrier to reporting errors.[55] Respondents identified the fear of medicolegal issues and judgment as the most common barriers to reporting errors. Several studies in Saudi Arabia have examined the reporting schemes of medication errors and revealed consistent findings.[17,24,30,32] AlJarallah and AlRowaiss[31] investigated 642 cases of lawsuits against healthcare providers: The OT was associated with the most cases of medication errors (20.4%). A study from the UK also discovered legal claims worth more than £4,000,000 due to anesthetic medication errors.[56] Our findings suggest that a culture of blame exists in Saudi Arabia and that medication errors might be underreported because of fear of blame and legal actions. Albalawi et al[55] indicates that clinicians would be encouraged to report errors more often if they worked in a blame-free culture.

Preventing Medication Errors

Respondents agreed that double-checking the medication and the use of color-coded syringes were essential preventive measures. Many studies presented similar results: Double-checking before withdrawing and administering medication was the most effective drug safety measure.[20,21,23] McCawley et al[18] found that in 84.4% of reported errors, a second clinician was

unavailable to double-check. However, the two-person confirmation is limited, owing to difficulty ensuring the availability of a second clinician.[16] Recently, Wu et al[57] invented a device that works as an electronic two-person confirmation. The syringe is filled out with medication and attached to the device, and then the anesthesia clinician verbally records the name and the dose of the medication. When the syringe is pulled off the device to administer the medication, automatic audio is generated to remind the anesthesia clinician of the medication name and dose. Electronic confirmation enables independent medication administration when a second clinician is unavailable.[16] Respondents advocated color-coded labels. Consistent with our findings, Gordon[21] revealed that color-coded syringes effectively reduce errors. However, some researchers had raised concerns that color-coding might cause more errors if clinicians relied on the color and neglected to read the label.[51]

Surprisingly, using prefilled syringes did not get respondents' approval: 36% were neutral about the value of prefilled syringes to reduce errors. Similarly, respondents from a previous study were uncertain about the value of prefilled syringes.[48] However, prefilled syringes could reduce errors for high-risk medication such as epinephrine and ephedrine by eliminating the potential of withdrawing the wrong medication in stressful emergency situations.[42] Anesthesiologists in our study believed that withdrawing and administering the medication by the responsible anesthesiologist would reduce errors. This finding is beneficial to avoid poor communication,[58] reported earlier by the respondents as a common cause of errors. Anesthesiologists in our study also believed that reducing night shifts would reduce errors. Fatigue, which is expected more at night, can explain this finding. It had been previously linked with the occurrence of medication errors.[55] Amponsah et al[22] found that most drug errors occurred in the afternoon (42.5%), followed by night shifts (26.4%).

Limitations

Our study has several limitations. First, survey studies rely on "self-report"— a known limitation of survey questionnaires,[34] which might have underestimated or overestimated the occurrence of medication errors. Second, the sample size was small to represent the entire population of anesthesiologists and anesthesia technology specialists in KSA, and most responses originated from the eastern and central regions, therefore limiting the generalizability of the findings. Third, 44.7% of the respondents have had less than 5 years of experience: Clinicians with more experience become more familiar with the medication process and commit fewer errors.[38] Despite these limitations, our findings show a high occurrence rate of anesthetic medication errors.

CONCLUSION

This study aimed to assess the occurrence of medication errors among anesthesia clinicians in Saudi Arabia and determined the contributing factors and preventive measures. We concluded that most anesthesia clinicians had committed at least one medication error in their career, and some have committed more than one. Experienced clinicians made fewer errors than less experienced clinicians. The respondents believed most errors were not associated with patient harm. The safety measures for medication management were generally practiced, such as always reading the drug name, double-checking the medication, and using color-coded labels. However, the labeling of syringes was not standardized among respondents. We found that clinicians who preferred labeling the syringe before withdrawing the medication made errors more frequently. Heavy workload and haste were the most reported factors to cause medication errors. The fear of legal actions and judgment by peers were the most common barriers to reporting errors. Our findings contribute to the small but growing body of literature about anesthetic medication safety in Saudi Arabia.

The findings of this study have some implications for practice. Understanding the causes of medication errors can help anesthesia clinicians and policymakers to formulate safety guidelines for anesthetic medication management, including preventive, corrective, and reporting strategies. Our findings also highlight the importance of revising and unifying the standards of syringe labeling. Although we did not ask respondents about the common anesthetic drugs associated with errors, we believe this is an important area for future research. It is also important to investigate what makes a positive and nonpunitive working culture in the OT to encourage clinicians to disclose errors frequently.

Supplemental Material

Supplemental materials are available online with the article.

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