Nurses' Knowledge and Practice Regarding Preventive Guidelines for Medication Errors

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ABSTRACT

Background: Nurses can play a paramount role in raising awareness about significance of medication safety and promoting continuous monitoring of potential medication errors, both of which can help lower the occurrence of medication errors and improve healthcare standards. **Aim:** This study aimed to evaluate nurses' knowledge and practice regarding preventive guidelines for medication errors. **Research design:** A descriptive exploratory design was utilized to conduct the study. **Setting:** This study was carried out in the intensive care unit at Beni-Suef University Hospital. **Subjects:** A convenience sample of all available nurses (50 nurses) who were providing care for critically ill patients in the previously mentioned setting. **Tools for Data Collection:** Two tools were used. Self-administered Questionnaire consists of two parts: Part I: Nurses' Demographic Characteristics, Part II: Nurses' Knowledge Questionnaire, and Tool II: Nurses' Observational Checklist. **Result:** This study revealed that 58% of the studied nurses had an unsatisfactory knowledge level, and 66% of them had an incompetent practice level regarding preventive guidelines for medication errors. Additionally, there was a statistically significant relationship between the total knowledge of the nurses studied and their years of experience. Also, there was a statistically significant relationship between the total practices of the nurses who were studied and their level of education and training courses. **Conclusion:** There was a positive correlation between total knowledge and total practices among the studied nurses. **Recommendations:** Implement educational programs about medication error prevention based on the nurses' actual need assessment.

Keywords: Knowledge, Medication errors, Nurses, Preventive guidelines, Practices.

INTRODUCTION

Several variables impact the secure administration of medication. There are differing opinions regarding the ability of registered nurses (RNs) to manage medication errors effectively. Some argue that RNs may lack the necessary knowledge and skills, while others attribute medication errors to factors such as normalization of risky behavior, interruptions, design flaws, use of technology, time constraints, lack of leadership, poor communication, and outdated policies and guidelines (**Odberg et al., 2019**).

Medication errors (MEs) happen when a patient or healthcare professional administers a medication incorrectly, which can have

major repercussions, like incorrect dosage or negative side effects. Any stage of the pharmaceutical usage process, including prescription, transcription, dispensing, and administration, is susceptible to medication mistakes (MEs). Prescription and drug administration are the phases most frequently associated with mistakes **(Aseeri et al., 2020).**

The etiology of medication errors (MEs) has been determined and may encompass factors such as indecipherable penmanship, excessive work demands, mislabeling, interruptions, and distractions encountered by healthcare practitioners during the process of prescribing and administering drugs, as well as incorrect drug calculations. It is essential to establish organizational policies and stratiges to prevent medication errors (MEs). These procedures should be implemented at every stage of the drug delivery process. Furthermore, it is important to promote the timely reporting of any medical errors that have taken place **(Rababah et al., 2022).**

Moreover, electronic prescribing serves as a valuable tool in mitigating errors caused by illegible handwriting and incomplete prescriptions. By utilizing the mandatory fields in electronic prescribing, the completeness of the prescription is guaranteed. Bar coding is a potential technology that can be employed to prevent medication errors (MEs). Implementing bar coding during the dispensing phase has been shown to decrease incorrect MEs, reduce wrong dose errors, and eliminate incorrect dosage form errors **(Schroers et al., 2021).**

Ensuring the safe administration of any medication necessitates the accurate prescription of the correct medication, followed by its correct dispensation in the appropriate form and dosage. Furthermore, it requires the accurate preparation and administration of the medication at the correct times and doses to the appropriate individual, using the correct route. The intricate nature of this process and the wide range of health professionals involved result in numerous possibilities for error **(Afaya et al., 2021).**

Finding and fixing the causes of nursing mistakes in medicine administration is critical for better healthcare delivery. Essential steps include standardizing protocols, following the five rights, communicating effectively, informing patients about their medications, following strict guidelines, improving labeling practices, creating a work environment that prioritizes reporting errors, reducing workload, minimizing distractions, creating a culture that encourages reporting errors, ensuring managerial support for reporting procedures, and raising awareness about the significance of reporting errors. **(Alandajani et al., 2022).**

Physicians have the duty of prescribing medications, while pharmacists have the duty of dispensing and storing medications. Nurses, on the other hand, are in charge of carrying out the last stage of giving such drugs. Consequently, all healthcare practitioners have the potential to make mistakes when it comes to administering medication, and nurses are the last link in this process. Therefore, adhering to proper nursing protocols ensured the implementation of the most effective strategies to minimize the occurrence of medical errors. Therefore, nurses play crucial roles in their actions to enhance safety and predict harm to patients **(Härkänen et al., 2019).**

To mitigate medication errors and enhance healthcare standards, nurses can assume the role of advocates for ongoing monitoring of potential medication errors and educate others about the significance of medication awareness. The nursing management of medication errors is a crucial component of the healthcare system, considering the widespread occurrence and consistent nature of errors that can happen in a hospital environment. The continuous surveillance of medications from initiation to completion and the participation of nursing personnel may potentially influence the decrease in potential medication mistakes that can occur in any healthcare environment *(Wondmieneh et al., 2020).*

Significance of the study

Data on the prevalence of medication errors in Egypt is still lacking. Errors involving equipment or devices accounted for 29.94% of all events, with errors involving treatments or medications coming in a close second at 29.68%. Out of all the incidents, 43.20 percent were classified as adverse events, 5.92 percent as sentinel events, and 0.222 percent as intentionally unsafe acts. Another thing that the reporters couldn't figure out was that 0.481% of the incidents. Medication errors (28.34%), education/training (28.26%), and communication problems (27.82%) were the main factors that contributed most often. In 2.94 percent of incidents, patients were seriously injured; in 4.528 percent, they died; and in 25.259 percent, they suffered only minor injuries. *(ELMeneza & AbuShady, 2020).*

AIM OF THE STUDY

This study aimed to evaluate nurses' knowledge and practice regarding preventive guidelines for medication errors through the following:

1. Evaluate level of nurses' knowledge regarding preventive guidelines for medication errors.

2. Monitor level of nurses' practice regarding preventive guidelines for medication errors.

Research questions

1. What is nurses' level of knowledge regarding preventive guidelines for medication errors?

2. What is nurses' level of practice regarding preventive guidelines for medication errors?

3. Is there any relation between nurses' knowledge and their characteristics?

4. Is there any relation between nurses' practices and their characteristics?

SUBJECTS AND METHODS

Subject and Methods of the study have been portrayed under four main topics as follows:

1_Technical item.

2- Operational item.

3- Administrative item.

4- Statistical item.

I- Technical Item:

Technical items include research design, setting, subject, and tools for data collection.

Research design:

A descriptive exploratory research design was used in this study.

Setting:

The present study took place in the intensive care unit (ICU) on the second floor of Beni Suef University Hospital, which comprises three rooms with a total of nineteen beds each.

Subjects:

A convenience sample of 50 nurses who were providing care for critically ill patients in the previously mentioned setting. The nurses possessed diverse qualifications and varying years of experience, and they represented both genders.

Tools of data collection:

Data were collected using the following tools:

Tool I: Self-Administered Interviewing Questionnaire

The researcher developed this questionnaire by conducting a thorough review of relevant literature. The questionnaire is written in plain Arabic and is divided into two sections:

Part I: Nurses' Demographic Characteristics: -

It was concerned with the demographic characteristics of the studied nurses, which include age, gender, marital status, educational level, years of experience in the critical care unit (ICU & CCU), and training courses on preventive guidelines for medication errors.

Part II: Nurses Knowledge Questionnaire

This tool was adapted from *(You et al., 2015)* and was used to assess nurses' knowledge regarding preventive guidelines for medication errors. It consists of (59) questions and reflecting (4) parts:

Part 1: Definition of medication errors questions **(2 items with two scores)**.

Part 2: Causes of medication errors **(27 items with 27 scores)**.

Part 3: Types of medication errors, which included types of medication errors given intravenously and types of medication errors given by methods other than intravenous (intramuscular, subcutaneous, oral, inhalation.etc.) **(15 items with 15 scores)**.

Part 4: Ways to prevent or reduce the occurrence of medication errors **(15 items with 15 scores)**.

Scoring system: Total global score of 59 questions with 59 scores were rated on two Likert scales (incorrect Zero and correct = 1). These scores were summed and converted into a percent score. It was classified into two categories according to the following:

> ➢ Satisfactory knowledge if total score ≥ 60% (≥ 35.4 scores).
> ➢ Unsatisfactory knowledge if the total score is < 60% (<35.4 scores).

Tool II: Nurses' Observational Checklist: (Appendix II)

This tool was adapted from *(Fathy et al., 2020)* and was used to assess nurses' level of practice regarding preventive guidelines for medication errors, which included three subscales.

> • The preparation phase, which included **(13 items)**.
> • During the administration phase, which included **(12 items)**.
> • Post-administration phase, which included **(5 items)**.

Scoring system: Total global score of 30 items with 60 scores were rated on three Likert scales (not done= 0, done incompletely= one, and done completely= 2). The scores were added together and then converted into a percentage. It was categorized into two groups based on the following criteria:

> ➢ Competent practice level if total score ≥ 80% (≥ 48 scores).
> ➢ Incompetent practices level if total score from < 80% (<48 scores).

II-Operational design:

The operational design encompasses several key components, including a preparatory phase, the assessment of tools' validity and reliability, conducting a pilot study, and carrying out fieldwork.

A) Preparatory phase:

The preparatory phase involved conducting a comprehensive review of relevant literature and theoretical knowledge on various aspects of the study. This was done by consulting books, articles, and online periodicals and journals. The purpose of this review was to develop tools for data collection.

B) Tool validity:

Face and content validity were confirmed by a panel consisting of three experts, specifically assistant professors of medical-surgical nursing from the Faculty of Nursing at Beni Suef University. The experts assessed the tools for their clarity, relevance, comprehensiveness, simplicity, and applicability. They made minor adjustments and finalized the forms.

Reliability:

The current study assessed the reliability of two tools: tool I part II, which measured nurses' knowledge of preventive guidelines for medication errors, had a Cronbach's Alpha coefficient of 0.858; and tool II, which was a nurses' observational checklist, had a coefficient of 0.799.

C) A pilot study:

A pilot study was conducted on a subset of the sample size, consisting of 10% (5 nurses), in order to assess the suitability,

comprehensibility, and effectiveness of the tools. Based on the findings of the pilot study, no adjustments or improvements were made, and the nurses were included in the final study sample.

D) Fieldwork:

Data were collected in the following order:

- After obtaining permission, the investigator conducted interviews with the nurses. The purpose of the study was explained, and their oral consent to participate and cooperate in the study was obtained.

- The data collection process spanned six months, commencing in June 2023 and concluding in November 2023.

- The investigator collected data during interviews with nurses, two days per week, during both morning and afternoon shifts in the previously mentioned settings.

- The self-administered questionnaire was distributed to the nurses who were being studied at their place of work. Each questionnaire required approximately 15 to 20 minutes to complete. The investigator evaluated the nurses' practices by employing an observational checklist. One to three nurses were observed providing care for critically ill patients during their work shifts.

Ethical Considerations:

Before the study began, the Faculty Scientific Ethical Committee gave their approval. Prior to beginning the study, the investigator made sure that all of the participating nurses understood its purpose and objectives. All nurses who participated in the study were guaranteed complete anonymity by the investigator. Participating nurses were made aware that they were under no obligation to continue participating in the study and could discontinue their involvement at any moment for any reason.

III-Administrative design:

Official letters issued by Beni Suef University's dean of the nursing faculty were submitted to the general manager of Beni Suef University Hospital in order to obtain official permission. Included in the description were the study's title and purpose, key data points, and anticipated results.

4) **Statistical design**

Summaries and tabulations of the data were created by utilizing descriptive statistics, specifically means and standard deviations, to assess dispersion. For the statistical analysis of the data, we utilized SPSS, version 26. This software includes the test of significance that is found in standard statistical books. Percentages were used to represent qualitative data. To compare proportions between qualitative parameters, we used the chi-square (X2) test of significance. A probability (P-value) below 0.05 was deemed statistically significant. Results were considered significant when the P-value was less than 0.001 (**), and the Pearson correlation test was used to determine the correlation coefficient. A smaller P-value indicated more significance (*).

RESULTS

Table (1) shows that the majority (84%) of the studied nurses their age group was 18 ≤ 29 years with mean age 26.98±4.51 years, less than three quarters (72%) of them were females, less than half (58%) of them were single, less than two thirds (60%) of them had technical institutes of nursing, less than half (44%) of them had 1 < 3 years experiences with mean years of experience 1.88±1.154 years and more than two thirds (68%) of them weren't having training courses on preventive guidelines for medication errors.

Table (2) presents that less than three quarters (60% & 74%), respectively, of the studied nurses had satisfactory knowledge levels regarding types of medication errors and ways to prevent or reduce the occurrence of medication errors. At the same time, more than half (58% & 72%), respectively, had unsatisfactory knowledge levels regarding the definition and causes of medication errors. **Figure (1)** illustrates that more than

half (58%) of the studied nurses had an unsatisfactory knowledge level, and less than half (42%) of them had a satisfactory knowledge level regarding preventive guidelines for medication errors.

Table (3) illustrates that less than three-quarters (74%) of the studied nurses had a competent practice level regarding the post-administration phase, and more than two-thirds (68%) of them had an incompetent practice level during the preparation phase.

Figure (2) shows that 34% of the studied nurses had competent practice levels. Meanwhile, 66% of them had incompetent practices regarding preventive guidelines for medication errors.

Table (4) reveals that there was a statistically significant relation between the total knowledge of the studied nurses and their years of experience. However, there was no statistically significant relationship between the total knowledge of the nurses studied and their age, gender, marital status, level of education, and training courses.

Table (5) illustrates that there was a statistically significant relationship between the total practices of the nurses who were studied and their level of education and training courses. There was no statistically significant relation between the total practices of the studied nurses and their age, gender, marital status, and years of experience.

Table (6) reveals that there was a positive correlation between total knowledge and total practices among the studied nurses.

Table (1): Distribution of the studied nurses according to their characteristics (n=50).

Items	No.	%
Age		
18 ≤ 29 years	42	**84.0**
30 < 49 years	8	16.0
Mean±SD	26.98±4.51	
Gender		
Male	14	28.0
Female	36	**72.0**
Marital status		
Single	29	**58.0**
Married	21	42.0
Level of Educational		
Technical institutes of nursing	30	**60.0**
Bachelor of Nursing Sciences	18	36.0
Post graduate studies	2	4.0
Years of experiences		
< 1 year	16	32.0
1 < 3 years	22	**44.0**
3 < 5 years	4	8.0
≥ 5 years	8	16.0
Mean±SD	1.88±1.154	
Training courses on preventive guidelines for medication errors		
Yes	16	32.0
No	34	**68.0**

Table (2): Distribution of the studied nurses' knowledge regarding preventive guidelines of medication errors sub-items (n=50).

Sub-items	Satisfactory		Unsatisfactory		Mini	Max	Range	Mean ±SD
	No.	%	No.	%				
Definition of medication errors	21	42.0	29	**58.0**	0	2	2	1.34±0.63
Causes of medication errors	14	28.0	36	**72.0**	7	23	16	14.58±3.59
Types of medication errors given intravenously	27	54.0	23	46.0	2	7	5	4.68±1.36
Types of medication errors are given by methods other than intravenous (intramuscular, subcutaneous, oral, inhalation, etc.)	25	50.0	25	50.0	2	7	5	4.50±1.33
All types of medication errors	30	**60.0**	20	40.0	4	14	10	9.18±2.20
Ways to prevent or reduce the occurrence of medication errors	37	**74.0**	13	26.0	6	13	7	9.72±1.84
Total knowledge	21	42.0	29	58.0	22	49	27	34.82±5.93

Fig. (1): Percentage distribution of the studied nurses' total knowledge regarding preventive guidelines for medication errors (n=50)
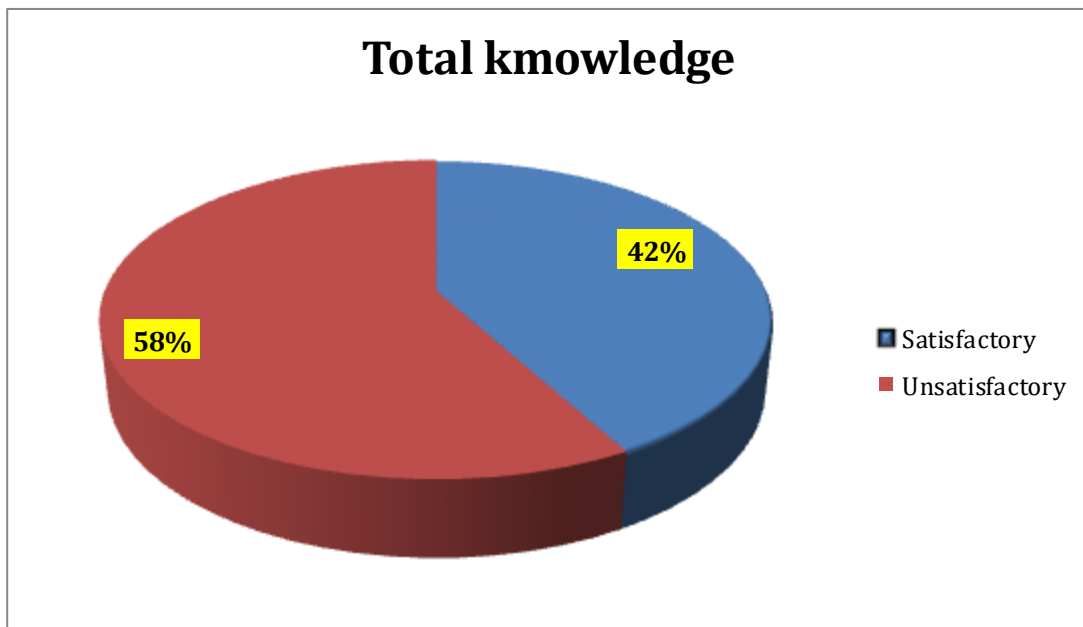
Total kmowledge

- Satisfactory 42%
- Unsatisfactory 58%

Table (3): Distribution of the studied nurses' practices regarding sub-items of preventive guidelines for medication errors (n=50).

Sub-items	Competent		Incompetent		Mini	Max	Range	Mean ±SD
	No.	%	No.	%				
During preparation phase	16	32.0	34	**68.0**	13	24	11	19.02±2.54
During administration phase	22	44.0	28	56.0	11	23	12	18.24±3.12
Post administration phase	37	**74.0**	13	26.0	5	10	5	8.00±1.35
Total practices	17	34.0	33	66.0	34	54	20	45.26±4.93

Fig. (2): Percentage distribution of the studied nurses' total practices regarding preventive guidelines for medication errors (n=50).
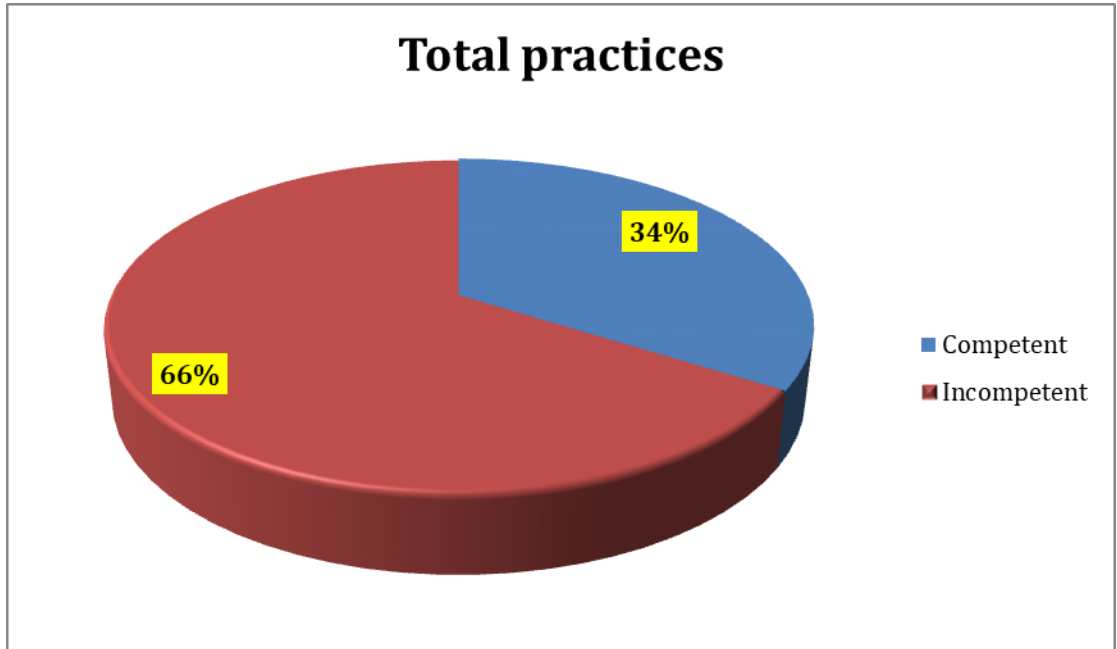
Table (4): Relation between demographic characteristics of studied nurses and their total level of knowledge (n=50).

Items	No.	Satisfactory (n=21)		Unsatisfactory (n=29)		X^2	p-value
		No.	%	No.	%		
Age							
18 ≤ 29 years	42	19	38.0	23	46.0	1.130	0.288
30 < 49 years	8	2	4.0	6	12.0		
Gender							
Male	14	8	16.0	6	12.0	1.830	0.176
Female	36	13	26.0	23	46.0		
Marital status							
Single	29	14	28	15	30.0	1.116	0.291
Married	21	7	14.0	14	28.0		
Level of Educational							
Technical institutes of nursing	30	13	26.0	17	34.0	.146	0.930
Bachelor of Nursing Sciences	18	7	14.0	11	22.0		
Post graduate studies	2	1	2.0	1	2.0		
Years of experiences							
< 1 year	16	8	16.0	8	16.0	8.109	0.044*
1 < 3 years	22	12	24.0	10	20.0		
3 < 5 years	4	1	2.0	3	6.0		
≥ 5 years	8	0	0.0	8	16.0		
Training courses on preventive guidelines for medication errors							
Yes	16	5	10.0	11	22.0	1.116	0.291
No	34	16	32.0	18	36.0		

*Statistically significant at p≤0.05   **** Highly statistically significant at p≤0.01**

Table (5): Relation between demographic characteristics of studied nurses and their total level of practices (n=50).

Items	No.	Competent (n=17)		Incompetent (n=33)		X^2	p-value
		No.	%	No.	%		
Age							
$18 \leq 29$ years	42	15	30.0	27	54.0	.344	0.558
$30 < 49$ years	8	2	4.0	6	12.0		
Gender							
Male	14	6	12.0	8	16.0	.680	0.410
Female	36	11	22.0	25	50.0		
Marital status							
Single	29	12	24.0	17	34.0	1.676	0.196
Married	21	5	10.0	16	32.0		
Level of Educational							
Technical institutes of nursing	30	15	30.0	15	30.0	8.655	0.013*
Bachelor of Nursing Sciences	18	2	4.0	16	32.0		
Post graduate studies	2	0	0.0	2	4.0		
Years of experiences							
< 1 year	16	4	8.0	12	24.0		
1 < 3 years	22	7	14.0	15	30.0	3.664	0.300
3 < 5 years	4	1	2.0	3	6.0		
≥ 5 years	8	5	10.0	3	6.0		
Training courses on preventive guidelines for medication errors						4.847	0.028*
Yes	16	2	4.0	14	28.0		
No	34	15	30.0	19	38.0		

*Statistically significant at p≤0.05   **** Highly statistically significant at p≤0.01**

Table (6): Correlation between total level of nurses' knowledge and practice regarding preventive guidelines for medication errors.

		Total practices
Total knowledge	r	.888
	p	0.020*

* Statistically significant at p≤0.05   ** Highly statistically significant at p≤0.01

DISCUSSION

The process of administering medication should be error-free. In order to protect their patients, nurses must be strict in their efforts to discourage interruptions. Patient safety must be prioritized due to the high rate of mistakes in medicine administration on the unit. Medication

safety is affected by a lot of things. Safe medication management is a complex process, and some people think RNs don't know enough about it. Some people mention that risky behavior and interruptions have become the norm, while others mention technology, design issues, time limitations, poor communication, poor leadership, and out-of-date policies and guidelines. *(Fathy et al., 2020).*

So, the current study aimed to evaluate nurses' knowledge and practice regarding preventive guidelines for medication errors.

Discussing the findings of the current study is categorized under Four main parts. The first part concerned with demographic characteristics of nurses included in the study. The second part displays the findings that related to studied nurses' level of knowledge regarding preventive guidelines for medication errors .The third part discusses nurses' practice regarding preventive guidelines for medication errors . The last part discusses the relations and correlations between the study variables

According to the current study, the age group of the majority of the nurses under investigation was $18 \leq 29$ years, with mean age 26.98±4.51 years. This study agreed with *Fathy et al. (2020),* who studied "Nurse's knowledge and practice regarding medication errors in critical care units" and mentioned that the majority of the studied nurses' age group was 20 – 29 years with mean age 26.7+1.30 years. Contrariwise, this result contradicts with *Alandajani et al. (2022),* who conducted a study entitled "Knowledge and attitudes regarding medication errors among nurses" and stated that a minority of the studied nurses their age group was <30 years old.

The current study reported that less than three-quarters of the studied nurses were females; in the researcher's point of view, this might be related to the fact that most of those affiliated with the nursing profession are females. This finding was supported by *Bucknall et al. (2019),* who carried out a study entitled "Nurses' Decision-making, practices and Perceptions of Patient

Involvement in medication administration in an acute hospital setting" and found that the majority of the studied nurses were females. In contrast, this study disagreed with *Abukhader & Abukhader (2020),* who studied the "Effect of medication safety education program on intensive care nurses' knowledge regarding medication errors" and revealed that more than half of the studied nurses were males.

The current study reported that more than half of the nurses studied were single and had technical institutes of nursing; from the researcher's point of view, this could be related to their age, so more than half of them were single. This result was in congruent with *Saber & Elshemy (2020),* who carried out a study entitled "Assessment of the nurse interns' medication administration safety performance. It revealed that the majority of the studied nurses were single. Contrariwise, this finding contradicts with *Mohamed et al. (2023)* in their recent study entitled "Medication safety climate: Managing high-alert medication administration and errors among nurses in intensive and critical care units" and found that a minority of the studied nurses had technical institute of nursing.

The current study reported that less than half of the studied nurses had 1<3 years of experience with mean years of experience of 1.88±1.154 years. This study results were in accordance with *Awan et al. (2023)* in their study entitled "Knowledge and attitude of nurses regarding medication errors: A significant element in the role of care complexity" and mentioned that more than one-quarter of the studied nurses had 1 to 3 years experiences. Contrariwise, this finding contradicts with *Yousef et al. (2021),* who carried out a study entitled "Medication administration errors: Causes and reporting behaviors from nurses' perspectives" and found that the mean years of experience among the studied nurses was 7.6±5.22 years.

The current study revealed that more than two-thirds of the studied nurses didn't have training courses on preventive guidelines for medication errors. This result

was in the same line with *Mostafa et al. (2023),* who conducted this study entitled "Medication administration errors and barriers to reporting: Critical care nurses' point of view," and mentioned that almost all of the studied nurses weren't attending training courses about medication administration errors. Also, this study agreed with *Abd Elmageed et al. (2020),* who conducted a study entitled "Knowledge, Attitude, and Practice of Nurses in Administering Medications at Mansoura University Hospitals" and revealed that most of the studied nurses didn't have training courses.

Concerning nurses' knowledge regarding preventive guidelines of medication errors sub-items, the current study reported that less than three-quarters of the studied nurses had a satisfactory knowledge level regarding types of medication errors and ways to prevent or reduce the occurrence of medication errors. At the same time, more than half of them had an unsatisfactory knowledge level regarding the definition and causes of medication errors.

This finding was in accordance with *Allehebi & Hamed (2023)* in their study entitled "Nurses' knowledge of adverse medication events and its contributing factors at intensive care units" and found that the majority of the studied nurses had poor knowledge regarding medication error definition, cofactors, and causes. Contrariwise, this study disagreed with *Ben et al. (2023),* who mentioned that more than three-quarters of the studied nurses had moderate knowledge levels regarding the types and prevention of medication errors.

Regarding the studied nurses' total knowledge regarding preventive guidelines for medication errors, the present study revealed that more than half of the studied nurses had an unsatisfactory knowledge level. Less than half of them had a satisfactory knowledge level regarding preventive guidelines for medication errors; from the researcher's point of view, this might be related to the fact that more than two-thirds of the studied nurses didn't have

training courses on preventive guidelines for medication errors.

This result was in accordance with *Maharjan et al. (2024),* who studied "Knowledge and Perception Regarding Medication Error among Nurses" and reported that more than one-third of the studied nurses had adequate knowledge of medication errors. This finding was in congruence with **Kainat et al. (2023),** who found that less than one-third of the nurses who were studied had poor knowledge regarding medication errors.

Regarding the studied nurses' practices regarding sub-items of preventive guidelines for medication errors, the present study found that less than three-quarters of the studied nurses had competent practice levels regarding the post-administration phase, and more than two-thirds of them had incompetent practice levels during the preparation phase.

This result was in the same line with *Shebl et al. (2020),* who conducted a study entitled "Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital" and revealed that less than two-thirds of the studied nurses had unsatisfactory practice level pre-administration of medication. Contrariwise, this study was in congruence with *Saber & Elshemy (2020),* who mentioned that less than three-quarters of the studied nurses had inadequate practices after medication administration.

In relation to the total practice of the nurses, regarding preventive guidelines for medication errors, the current study revealed that one-third of the nurses had a competent practice level. While two-thirds of them had incompetent practices level regarding preventive guidelines for medication errors, from the researcher's point of view, this might be related to the fact that less than half of the studied nurses had 1<3 years experiences, so their years of experience short on having good experience on preventing medication errors.

This finding agreed with *Fathy et al. (2020),* who found that more than two-thirds

of the nurses who were studied had poor practices regarding medication administration. Contrariwise, this result disagreed with *Jeba et al. (2020),* and mentioned that most of the studied nurses had good knowledge regarding prevention of medication errors.

Concerning the relation between the demographic characteristics of studied nurses and their total level of knowledge, the present study reported that there was a statistically significant relation between the total knowledge of the studied nurses and their years of experiences; in the researcher's point of view, this could be related to that, short years of experience can affect on nurses' knowledge to become poor. In comparison, there was no statistically significant relationship between the total knowledge of the nurses studied and their age, gender, marital status, level of education, and training courses.

This study was in accordance with *Abukhader & Abukhader (2020),* who mentioned no statistically significant relation between the studied nurses' total knowledge level and their age, gender, marital status, educational level, and training courses. Contrariwise, this finding disagreed with *Alenezi & Baker (2023)* in their study entitled " Knowledge, attitude, and behavior toward medication error in Saudi Arabia" and found that there was no statistically significant relation between the studied nurses' total knowledge level and their years of experience.

Regarding the relation between the demographic characteristics of studied nurses and their total level of practices, the current study found that there was a statistically significant relation between the total practices of the studied nurses and their level of education and training course from the researcher's point of view, this might be related to that, high education level and taking training courses can improve nurses' practices and vice versa. At the same time, there was no statistically significant relation between the total practices of the studied nurses and their age, gender, marital status, and years of experience.

This result was similar to *Kerari & Innab (2021),* who carried out a study entitled " The influence of nurses' characteristics on medication administration errors" and represented that there was strong evidence that nurses' level of education, length of experience, and attendance at training courses, are directly associated with the occurrence of medication error. Contrariwise, this study was dissimilar to *Khalil et al. (2022),* who mentioned that there was a positive relation between the studied nurses' total practice and their age and years of experience. Also, this study results were in disagreed with *Al Khreem & Al-khadher (2021),* who carried out a study entitled " Perceptions of nurses about medication errors" and revealed that statistically significant relation between the studied nurses' practice level and their age, gender, and marital status.

Concerning the correlation between the total level of nurses' knowledge and practice regarding preventive guidelines for medication errors, the present study reported that there was a positive correlation between total knowledge and total practices among the studied nurses; from the researcher's point of view, this could be related to that, if nurses had minimum good knowledge that can affect positively on their practices regarding preventive guidelines for medication errors.

This finding agreed with *Mohamed & Abdalla (2022),* and found that positive correlation between total knowledge level and total practice level. Contrariwise, this study disagreed with *Shebl et al. (2020),* who revealed that there was a negative correlation between total knowledge and total practice level among the studied nurses regarding medication administration errors.

CONCLUSION

Based on the finding of the current study, it was concluded that:

The present study showed that more than half of the nurses who were studied had an unsatisfactory knowledge level, and less than half of them had a satisfactory knowledge level regarding preventive guidelines for medication errors. Also, one-third of the

studied nurses had a competent practice level. At the same time, two-thirds of them had incompetent practices regarding preventive guidelines for medication errors. Additionally, a statistically significant relationship between the total knowledge of the nurses studied and their years of experience. Also, statistically significant relationship between the total practices of the nurses studied and their level of education and training course. Finally, a positive correlation between total knowledge and total practices among the studied nurses.

RECOMMENDATIONS

Based on the current study's finding, the following recommendations are suggested:

➢ Assessment of medication errors should be done periodically.

➢ Implementing and spreading educational programs to improve nurses' knowledge and practices in medication management and enhancing in-service training efficiency using interactive methods and technology.

➢ Implement educational programs about medication error prevention based on nurses' actual need assessment.

➢ Nurses and nurse managers undergo periodic training on medication error reporting, including lectures, projects, simulations, and more.

➢ Additional studies involving Egyptian nurses to improve safety practices and address medication administration errors from various angles.

➢ The study must be repeated with a bigger sample size in order for the findings to be generalized

➢ Further studies are recommended to consider describing the differing cultural, demographic, and contextual aspects of nurses regarding their knowledge and practices on preventive guidelines for medication errors.

REFERENCES

Abd Elmageed, E. M., Soliman, H. M., & Abdelhamed, H. M. (2020): Knowledge, Attitude, and Practice of Nurses in Administering Medications at Mansoura University Hospitals. *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, *9*(4), 06-16. Retrieved from https://www.researchgate.net/profile/Hala-Abdelhamed/publication/344617756_Knowledge_Attitude_and_Practice_of_Nurses_in_Administering_Medications_at_Mansoura_University_Hospitals/links/5f84c6aaa6fdccfd7b5cb03a/Knowledge-Attitude-and-Practice-of-Nurses-in-Administering-Medications-at-Mansoura-University-Hospitals.pdf.

Abukhader, I., & Abukhader, K. (2020): Effect of medication safety education program on intensive care nurses' knowledge regarding medication errors. *Journal of Biosciences and Medicines*, *08*(06), 135-147. doi:10.4236/jbm.2020.86013.

Afaya, A., Konlan, K. D., & Kim Do, H. (2021): Improving patient safety through identifying barriers to reporting medication administration errors among nurses: An integrative review. BMC Health Services Research, 21(1). doi:10.1186/s12913-021-07187-5.

Al Khreem, S. M., & Al-khadher, M. (2021): Perceptions of nurses about medication errors: A cross-sectional study. *Journal of Scientific Research in Medical and Biological Sciences*, *2*(1), 30-41. doi:10.47631/jsrmbs.v2i1.178.

Alandajani, A., Khalid, B., Ng, Y. G., & Banakhar, M. (2022): Knowledge and attitudes regarding medication errors among nurses: A cross-sectional study in major Jeddah hospitals. *Nursing Reports*, *12*(4), 1023-1039. doi:10.3390/nursrep12040098.

Alenezi, A. M., & Baker, O. G. (2023): Knowledge, attitude, and behavior toward medication error in Saudi Arabia. *Saudi Journal of Nursing and Health Care*, *6*(09), 297-304. doi:10.36348/sjnhc.2023.v06i09.002.

Allehebi, R. A., & Hamed, L. A. (2023): Nurses' knowledge of adverse medication events and its contributing factors at intensive care units: A cross-sectional

study. *Evidence-Based Nursing Research*, *5*(4), 38-45. doi:10.47104/ebnrojs3.v5i4.310.

Alrabadi, N., Haddad, R., Haddad, R., Shawagfeh, S., Mukatash, T., Al-rabadi, D., & Abuhammad, S. (2020): Medication errors among registered nurses in Jordan. Journal of Pharmaceutical Health Services Research, 11(3), 237-243. doi:10.1111/jphs.12348.

Aseeri, M., Banasser, G., Baduhduh, O., Baksh, S., & Ghalibi, N. (2020): Evaluation of medication error incident reports at a tertiary care hospital. Pharmacy, 8(2), 69. doi:10.3390/pharmacy8020069.

Awan, S., Rubab, Z., Yamin, K., Ali, K., Farman, S., Latif, L., & Iqbal, A. (2023): Knowledge and attitude of nurses regarding medication errors: A significant element in the role of care complexity. *International Journal of Science and Research Archive*, *10*(1), 990-994. doi:10.30574/ijsra.2023.10.1.0872.

Ben, R., Ahmad, A., Radizuan, T. H., & Kunjukunju, A. (2023): Knowledge, attitude regarding prevention of medication errors among registered nurses. Malahayati International Journal of Nursing and Health Science, 6(3), 235-246. doi:10.33024/minh.v6i3.10779.

Bucknall, T., Fossum, M., Hutchinson, A. M., Botti, M., Considine, J., Dunning, T., & Manias, E. (2019): Nurses' decision-making, practices and perceptions of patient involvement in medication administration in an acute hospital setting. Journal of Advanced Nursing, 75(6), 1316-1327. doi:10.1111/jan.13963.

ELMeneza, S., & AbuShady, M. (2020): Anonymous reporting of medical errors from the Egyptian neonatal safety training network. Pediatrics & Neonatology, 61(1), 31-35. doi:10.1016/j.pedneo.2019.05.008.

Fathy, A. M., Khalil, N. S., Taha, N. M., & Abd-Albany, M. M. (2020): Nurse' s knowledge and practice regarding medication errors in critical care units: Descriptive study. Minia Scientific Nursing Journal, 008(1), 111-120. doi:10.21608/msnj.2020.188051.

Härkänen, M., Vehviläinen-Julkunen, K., Murrells, T., Rafferty, A. M., & Franklin, B. D. (2019): Medication administration errors and mortality: Incidents reported in England and Wales between 2007–2016. Research in Social and Administrative Pharmacy, 15(7), 858-863. doi:10.1016/j.sapharm.2018.11.010.

Jeba, B., Kaur, J., & Sethi, D. (2020): Effectiveness of module on knowledge and practice regarding prevention of medication errors among critical care nurses in selected hospital. *Indian Journal of Forensic Medicine & Toxicology, 8(5), 1102*. doi:10.37506/ijfmt.v14i4.11475.

Kainat, M., Tariq, Z., Khan, H., & Shabir, K. (2023): Knowledge, Attitude, and Practice Regarding Medication Error Reporting among Nurses. *International Journal of Research Publication and Reviews*, *4*(9), 1732-1735. Retrieved from https://www.researchgate.net/publication/375073282_Knowledge_Attitude_and_Practice_Regarding_Medication_Error_Reporting_among_Nurses.

Kerari, A., & Innab, A. (2021): The influence of nurses' characteristics on medication administration errors. SAGE Open Nursing, 7, 237796082110258. doi:10.1177/23779608211025802.

Khalil, n., Abd-Albany, m., Taha, N., & Fathy, A. (2022): Nurses practices' errors regarding medication administration in different critical care units at a teaching hospital in Upper Egypt.: An observational study. International License Journal, 5 (1), 197. doi:10.21203/rs.3.rs-1418273/v2.

Maharjan, S., Shrestha, A., Shakya, V., Maharjan, M., Panthee, B., & Joshi, R. (2024): Knowledge and Perception

Regarding Medication Error Among Nurses. *J Nepal Health Res Counc*, *21*(4), 629-635. doi:10.33314/jnhrc.v21i4.4883.

Mohamed, E., El-Shanawany, S. M., Ghanem, M., Elbiaa, M. A., Mohamed, H. A., & Lotfy, W. M. **(2023):** Medication safety climate: Managing high-alert medication administration and errors among nurses in intensive and critical care units. *Egyptian Nursing Journal*, *20*(2), 228-236. doi:10.4103/enj.enj_16_23.

Mohamed, H. R., & Abdalla, S. S. **(2022):** Effectiveness of nursing guidelines on nurses' performance regarding high alert medications at neonatal intensive care units. *Evidence-Based Nursing Research*, *4*(2), 54-63. doi:10.47104/ebnrojs3.v4i2.241.

Mostafa, M. F., Aboseada, A. I., & Sayed, S. **(2023):** Medication administration errors and barriers to reporting: Critical care nurses' point of view. International Egyptian Journal of Nursing Sciences and Research, 3(2), 103-121. doi:10.21608/ejnsr.2023.277886.

Odberg, K. R., Hansen, B. S., & Wangensteen, S. **(2019):** Medication administration in nursing homes: A qualitative study of the nurse role. Nursing Open, 6(2), 384-392. doi:10.1002/nop2.216.

Rababah, A., Mardini, A., Ababneh, M., Rababa, M., & Hayajneh, M. **(2022):** Medication errors in Jordan: A systematic review. International Journal of Critical Illness and Injury Science, 12(2), 106. doi:10.4103/ijciis.ijciis_72_21.

Saber, A. S., & Elshemy, H. M. **(2020):** Assessment of the nurse interns' medication administration safety performance. *Evidence-Based Nursing Research*, *2*(4), 9. doi:10.47104/ebnrojs3.v2i4.171.

Saber, A. S., & Elshemy, H. M. **(2020):** Assessment of the nurse interns' medication administration safety performance. *Evidence-Based Nursing Research*, *2*(4), 9. doi:10.47104/ebnrojs3.v2i4.171.

Schroers, G., Ross, J. G., & Moriarty, H. **(2021):** Nurses' perceived causes of medication administration errors: A qualitative systematic review. The Joint Commission Journal on Quality and Patient Safety, 47(1), 38-53. doi:10.1016/j.jcjq.2020.09.010

Shebl, A. M., Reyad, A. R., Moustafa, M. F., & Sammy, A. M. **(2020):** Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital. *International Journal of Novel Research in Healthcare and Nursing*, *7*(1), 951-958. Retrieved from https://www.noveltyjournals.com/upload/paper/Critical%20Care%20Nurses-2261.pdf.

Shebl, A. M., Reyad, A. R., Moustafa, M. F., & Sammy, A. M. **(2020):** Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital. *International Journal of Novel Research in Healthcare and Nursing*, *7*(1), 951-958. Retrieved from https://www.noveltyjournals.com/upload/paper/Critical%20Care%20Nurses-2261.pdf.

Wondmieneh, A., Alemu, W., Tadele, N., & Demis, A. **(2020):** Medication administration errors and contributing factors among nurses: A cross-sectional study in tertiary hospitals, Addis Ababa, Ethiopia. BMC Nursing, 19(1). doi:10.1186/s12912-020-0397-0

You, M. A., Choe, M. H., Park, G. O., Kim, S. H., & Son, Y. J. **(2015):** Perceptions regarding medication administration errors among hospital staff nurses of South Korea. International Journal for Quality in Health Care, 27(4), 276-283.

Yousef, A., Abu Farha, R., & Da' meh, K. **(2021):** Medication administration errors: Causes and reporting behaviors from

nurses' perspectives. *International Journal of Clinical Practice*, *75*(10). doi:10.1111/ijcp.14541