

Knowledge, Attitude, and Behavior toward Medication Error in Saudi Arabia

Ali Mohammed Alenezi, RN, PhDs^{1*}, Omar Ghazi Baker, PhD, RN(BC)²

¹PhD Candidate, College of Nursing, King Saud University Riyadh, Kingdom of Saudi Arabia

²Professor, Department of Community, Psychiatric & Mental Health Nursing, College of Nursing, King Saud University, Riyadh, Saudi Arabia

DOI: [10.36348/sjnhc.2023.v06i09.002](https://doi.org/10.36348/sjnhc.2023.v06i09.002)

| Received: 01.08.2023 | Accepted: 06.09.2023 | Published: 13.09.2023

*Corresponding author: Ali Mohammed Alenezi, RN, PhDs

PhD Candidate, College of Nursing, King Saud University Riyadh, Kingdom of Saudi Arabia

Abstract

Medication errors are a significant cause of adverse events, with knowledge, attitudes, and behavior (KAB) being key factors. Nurses play a crucial role in the medication administration process and should be proactive in preventing medication errors. This article is based on the author's dissertation research on the influence of nurses' knowledge, attitude, and behavior toward medication errors on medication errors reported. In this article, the author focuses on the comparison of the mean ranks of KAB scores towards medication errors in relation to nurses' socio-demographic and professional characteristics. The researchers utilized a descriptive correlational design with a cross-sectional survey to examine the relationship between variables. Knowledge scores towards medication errors in relation to nurses' socio-demographic and professional characteristics show that there is no significant difference found in the mean ranks of knowledge scores across any of these characteristics. However, both attitude and behavior scores towards medication errors were significantly higher among female nurses, non-Saudi nurses, nurses with education in intravenous drug administration, and nurses of more than 40 years of age in attitude score. Knowledge influences attitude, as nurses who have a deep understanding of the subject matter are more likely to have positive attitudes towards their patients, their colleagues, and their work. Attitude, on the other hand, influences behavior. It is understood that nurses who have positive attitudes are more likely to behave in a professional and ethical manner.

Keywords: Medication Errors, Nursing, Knowledge, Attitude, behavior.

Copyright © 2023 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Patient safety is an essential health concern that is being reviewed and audited in an effort to reduce medical risks and malpractices, thereby reducing hospital morbidity and mortality. Patient Safety, as defined by the World Health Organization, is a discipline that seeks to prevent and reduce risks, errors, and patient harm during healthcare provision ("Patient Safety", 2019). Medication errors are among the leading causes of adverse events, with insufficient knowledge and training of nurses contributing to their occurrence. Inappropriate professional behavior, such as inadequate handwashing, can also result in medication errors ("Patient Safety", 2019).

On the other hand, medication errors are under-reported globally and especially in developing countries (Kapborg & Svennson 1999; Mrayyan *et al.*, 2007), which may indicate problems in the healthcare

sector (Moore 1998, Hume 1999, Anderson 2003). In Saudi Arabia, reporting medication errors may be challenging. Alshammari *et al.*, in their study "Medication Error Concept and Reporting Practices in Saudi Arabia: A Multiregional Study Among Healthcare Professionals" (2019) stat that only 44.8% of medication errors were reported in Saudi Arabia. Another study by Alandajani *et al.*, in 2022, shows that only 41.2% of nurses in Jeddah, Saudi Arabia, reported medication errors. The most common cause for not reporting errors in their study was fear of blame, with 23.5% of nurses. However, nurses are typically the first line of defense against drug errors (Aiken *et al.*, 2002, Benjamin 2003). Nurses play a vital role in the medication administration process. Therefore, they should be proactive in preventing medication errors.

In order to increase nurses' involvement in preventing medication errors, health care systems must

be reformed, as compared to maintaining the current traditional systems in which individuals are punished for prescription errors. Increasingly prevalent in developing countries (Board of Nurse Examiners, 2001) are such measures. For the purposes of this study, the researchers examined the knowledge, attitudes, and behaviors of Madinah nurses regarding medication errors, as well as their influence on medication error reporting.

LITERATURE REVIEW

Medication errors are a significant global problem resulting in patient harm and mortality, and they cause a significant threat to the healthcare system (BagheriNesami *et al.*, 2015). In the United States, between 7,000 and 9,000 individuals die annually as a result of medication errors, and hundreds of thousands more suffer complications (Tariq *et al.*, 2023). It is estimated that treatment of patients with medication-related errors costs \$40 billion annually (Tariq *et al.*, 2023).

One of the studies by Gianneta *et al.*, (2021) was aimed to determine the level of agreement among 1383 intensive care unit nurses regarding medication error prevention strategies and to identify potential predictors of nurses' knowledge, attitude, and behavior. The results indicated that adequate knowledge significantly improves behavior, whereas positive attitudes predict nurses' appropriate behavior.

In another study, Gianneta *et al.*, (2020) found that 83 percent of participants agreed that knowledge of medication calculation, in addition to guidelines, protocols, and procedures, helps to reduce errors. Additionally, 67.9% agreed that medication errors may occur due to noise and alarms, and 66% agreed that the hypothetical implementation of computerized provider order entry (CPOE) could decrease medication errors.

A study by Di Simone *et al.*, (2018) surveyed 103 nurses at a university hospital in Rome and found that 77% of the sample believed that drug dosage calculation skills were crucial for preventing medication errors during drug preparation. In addition, 59.6% of the sample believed that electronic prescriptions would reduce errors in the preparation of medications.

In Jordan, 81.6% of ICU nurses believed that IV medication dosage calculation reduced medication errors, according to a cross-sectional and correlational study. Moreover, 79.6% of respondents agreed that the presence of instructive protocols, posters, and brochures in the department decreased the likelihood of error (Hamdan *et al.*, 2022).

In Gianneta *et al.*'s (2020) study, nurses showed a positive attitude toward nursing education, worker motivation, clinical skills regarding the safe management of drug therapy, and reporting of

medication errors. However, a statistically significant correlation was found between nurses who spent more time on education and training and the use of vital parameter monitoring during the administration of vasoactive medications.

Approximately 95% of respondents viewed specific and systematic training as crucial for reducing error risk, with protocols and procedures being crucial for influencing worker behavior (Dougherty *et al.*, 2011; Berdot *et al.*, 2016). To be specific, Varndell *et al.*, (2015). 81.1% of ICU nurses believed that clinical skills associated with the safe preparation and administration of medication should be assessed frequently, and 77% agreed that continuous training on the safe management of IV medications could reduce the likelihood of errors (Hamdan *et al.*, 2022).

The attitudes of nurses toward medication administration were positively correlated with their English proficiency, workplace library availability, gender, and IV medication administration training following graduation (Hamdan *et al.*, 2022). Higher behavior scores were observed among nurses without a workplace library, female nurses, and those who had not received IV medication training after graduation (Hamdan *et al.*, 2022). Postgraduate courses on IV medication preparation and administration led to a significant improvement in positive attitudes (Hamdan *et al.*, 2022).

Study Design and Setting

This study utilized a descriptive correlational design with a cross-sectional survey to examine the relationship between two or more variables. The study was conducted in Madinah, Saudi Arabia. Madinah, a city with a population of over 2 million and known as the "cradle of Islamic culture and civilization". It is considered the second holiest of the three cities in Islamic tradition (Lammens, 2013). Health care services in this city are provided not only to Madinah citizens but also to visitors from all around the world. In 2018, more than seven million visitors participated in Umrah, with most staying in Madinah before traveling to Makkah or vice versa (Open Data Library, 2018). Therefore, the hospitals in Madinah received a huge number of patients with a variety of ethnicities and age groups.

Study Sample

In this study, the accessible population is comprised of bedside nurses working in four government hospitals in Madinah. Participants must be registered nurses in Saudi Arabia, have valid registration, be able to read, write, and comprehend the English language, and have direct contact with patients and medication preparation. Exclusion criteria include nurses participating in the pilot study and nurses on leave or annual vacation.

To ensure a sufficient number of participants and minimize the risk of attrition, this study used nonprobability sampling strategies through the convenience sampling method.

In this study, the target population includes nurses in four government hospitals in Madinah, with approximately 2605 nurses in total. The required sample size is 335, based on the calculation.

Ethical Considerations

The study received approval from King Saud University's Nursing College, then another approval from the Institutional Review Board (IRB), Madinah Health Cluster, for the designated hospitals. An explanation was provided to all nurses, and consent was obtained with a clear statement that participants are kept anonymous, and the research results might be published, but their identities will never be revealed. Furthermore, there will be no penalties or loss of benefits imposed for refusal.

Data Collection and Management

This study is part of a PhD thesis that utilized a self-administered questionnaire consisting of 50 questions to examine nurses' knowledge, attitudes, and behaviors towards medication errors in Madinah, Saudi Arabia. The questionnaire was designed to identify demographic variables that may influence medication error reporting. The first section included instructions and consent for participation, while the second section included eleven items from the demographic profile.

The third, fourth, and fifth sections described knowledge, attitudes, and behaviors toward medication errors, respectively, with a total of 19 items. The tool in this section was first used in the Italian version (Di Muzio *et al.*, 2017; Di Muzio *et al.*, 2016), then translated to English and validated, showing satisfactory internal validity with the highest Cronbach's alpha value of 0.779. The last section included 20 items addressing the percentage of each form of medication error reported in their departments. The Medication Administration Error Reporting Survey (MAERS) was

developed in 1993 and has been used in several studies to assess nurses' perceptions of MAEs (Wakefield *et al.*, 2005).

In this research, 30 nurses were surveyed as a pilot study. The Cronbach's alpha is (0.938), indicating high internal consistency, reliability, and readiness for data collection. Participants were asked if they experienced any challenges with the questionnaire, and the questionnaires took between 10 and 15 minutes to complete. The study was conducted with the same commitment to detail as the main trial, including adherence to ethical considerations. Data collection procedures involved an official letter from King Saud University and the Madinah Health Cluster. The data was collected through an electronic self-administered questionnaire built electronically on Google Form and distributed in the form of a poster with a barcode at each nursing station in the target area. The data entry stage began after all questionnaires were gathered, and the researchers verified the accuracy of the coded and entered questionnaires to enhance the quality of the data analysis.

Data Analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 26.0 software (IBM Inc., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, median and inter quartile range) were used to describe the categorical and skewed quantitative variables.

RESULTS

The study displays in Table 1 the median, interquartile range, mean ranks, and comparison of mean ranks of knowledge scores towards medication errors in relation to adult nurses' socio-demographic and professional characteristics. No significant difference was found in the mean ranks of knowledge scores across any of these characteristics, indicating that sociodemographic and professional characteristics do not have a significant effect on their knowledge scores regarding medication errors.

Table 1: Comparison of mean ranks of knowledge scores towards medication errors in relation to Socio-demographic and professional characteristics of nurses

Characteristics	Median (IQR)	Mean Ranks	p-value
<u>Age groups (in years)</u>			
20-30	4.07(0.71)	80.85	0.197
31-40	4.14(0.79)	91.79	
>40	4.28(0.86)	102.22	
<u>Gender</u>			
Male	4.28(1.1)	94.03	0.960
Female	4.14(0.71)	94.58	
<u>Nationality</u>			
Saudi	4.14(1.4)	84.98	0.137
Non-Saudi	4.14(0.71)	98.14	
<u>Educational status</u>			
Diploma	4.14(0.86)	84.85	0.520

Characteristics	Median (IQR)	Mean Ranks	p-value
Bachelor	4.14(0.71)	95.15	
Post Graduate	4.28(0.71)	101.93	
<u>Work experience (in years)</u>			
1-5	4.21(0.86)	91.73	0.594
6-10	4.14(0.64)	87.97	
>10	4.28(0.86)	97.34	
<u>Education of administration of IV drugs during nursing study</u>			
Yes	4.14(0.71)	95.32	0.405
No	4.0(2.0)	81.27	
<u>Education of administration of IV drugs during work</u>			
Yes	4.14(0.71)	95.85	0.248
No	4.0(1.57)	78.97	
<u>Knowledge of English language</u>			
Intermediate	3.71(2.1)	68.03	
Good	4.14(0.71)	96.08	0.104
Excellent	4.28(0.86)	98.44	
<u>Availability of Library in workplace</u>			
Yes	4.14(0.71)	92.15	
No	4.28(0.75)	98.12	0.461
<u>Hours per week to CME</u>			
None	4.28(1.18)	95.36	
< 1 hour	4.14(0.71)	94.10	0.765
1-3 hours	4.14(0.71)	91.30	
>3 hours	4.28(0.86)	105.55	

Among the socio-demographic and professional characteristics of nurses, a statistically significant difference in the mean ranks of attitude scores towards medication errors was observed for the age groups, gender, nationality, and education of administration of IV drugs during work. That is, among the three age groups, the mean ranks of attitude scores of the age group > 40 years is statistically significantly higher when compared with the mean ranks of attitude scores of the other two age groups (20–30 and 31–40) ($p = 0.015$), which indicates the attitude scores are significantly higher among nurses of > 40 years of age. And female nurses have significantly higher attitude

scores towards medication errors when compared with male nurses ($p = 0.042$). For the nationality of nurses, Non-Saudi nurses have significantly higher attitude scores towards medication errors when compared with Saudi nurses ($p = 0.001$). And the nurses who had education in the administration of IV drugs during work had significantly higher attitude scores towards medication errors when compared with those nurses who did not have education in the administration of IV drugs ($p = 0.036$). The remaining characteristics do not have any effect on the nurse's attitude scores towards medication errors (Table 2).

Table 2: Comparison of mean ranks of Attitude scores towards medication errors in relation to Socio-demographic and professional characteristics of nurses

Characteristics	Median (IQR)	Mean Ranks	p-value
<u>Age groups (in years)</u>			
20-30	4.36(1.29)	84.33	0.015
31-40	4.43(1.00)	85.65	
>40	4.71(0.86)	108.56	
<u>Gender</u>			
Male	4.28(0.86)	75.88	0.042
Female	4.57(1.0)	97.90	
<u>Nationality</u>			
Saudi	4.07(1.3)	73.13	0.001
Non-Saudi	4.57(0.86)	102.67	
<u>Educational status</u>			
Diploma	4.42(1.0)	85.50	0.464
Bachelor	4.57(1.0)	97.41	
Post Graduate	4.57(0.71)	87.63	
<u>Work experience (in years)</u>			
1-5	4.43(1.75)	86.70	0.064
6-10	4.57(0.93)	93.78	

Characteristics	Median (IQR)	Mean Ranks	p-value
>10	4.57(1.0)	96.03	
<u>Education of administration of IV drugs during nursing study</u>			
Yes	4.57(1.0)	95.88	0.158
No	4.14(1.71)	72.32	
<u>Education of administration of IV drugs during work</u>			
Yes	4.57(1.0)	96.92	0.036
No	4.0(1.71)	66.63	
<u>Knowledge of English language</u>			
Intermediate	4.14(1.71)	80.97	
Good	4.57(0.86)	93.21	0.427
Excellent	4.57(1.0)	99.14	
<u>Availability of Library in workplace</u>			
Yes	4.50(1.0)	95.00	
No	4.57(0.89)	93.74	0.875
<u>Hours per week to CME</u>			
None	4.50(0.89)	91.41	
< 1 hour	4.42(1.0)	93.73	0.953
1-3 hours	4.57(1.0)	95.18	
>3 hours	4.71(1.0)	99.57	

For the behavior scores towards medication errors among the nurses shown in Table 3, only three characteristics (gender, nationality, and education in the administration of IV drugs during work) are statistically significant. That is, female adult nurses have significantly higher behavior scores towards medication errors when compared with male adult nurses ($p = 0.020$). For the nationality of adult nurses, non-Saudi adult nurses have significantly higher behavior scores

towards medication errors when compared with Saudi adult nurses ($p < 0.001$). And the adult nurses who had education in the administration of IV drugs during work had significantly higher behavior scores towards medication errors when compared with those adult nurses who did not have education in the administration of IV drugs during work ($p = 0.004$). The remaining characteristics do not have any effect on the adult nurse's behavior scores towards medication errors.

Table 3: Comparison of mean ranks of Behavior scores towards medication errors in relation to Socio-demographic and professional characteristics of nurses

Characteristics	Median (IQR)	Mean Ranks	p-value
<u>Age groups (in years)</u>			
20-30	5.0(0.75)	91.25	0.136
31-40	5.0(0.40)	88.26	
>40	5.0(0.20)	103.14	
<u>Gender</u>			
Male	4.60(0.90)	75.31	0.020
Female	5.0(0.20)	98.00	
<u>Nationality</u>			
Saudi	4.70(1.0)	71.13	<0.001
Non-Saudi	5.0(0.20)	103.44	
<u>Educational status</u>			
Diploma	5.0(0.60)	87.33	0.077
Bachelor	5.0(0.20)	98.96	
Post Graduate	4.80(0.60)	76.13	
<u>Work experience (in years)</u>			
1-5	5.0(0.35)	100.33	0.064
6-10	4.80(0.60)	79.83	
>10	5.0(0.20)	98.92	
<u>Education of administration of IV drugs during nursing study</u>			
Yes	5.0(0.40)	95.40	0.306
No	4.80(0.60)	80.05	
<u>Education of administration of IV drugs during work</u>			
Yes	5.0(0.20)	97.48	0.004
No	4.40(1.40)	60.13	
<u>Knowledge of English language</u>			
Intermediate	4.80(0.80)	78.50	0.337

Characteristics	Median (IQR)	Mean Ranks	p-value
Good	5.0(0.40)	94.96	
Excellent	5.0(0.20)	97.51	
<u>Availability of Library in workplace</u>			
Yes	5.0(0.20)	99.59	0.072
No	5.0(0.40)	86.66	
<u>Hours per week to CME</u>			
None	5.0(0.40)	96.11	0.983
< 1 hour	5.0(0.40)	95.39	
1-3 hours	5.0(0.40)	92.80	
>3 hours	5.0(0.30)	95.52	

DISCUSSION

There was no significant difference in knowledge scores towards medication errors among adult nurses across socio-demographic and professional characteristics. However, adult nurses aged > 40 years had significantly higher attitude scores compared to other age groups, possibly due to their experience and knowledge gained. Female nurses had significantly higher attitude scores towards medication errors compared to male nurses, and Non-Saudi adult nurses had significantly higher attitude scores towards medication errors compared to Saudi adult nurses. That might give future researchers insight to go through the influence of social life and lifestyle between local and expat nurses.

Similar to this study is the study of Gianneta *et al.*'s (2020), as it showed a positive attitude toward nursing education. In addition, another study shows that 77% agreed that continuous training on the safe management of IV medications could reduce the likelihood of errors, and About 81.6% of the ICU nurses considered dosage calculation of intravenous drugs to reduce preparation errors (Hamdan *et al.*, 2022). That might give future researchers insight to go through the influence of social life and live style between local and expat nurses. Nurses with IV drug administration education had significantly higher attitude scores towards medication errors compared to those without. This could prompt universities to review medication administration curriculum.

On the other hand, Behavior scores towards medication errors among nurses were also statistically significant. Female nurses had significantly higher behavior scores towards medication errors compared to male nurses and Non-Saudi nurses had significantly higher behavior scores towards medication errors compared to Saudi nurses. Further research on this part might give more explanation for this.

Implications and Recommendations of Findings

It is important for patients' safety to improve the nurse's environment to reduce medication errors by identifying factors that influence the knowledge, attitude, and behavior of nurses. Therefore, leaders should develop strategies to encourage nurses to report

medication errors, as they are more likely to report errors if they believe it will improve patient safety.

In addition, nursing education is crucial for the nursing profession, and this study highlights the need for more education about medication errors. Factors such as educational status and IV drug administration knowledge can improve reporting rates and decrease medication errors. Universities should modify their nursing curriculum to cover the field's needs.

However, further studies on nurses' socio-demographic and professional characteristics and their relation to nurses KAB toward medication might show more findings. On the other hand, further studies on how to explain this study's findings will be very valuable, such as understanding the influence of social life or lifestyle, which shows significantly higher scores among female nurses and non-Saudi nurses.

CONCLUSION

Both attitude and behavior scores towards medication errors were significantly higher among female nurses, non-Saudi nurses, nurses with education in IV drug administration, and nurses over 40 years of age.

Furthermore, knowledge influences attitude, as nurses who have a deep understanding of the subject matter are more likely to have positive attitudes towards their patients, their colleagues, and their work. Attitude, on the other hand, influences behavior. It is understood that nurses who have positive attitudes are more likely to behave in a professional and ethical manner. Lastly, behavior influences patient outcomes. Nurses who behave in a professional and ethical manner are more likely to provide quality care, which can lead to improved patient outcomes.

Declarations

Ethical approval

Approval from King Saud University's Nursing College, then another approval from the Institutional Review Board (IRB), Madinah Health Cluster, was obtained and shared with the designated hospitals.

Funding: There is no fund for this research.

Informed Consent Statement

All participants were provided with an explanation of the study and an approval consent, which explained their right to participate in the study and that there would be no penalty or loss of benefits if they chose not to participate. It was also clearly stated that participants would be kept anonymous, confidentiality would be granted, and that the results of the research may be published, but their identities would never be revealed.

Acknowledgements

The authors are thankful to all the participants for their time and effort in participating in this study.

REFERENCES

- Aiken L., Clarke S., Sloane D., Sochalski J. & Silber J. (2002) Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA*, 288(16), 1987–1993.
- Alandajani, A., Khalid, B., Ng, Y. G., & Banakhar, M. (2022, December 16). Knowledge and Attitudes Regarding Medication Errors among Nurses: A Cross-Sectional Study in Major Jeddah Hospitals. *Nursing Reports*, 12(4), 1023–1039. <https://doi.org/10.3390/nursrep12040098>
- Alenezi, A. M. (2023). Influence of Nurses' Knowledge, Attitude, and Behavior Toward Medication Errors on Medication Error Reported [Doctoral dissertation]. King Saud University, Saudi Arabia.
- Alshammari, F. M., Alanazi, E. J., Alanazi, A. M., Alturifi, A. K., & Alshammari, T. M. (2021). Medication Error Concept and Reporting Practices in Saudi Arabia: A Multiregional Study Among Healthcare Professionals. *Risk management and healthcare policy*, 14, 2395–2406. <https://doi.org/10.2147/RMHP.S281154>
- Anderson, J. G. (2003). A systems approach to preventing adverse drug events. *Studies in Health Technology and Informatics*, 92, 95–102.
- BagheriNesami, M., Esmaili, R., & Tajari, M. (2015). Intravenous Medication Administration Errors and their Causes in Cardiac Critical Care Units in Iran. *Materia Socio Medica*, 27(6), 442. <https://doi.org/10.5455/msm.2015.27.442-446>
- Benjamin, D. M. (2003). Reducing medication errors and increasing patient safety: case studies in clinical pharmacology. *Journal of Clinical Pharmacology*, 43, 768–783.
- Berdot, S., Roudot, M., Schramm, C., Katsahian, S., Durieux, P., & Sabatier, B. (2016). Interventions to reduce nurses' medication administration errors in inpatient settings: A systematic review and meta-analysis. *International Journal of Nursing Studies*, 53, 342–350. <https://doi.org/10.1016/j.ijnurstu.2015.08.012>
- Board of Nurse Examiners. (2001) Medication Errors. Available at: <http://www.bne.state.tx.us/gen-apn.htm>, accessed on 29 January 2006.
- Di Muzio, M., De Vito, C., Tartaglino, D., & Villari, P. (2017). Knowledge, behaviors, training and attitudes of nurses during preparation and administration of intravenous medications in intensive care units (ICU). A multicenter Italian study. *Applied Nursing Research*, 38, 129–133. <https://doi.org/10.1016/j.apnr.2017.10.002>
- Di Muzio, M., Marzuillo, C., De Vito, C., La Torre, G., & Tartaglino, D. (2016). Knowledge, attitudes, behaviour and training needs of ICU nurses on medication errors in the use of IV drugs: a pilot study. *Signa Vitae*, 11(1), 182. <https://doi.org/10.22514/sv111.052016.13>
- Di Simone, E., Giannetta, N., Auddino, F., Cicotto, A., Grilli, D., & Di Muzio, M. (2018). Medication errors in the emergency department: Knowledge, attitude, behavior, and training needs of Nurses. *Indian Journal of Critical Care Medicine*, 22(5), 346–352. https://doi.org/10.4103/ijccm.ijccm_63_18
- Dougherty, L., Sque, M., & Crouch, R. (2011). Decision-making processes used by nurses during intravenous drug preparation and administration. *Journal of Advanced Nursing*, 68(6), 1302–1311. <https://doi.org/10.1111/j.1365-2648.2011.05838.x>
- Giannetta, N., Dionisi, S., Cassar, M., Trapani, J., Renzi, E., Di Simone, E., & Di Muzio, M. (2020). Measuring knowledge, attitudes and behavior of nurses in medication management: cross-cultural comparisons in Italy and Malta. *European Review for Medical and Pharmacological Sciences*, 24(9), 5167–5175. https://doi-org.sdl.idm.oclc.org/10.26355/eurrev_202005_212_12
- Giannetta, N., Dionisi, S., Stievano, A., Eltaybani, S., Abdelgawad, M. E., Katigri, M. R., Azadboni, T. T., López-Soto, P. J., Morales-Cané, I., Ali, I., Urban, J., Shrestha, S., Christensen, M., Voutilainen, A., Vaajoki, A., Hamdan, K., Rubicini, G., Rivera Pizarro, J. Y., Liquori, G., ... Di Muzio, M. (2021). Comparison across 12 countries on knowledge, attitude, and behavior scores about medication errors in Intensive Care Units: an international study. *European Review for Medical and Pharmacological Sciences*, 25(23), 7223–7230. https://doi-org.sdl.idm.oclc.org/10.26355/eurrev_202112_27415
- Hamdan, K. M., Albqoor, M. A., & Shaheen, A. M. (2022). Intravenous medication errors among ICU nurses: Differences in knowledge attitudes and behavior. *The Open Nursing Journal*, 16(1). <https://doi.org/10.2174/18744346-v16-e2206201>
- Hume M. (1999). Changing hospital culture and systems reduces drug errors and adverse events. *The Quality Letter for Healthcare Leaders*, 11(3), 2–9.
- Kapborg I. & Svennson H. (1999). The nurse's role in drug handling within municipal health and medical care. *Journal of Advanced Nursing*, 30(4), 950–957.
- Lammens, H. (2013, January 1). Islam: Beliefs and Institutions.

- Moore J. D. (1998) Getting the whole story: the way medication errors are reported affects the results. *Modern Healthcare*, 46, 21–28.
- Mrayyan, M. T., Shishani, K., & Al-Faouri, I. (2007, September). Rate, causes and reporting of medication errors in Jordan: nurses' perspectives. *Journal of Nursing Management*, 15(6), 659–670. <https://doi.org/10.1111/j.1365-2834.2007.00724.x>
- Open Data Library. (2018). Ministry of Hajj and Umrah. Retrieved May 14, 2023, from <https://www.haj.gov.sa/OpenResources>
- Patient Safety. (2019). Retrieved 16 October 2020, from <https://www.who.int/news-room/fact-sheets/detail/patient-safety>.
- Tariq, R. A., Vashisht, R., Sinha, A., & Scherbak, Y. (2023, February 26). Medication Dispensing Errors and Prevention - StatPearls - NCBI Bookshelf. Medication Dispensing Errors and Prevention - StatPearls - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK519065/#:~:text=Each%20year%2C%20in%20the%20Unit> ed, reaction%20or%20other%20medication%20complications
- Varndell, W., Elliott, D., & Fry, M. (2015). Assessing, monitoring and managing continuous intravenous sedation for critically ill adult patients and implications for emergency nursing practice: A systematic literature review. *Australasian Emergency Nursing Journal*, 18(2), 59–67. <https://doi.org/10.1016/j.aenj.2014.08.002>
- Wakefield, Tanya Uden-Holman, Douglas S. Wakefield, B. J., Wakefield, B. J., Uden-Holman, T., & Wakefield, D. S. (2005, February 1). Development and Validation of the Medication Administration Error Reporting Survey - Advances in Patient Safety: From Research to Implementation (Volume 4: Programs, Tools, and Products) - NCBI Bookshelf. Development and Validation of the Medication Administration Error Reporting Survey - Advances in Patient Safety: From Research to Implementation (Volume 4: Programs, Tools, and Products) - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK20599/#A8296>