Pediatric Nurses´ Performance Regarding Medication Errors and Safety Measures

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Abstract

Background: Medication errors can cause significant morbidity and mortality for children who admitted to pediatric units. Therefore, assessing pediatric nurses' performance regarding medication errors and safety measures is important for identify areas of weakness to improve medication administration practice and promote safety**. Aim:** This study aimed to assess the performance of pediatric nurses regarding medication errors and safety measures. **Design**: A descriptive design was used to achieve the study's aim. **Setting**: The study was conducted in Pediatric Intensive Care Unit (PICU), Pediatric Emergency Unit, and Cardio-thoracic department in Zagazig University Children Hospital. **Sample** Convenience sample of 80 nurses working in the above mentioned settings participated in the study. **Tools:** Three tools were used. **Tool I**: A structured interviewing questionnaire sheet. **Tool II**: An observational checklist. **Tool III**: Patient Safety Assessment in Medication Administration. **Results:** The study revealed that three quarters of the studied nurses had poor total knowledge score regarding medication errors, as well as nearly two thirds had poor total knowledge score regarding medication safety measures. In addition, three quarters of the studied nurses had unsatisfactory total practice score regarding medication administration and patient safety assessment. Furthermore, there was a highly statistically significant positive correlation between total nurses' knowledge, practice and patient safety assessment score **(P= 0. 01).Conclusion:** The present study concluded that pediatric studied nurses had poor knowledge regarding medication errors and medication safety measures. Moreover, the majority of pediatric studied nurses demonstrated inadequate performance regarding medication errors and medication safety measures. **Recommendations:** Conducting continuous in-service educational and training programs for pediatric nurses to improve performance regarding medication errors and medication safety measures.

Keywords: Medication Errors, Pediatric Nurses, Performance, Safety Measures

Introduction

Medication therapy is an essential component of pediatric healthcare and is fundamental to the prevention and treatment of childhood illnesses. However, medication use is also a major source of preventable patient harm. The World Health Organization (WHO) identifies unsafe medication practices and medication errors as important causes of avoidable harm in healthcare, with errors potentially occurring during prescribing, transcribing, dispensing, preparation, administration, and monitoring. Medication safety is therefore a critical component of patient safety and requires coordinated efforts from healthcare professionals and healthcare organizations to identify risks and prevent avoidable medication-related harm **(WHO, 2024).**

Pediatric patients are particularly vulnerable to medication errors because medication doses are commonly individualized according to age, body weight, body surface area, and clinical condition. In addition, children may have developmental and physiological differences that influence medication absorption, distribution, metabolism, and elimination. Consequently, errors involving dose calculation, decimal points, medication selection, preparation, route, or administration may have serious consequences in pediatric patients. A systematic review reported that medication errors are a significant concern in pediatric and neonatal settings and highlighted the complexity of medication administration in these populations **(Alghamdi et al., 2019; Marufu et al., 2022).**

Medication errors are preventable events that may occur at different stages of the medication-use process and may involve the wrong medication, dose, route, time, patient, or omission of a prescribed medication. In pediatric settings, several factors may increase the likelihood of errors, including weight-based dose calculations, inadequate medication information, and interruptions during medication preparation, workload, staffing limitations, communication problems, and insufficient knowledge or experience. Recent evidence indicates that nurses perceive workload, interruptions, and inadequate resources as important contributors to medication errors in children, while fear and negative feelings may also represent barriers to reporting errors **(Alhewaml et al., 2024).**

Pediatric nurses have a central role in medication safety because they are directly involved in medication preparation, dose calculation, administration, monitoring, and documentation. Their knowledge, clinical skills, adherence to medication-administration principles, and ability to recognize potential risks are therefore essential for preventing medication-related harm. Safe medication administration requires nurses to verify medication orders, accurately calculate doses, correctly identify patients, assess allergies and relevant clinical conditions, follow the rights of medication administration, use appropriate preparation and administration techniques, document medications accurately, and monitor children for therapeutic and adverse effects **(Shabaan et al., 2024*).***

Medication-safety measures provide systematic strategies for reducing preventable medication errors. These measures include standardized medication-administration procedures, accurate dose calculation, independent double-checking when appropriate, reducing interruptions during medication preparation and administration, clear communication among healthcare professionals, appropriate documentation, medication reconciliation, incident reporting, and continuous education and competency assessment. Evidence from a systematic review and meta-analysis demonstrated that nursing interventions—including medication-safety education, double-checking, reducing interruptions, medication information services, smart infusion technologies, and process or policy improvements can reduce medication administration errors among pediatric and neonatal patients **(Marufu et al., 2022).**

Despite the availability of medication-safety strategies, medication errors continue to represent an important challenge in pediatric healthcare. Effective medication safety depends not only on policies and technological systems but also on the competence and performance of nurses who implement medication-related practices at the bedside. (**Alshammari, 2024)** Therefore, assessing pediatric nurses' performance regarding medication errors and safety measures is important for identifying gaps in knowledge and practice, recognizing factors that may contribute to errors, determining educational and training needs, and developing evidence-based interventions to strengthen medication safety and promote safer, higher-quality care for pediatric patients.

Significance of the Study

Medication errors represent an important patient-safety concern in pediatric care because children are particularly vulnerable to medication-related harm. Pediatric medication administration involves weight- and age-based dose calculations and other factors that increase the complexity of medication use. Evidence indicates that medication

errors occur throughout the medication-use process, with dosing and administration errors being among the major concerns in pediatric practice. Moreover, studies have identified inadequate pharmacological knowledge, workload, interruptions, and difficulties in medication practices as important factors contributing to errors among pediatric nurses. (**Alsabri, et al. 2024)**

Improving medication safety among pediatric patients requires effective nursing practices and systematic preventive measures. Evidence from a systematic review and meta-analysis indicates that nursing interventions, particularly medication-safety education, double-checking, reducing interruptions, medication information services, and the use of appropriate technologies, can contribute to reducing medication administration errors in pediatric and neonatal settings. Furthermore, recent evidence emphasizes the important role of nurses in preventing and reporting pediatric medication errors and highlights the need to address workload, resource limitations, and organizational factors that may affect medication safety **(Alhewamlet al., 2024).**

Objective of the Study:

This study aimed to assess the performance of pediatric nurses regarding medication errors, and safety measures.

Research questions:

1. What is the level of pediatric nurses' knowledge regarding medication errors?
2. What is the level of pediatric nurses' knowledge regarding medication safety measures?
3. What is the level of pediatric nurses' practice regarding medication safety errors?
4. What is the level of pediatric nurses' practice regarding medication safety measures?
5. Is there a relationship between pediatric nurses' knowledge, practice and safety measures?

Subjects and Method

Study Design:

A descriptive design was utilized for this study.

Study Setting:

The study was conducted at Pediatric Intensive Care Unit (PICU), Pediatric Emergency Unit, and Cardio-thoracic department in Zagazig University Children Hospital.

Sample:

Convenience sample of 80 nurses working in the above mentioned settings were included in this study. They were at different ages and years of experience as well as different qualifications during study period (6 months).

Data Collection Tools

Three tools were utilized for data collection in this study.

Tool I: **A structured interviewing questionnaire Sheet**

It was developed by the researcher under supervision of supervisors after thorough review of relevant literatures to collect the required data. It was divided into four main parts as the following:

Part (A): Characteristics of the studied nurses Included their age, gender, marital status, place of work, qualification, years of experience, and previous training courses about medication administration and total score of medication errors.

Part (B): Nurses' knowledge regarding preparation and administration of medications for children consisted of 23 multiple choice questions this questions covered medication. verification before preparation, reconsistuation of powdered medications, infection control measures during medication preparation, oral and intravenous medication administration , pediatric dose calculation , medication storage , five rights of medication administration, identification of medication orders requiring clarification , monitoring requirements and other principles of safe medication administration .

Part (C): Nurses' knowledge regarding medication errors and nursing care provided for children

Included 17 multiple choice questions such as definition, types, causes, prevention, management, consequences of medication errors for children in addition the roles of nurses in prevention of medication errors for children.

Part (D): Nurses' knowledge regarding medication safety Measures consisted of 14 multiple choice questions such as medication safety procedures, safe storage of medication , principles of safe drug

administration, prevention of pediatric medication errors, allergy precaution , safe disposal of medication, emergency management of medication over dose, safe medication storage, medication documentation.

Tool (II): An observational checklist. Was designed by the researcher based on related pediatric nursing procedures manual. As guided by, **(Viera and Solis, 2023), (Infusion Nurses Society [INS], 2024)** It was used to assess nurses' practice regarding medication administration among children such as (order review and verification, during Preparation of medication, during administration of medication, after administration of medication.

Tool (III): Patient Safety Assessment in Medication Administration. developed by**(Fortaleza, etal. 2016)** consisted of 28 items organized into 9 domains : Right patient (item 1), right medication (5items), right route (4items), right time (3items) right dose (5items), right record (5items), right guidance(1item) right way (1item) and right answer (2items). Each item is answered on 5 point Likert scale (1 - never, 2 - almost never, 3 - sometimes, 4 - almost always and 5 - always).

Scoring system:

- Total nurses' knowledge score was developed by the researcher.
- Each right answer was given 1 point and zero for wrong one.
- The total score of knowledge was categorized as follows

***Good knowledge: > 75%of the total score.**

*** Average knowledge: 60 to 75% of the total score.**

***Poor knowledge: < 60% of the total score.**

. Scoring system of nurse's performance about medication preparation and administration among children was developed by the researcher. Step done correctly was given 1 point and zero was given to not done.

The total score of nurses 'practice was categorized as follows:

Unsatisfactory ≤ 80 %

Satisfactory > 80 %

Number of items 28

Minimum total score 28

Maximum total score 140

Total score of Patient Safety Assessment in Medication Administration.

Unsatisfactory ≤ 80 %

Satisfactory > 80 %

Validity

Tools were developed after thorough review of the related literature and submitted to a jury of three nursing and medical experts including: two professors of pediatrics nursing & one professor of pediatrics medication. The recommended modifications were done and the final was ready to use. It also involved their general or overall opinion about tools of data collection form regarding its clarity, relevance and suitability for implementation as well as their suggestions for any additions or omissions of items

Reliability

The consistency of the tool used in this study was assessed by applying Cronbach's alpha. The results revealed a reliability of the tool scale was tested through measuring its internal consistency using Cronbach alpha coefficient. The reliability coefficient was accepted for structured interview questionnaire **(0.725),** accepted for observation checklist **(0. 736)** and good for patient safety assessment **(0.847)**

Pilot Study:

A pilot study was conducted before performing the current study. Eight nurses enrolled in a children's hospital were included in the pilot study. They represented 10% of subjects.

The aim was to determine the applicability of the designed tools, feasibility, clarity of tools language, estimate the time needed to complete the questionnaire and identifying potential obstacles and problems that may be encountered during the period of data collection. Data obtained from the pilot study was analyzed and no modifications were done. Nurses who shared in the pilot study were included in the main study sample as no radical modification were needed on the study tools.

Field work:

Data was collected during six months starting in the period from July 2024 to December 2024. The researcher started the data collection (three days per week Sunday, Tuesday, and Thursday) from 9 am: to 2 pm at the morning shift at Pediatric Intensive Care Unit (PICU), Pediatric Emergency Unit, Cardio-thoracic department in Zag zig University Children Hospitals. Sharqia Governorate, Egypt. Each nurse was individually interviewed to complete **Tool I**. The time consumed to answer each questionnaire sheet ranged 20-30 minutes. Also, every nurse was observed during the morning shift to collect **Tool II** The researcher observed nurses' practice skills about studied procedure. The time needed to complete the checklist ranged around 15-30 minutes depending on the time of the procedure. The checklist was completed by the researcher during nurses' performance inside PICU.
Also, the researcher observed nurses safety skills to complete **Tool III**, it took 15-30 minutes to complete.

Ethical consideration:

Prior to the initial interview the researcher introduced herself, verbal explanation of the nature and the aim of the study was presented to the studied nurses who agreed to participate in the study. Clarification of the nature and the purpose of the study was done in the initial interview with each subject individually. They were given an opportunity to refuse, to participate and to withdraw from the study at any time without giving any reason. They were assured that the information would be utilized confidentially and used for research purposes only.

Administrative design

An official permission was obtained by submission of an official letter issued from the Dean of the Faculty of Nursing, Zagazig University, to the Director of Pediatric Intensive Care Unit (PICU), Pediatric Emergency Unit, Cardio-thoracic department in Zagazig University Children Hospital. Meeting was conducted firstly with the director of PICU to obtain permission for conducting the research, explaining the aim, and expected outcomes.

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Statistical analysis:

All data were collected, tabulated and statistically analyzed using IBM SPSS for windows (Version 25; IBM Corp., Armonk, NY, USA, 2017). Quantitative data were expressed as the mean ± SD and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate. Pearson correlation coefficient was calculated to assess relationship between study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation. Multiple linear regression (step-wise) was also used to predict factors which affect knowledge, practice, and safety assessment scores. Cronbach alpha coefficient was calculated to assess the reliability of the scales through their internal consistency. P-value < 0.05 was considered statistically significant, p-value < 0.01 was considered highly statistically significant, and p-value ≥ 0.05 was considered statistically non-significant.

Results

Table (1): Characteristics of the studied nurses (n=80).

Characteristics	No.	%
Age in years :		
• 20-	28	35.0
• 30-	26	32.5
• 40-49	26	32.5
Mean ± SD 34.5±10.21		
Gender :		
• Male	21	26.3
• Female	59	73.8
Marital status :		
• Single	25	31.3
• Married	50	62.5
• Divorced	4	5.0
• Widowed	1	1.3
Place of work :		
• Pediatric Intensive Care Unit	31	38.8
• Pediatric Emergency unit	25	31.3
• Cardio-thoracic Department	24	30.0
Years of Experience in Pediatric Nursing :		
• < 3	22	27.5
• 3 –	17	21.3
• 6 –	13	16.3
• 9 & more	28	35.0
Mean± SD 6.6±2.88		
Previous training courses about medication administration and medication errors :		
• Yes	17	21.3
• No	63	78.8

Table (1) shows characteristics of the studied nurses. It was found that 35% of the studied nurses were aged 20 to less than 30 years, with a mean age 34.5±10.21 years. Also 73.8 % were females compared 26.3% were males, As well as those who were married constituted 62.5 %.It is revealed from the table that, 38.8 % of the studied nurses were working in Pediatric Intensive Care Unit. Moreover, 35 % of studied nurses had 9 years of experience and more. In addition, it was observed that 78.8 % of the studied nurses never attended any previous training courses about medication administration and medication errors.

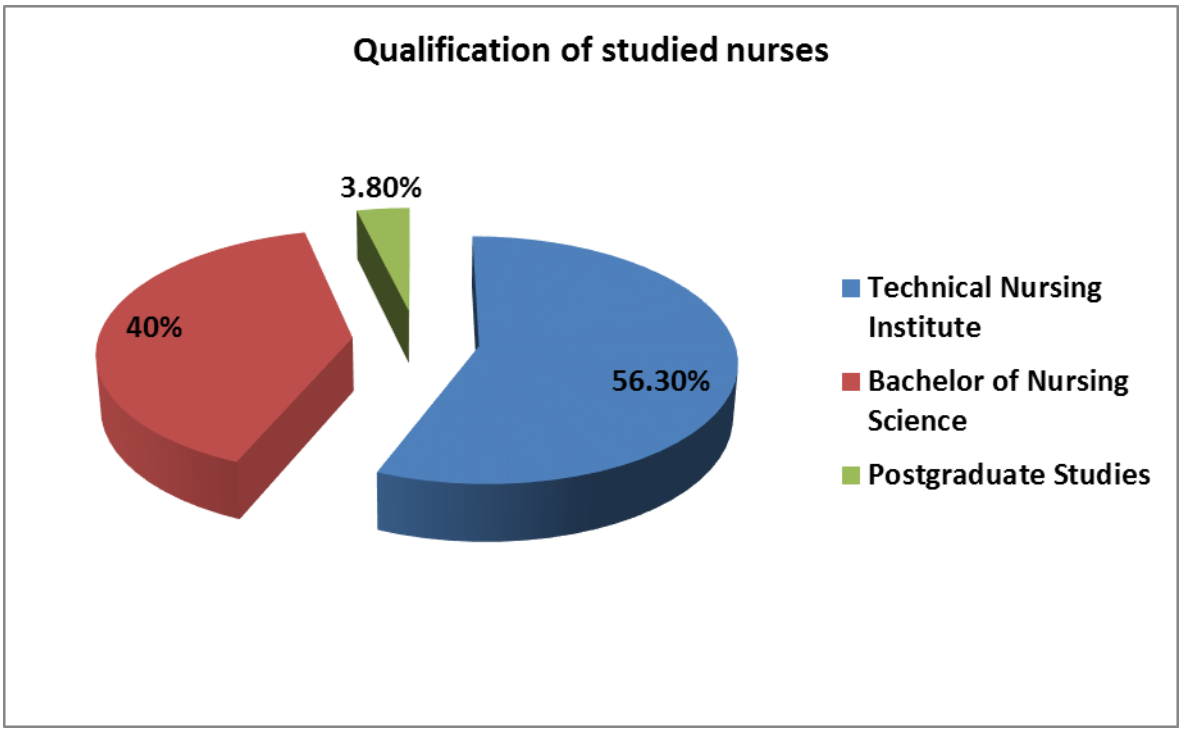


Figure (1): Qualifications of the studied nurses.

Qualifications of the studied nurses were illustrated in **figure (1)**. It was found that 56.30 % of the studied nurses had technical nursing institute, while only 3.80% had post graduate studies.

Table (2): Total score of the studied nurses' knowledge domains regarding medication administration for children (n=80).

Knowledge domains	Good		Average		Poor		Mean± SD
	No.	%	No.	%	No.	%	
- Preparation of medications for children	4	5.0	10	12.5	66	82.5	6.15±1.45
- Administration of medications for children	7	8.75	9	11.25	64	80.0	7.91±1.49
- Medication errors and nursing care for children	10	12.5	9	11.25	61	76.3	10.71±1.95
- Safety measures in pediatric medication administration	10	12.5	18	22.50	52	65.0	10.80±1.98

Total score of the studied nurses' knowledge domains regarding medication administration for children was revealed in Table (13). It was clarified that, 82.5% of the studied nurses had poor total knowledge score regarding preparation of medications for children with a mean score 6.15±1.45, as well as 80 % had poor total knowledge score regarding administration of medications for children with a mean score 7.91±1.49.Also, the same table portrays that, 76.3% of the studied nurses had poor total knowledge score regarding medication errors and nursing care for children

with a mean score 10.71±1.95, While, 22.50 % had average total knowledge score regarding safety measures in pediatric medication administration with a mean score 10.80±1.9

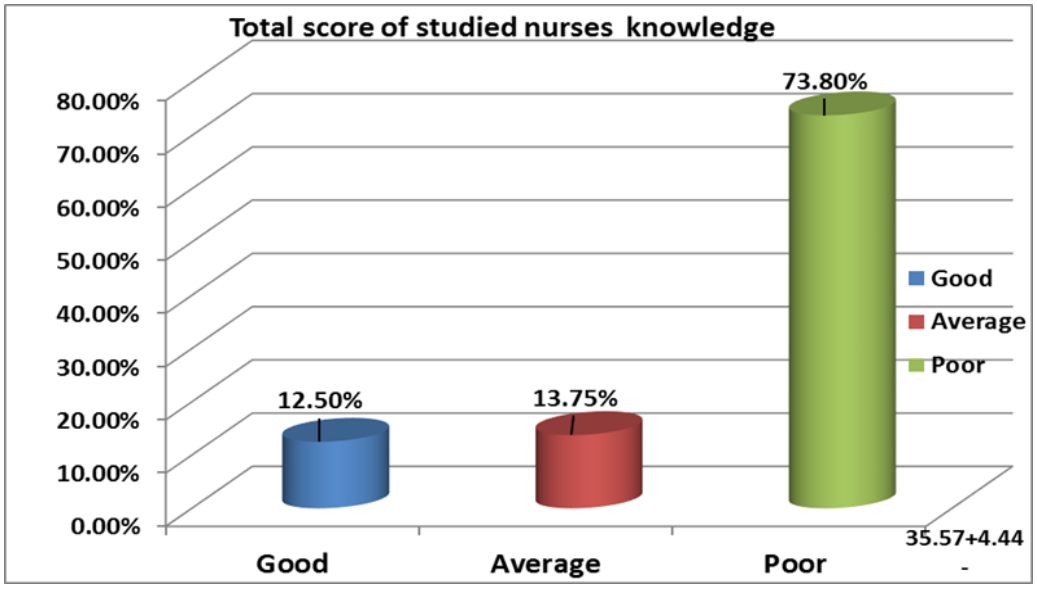


Figure (2): Total score of studied nurse's knowledge regarding overall knowledge domains of medication administration among children.

Figure (2) Illustrates total score of studied nurse's knowledge regarding overall knowledge domains of medication administration among children. It was found that, 73.8 % of studied nurse had poor total knowledge score regarding overall knowledge domains of medication administration among children. While, 12.5% had good total knowledge score with a total mean score 35.57±4.44.

Table (3): Total and mean score of practice regarding medication administration domains among children (n=80).

Practice domains	Satisfactory		Un satisfactory		Mean± SD
	No.	%	No.	%	
-Order review and verification	28	35.0	52	65.0	3.51±2.06
-Preparation of medication	3	3.8	77	96.3	10.83±4.02
-During administration of medication	13	16.3	67	83.8	5.63±2.64
-After administration of medication	22	27.5	58	72.5	2.56±1.94
-Instillation of eardrops	13	16.3	67	83.8	4.20±2.16
-Instillation Of eye drops	24	30.0	56	70.0	4.10±2.21
-Inhalation drug administration	11	13.8	69	86.3	8.07±3.51
-Oral drug administration using spoon	23	28.7	57	71.3	6.85±2.77
-Administration of intra venous injection	2	2.5	78	97.5	5.00±2.43
-Administration of intramuscular injection	8	10.0	72	90.0	13.30±4.69
-Administration of intradermal injection	8	10.0	72	90.0	7.13±2.90
-Administration of subcutaneous injection	9	11.3	71	88.8	7.62±2.56

Table (3) demonstrates total and mean score of practice regarding medication administration domains among children. It was found, 96.3% of the studied nurses had unsatisfactory practice regarding preparation of medication with a mean score 10.83±4.02. While, 16.3% had satisfactory practice during administration of medication with a mean score 5.63±2.64. Also the same table portrays that, 90% had unsatisfactory practice compared to 10% had satisfactory regarding administration of intramuscular injection with a mean score13.30±4.69. In addition, it was observed that 11.3% had satisfactory compared to 88.8 % had unsatisfactory practice regarding administration of subcutaneous injection with a mean score7.62±2.56.

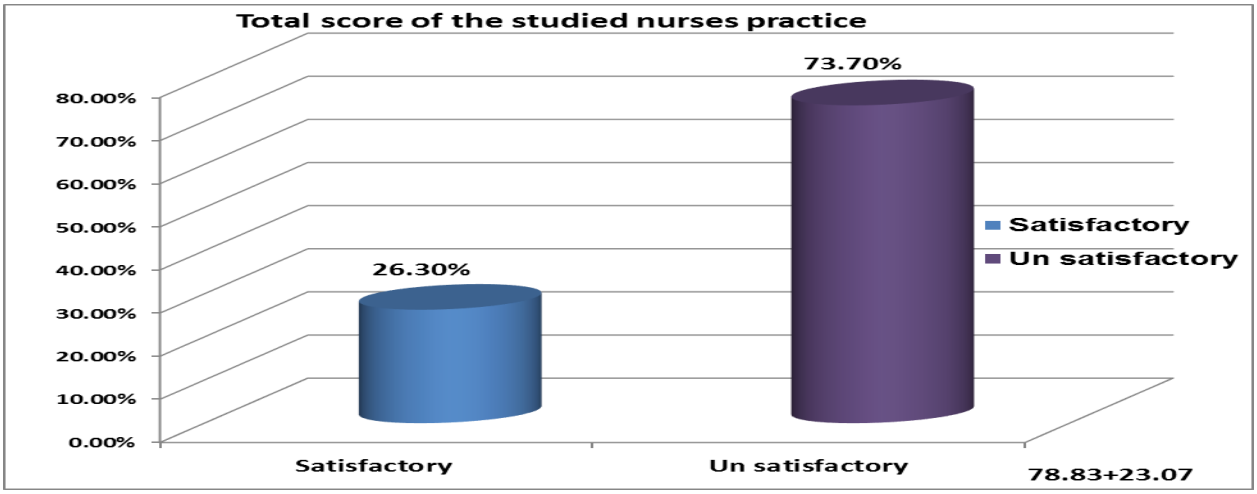


Figure (3): Total score of the studied nurses' practice regarding overall medication administration domains among children.

Figure (3) shows total score of the studied nurses' practice regarding overall medication administration domains among children. It was found that, 73.7% of the studied nurses' had unsatisfactory total practice score regarding overall medication administration domains among children. While, 26.30% had satisfactory total practice score with a total mean score78.83±23.07.

Table (4): Total score of the studied nurses regarding patient safety assessment domains in medication administration (n=80).

Patient Safety Assessment domains	Satisfactory		Un satisfactory		Mean± SD
	No.	%	No.	%	
Right patient	20	25.0	60	75.0	2.76±1.70
Right medication	24	30.0	56	70.0	17.83±5.10
Right route	38	47.5	42	52.5	14.88±4.40
Right time	27	33.8	53	66.3	10.82±3.40
Right dose	26	32.5	54	67.5	16.32±6.05
Right record of the administration	24	30.0	56	70.0	16.18±6.28
Right guidance	21	26.3	59	73.8	7.36±1.93
Right way	29	36.3	51	63.7	3.71±1.28
Right answer	23	28.7	57	71.3	7.30±2.24

Table (4) portrays total score of the studied nurses regarding patient safety assessment domains in medication administration. It was clarified that, 75% of the studied nurses had un satisfactory patient safety assessment regarding right patient with a mean score 2.76±1.70. While, 47.5% of the studied nurses had satisfactory patient safety assessment towards right route with a mean score 14.88±4.40. Also, It was revealed from the table that, 73.85% of the studied nurses had un satisfactory patient safety assessment regarding right guidance domain of patient safety assessment with mean score 7.36±1.93. But, 28.7 % had satisfactory patient safety assessment towards right answer domain of patient safety assessment with a mean score7.30±2.24.

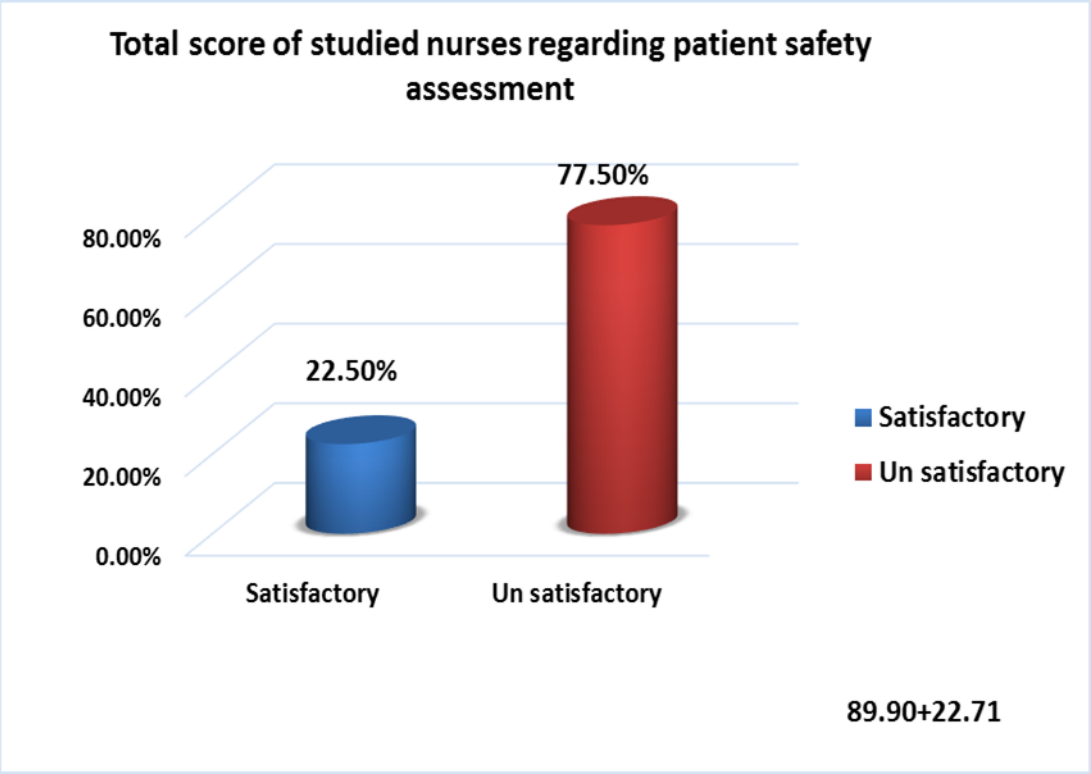


Figure (4): Total score of studied nurses regarding overall domains of patient safety assessment in medication administration among children.

Figure (4) illustrates total score of studied nurses regarding overall domains of patient safety assessment in medication administration among children. It was found that, 77.5% had unsatisfactory practice regarding overall domains of patient safety assessment in medication administration among children. Compared to 22.5 % had satisfactory with a mean score of 89.90±22.71.

Table (5): Correlation matrix between studied nurses' total knowledge, practice and patient safety assessment score.

Total Score	Knowledge		practice	
	R	P	R	P
knowledge				
Practice	0 .884	0.01**		
patient safety assessment	0 .919	0.01**	0 .871	0. 01**

**: Highly statistically significant (p<0. 01), r: Correlation coefficient.

Table (5) demonstrates the correlation matrix between studied nurses' total knowledge, practice and patient safety assessment score. The findings revealed a highly statistically significant (p<0. 01) positive correlation between total nurses' knowledge and total practice score (R =0 .884, P= 0. 01).Furthermore, there was a highly statistically significant (p<0. 01) positive correlation between total nurses' knowledge and patient safety assessment score (R = 0 .919, P= 0.01).Additionally, a highly statistically significant (p<0. 01) positive correlation was found between total nurses' practice score and patient safety assessment score (R =0 .871, P= 0. 01).

Discussion

Medication administration is a daily basic activity in nursing practice. Therefore, the nurses need to have sufficient knowledge, attitude and competency to perform these tasks **(Mahmood & Hassan, 2020).** Failure at any step can result in adverse events to the children and increases the child's morbidity and mortality rates. Medication errors are a major cause for serious adverse events, also, can occur during any stage starting from writing the drug order, dispensing the drug, drug administration and monitoring. All professionals in the health-care team have a responsibility toward identification of the factors that may contribute to any medication error in children **(Noviyanti et al. 2023).**Nurses spend approximately 40% of their time of nursing care in medication preparation and administration. It is important for all nurses to follow safety strategies to reduce and prevent medication errors and ensure correct administration of drugs and address causes of medication errors **(Aghabarary et al. 2024)**. So that the purpose of this study was to assess the performance of pediatric nurses regarding medication errors and safety measures.

The present study revealed that the majority of the studied nurses had poor knowledge score regarding medication preparation. This finding may be attributed to lack of training courses related to medication preparation. This finding is consistent with **Alalhareth et al. (2024)** who conducted a study entitled "Assessment of Nurses Knowledge and Practice Regarding Pharmacology of the Drugs They Usually Used in Tertiary Hospital" and reported that approximately two-fifths of nurses had low scores in knowledge areas related to drug preparation. Similarly, **Elsayed (2023)** who assessed "nurses' performance regarding medication administration safety in intensive care units at Ain Shams University hospitals" and found that most of the studied nurses had unsatisfactory knowledge regarding medication preparation.

In contrast, the present finding disagrees with **Johari et al. (2023)** who revealed that most nurses had good medication knowledge. Also, **Zakria & Elsayed (2019),** in a study conducted in Egypt reported that majority of nurses had sufficient knowledge related medication preparation. Concerning nurses' knowledge about medication errors. The current study found that approximately one- quarter of the studied nurses correctly identified the definition of a medication error. Additionally, only around one- fifth of the studied nurses reported the correct answer about the most common type of medication error in pediatric care. These findings may be attributed to insufficient educational programs on medication errors prevention. This finding matches with **Ahmed et al. (2020)** who reported that less than one-quarter of the studied nurses correctly defined a medication error and a minority correctly identified the most common types of medication errors in pediatric care.

Conversely, the present finding is inconsistent with **Al-Husseinawi, Lafta (2024)** who assessed "nurses' knowledge concerning medication administration errors at pediatric wards" and mentioned that half of the nurses demonstrated an average level of knowledge and only 8.3% had a poor level of knowledge regarding medication errors.

The study results revealed that nearly three- quarters of studied nurses had poor total knowledge score regarding all knowledge domains including medication preparation, administration, errors and safety measures. This may be due to limited training courses and low educational qualifications. Such result matches with **Alalhareth et al. (2024)** who assessed "nurses' knowledge and practice regarding pharmacology of the drugs in Tertiary Hospital" and found that nearly two-thirds had low overall knowledge scores. According to the current study, there was a highly statistically significant **(p < 0.01)** relation between age, experience years and their total knowledge score. This finding may be related to increasing age and longer professional experience provide nurses with greater opportunities for clinical exposure, repeated medication administration that enhance their knowledge. Conversely, this disagrees with **Dhungana et al. (2024)** reported no significant relationship between nurses' knowledge level and their age, work experience. This outcome contrasts with **Din et al. (2024)** who carried out a study about **"**Nurses' Knowledge and

Practices Regarding Safe Medication Administration at The Children's Hospital, Lahore" and indicated that nurses in pediatric tertiary care hospital had high levels of knowledge regarding safe medication administration. It also disagrees with **Nair (2021)** who reported that nurses had an above-average level of knowledge regarding pediatric medication administration.

In addition, it is revealed from the study that nearly three-quarters of the studied nurses had unsatisfactory overall practice score regarding all domains of medication administration among children. This may be related to inadequate availability of updated protocols, limited access to continuing education programs, and infrequent staff supervision. Such result matches with **Shahzeydi et al. (2023),** who conducted a study in Iran to "evaluate nurses' knowledge and performance regarding preparation and injection of intravenous drugs in pediatric wards" and mentioned that nurses' performance across different medication administration domains was below the average level. Similarly, **Alalhareth et al. (2024)** found that half of the participating nurses demonstrated poor overall practice scores regarding medication administration.

Additionally, more than three- quarters of the studied nurses had unsatisfactory practice regarding overall patient safety assessment domains including verification of the right patient, right medication, right dose, right route, right time and accurate documentation as well as medication guidance. This may be due to limited knowledge about medication safety guidelines. Such result goes in line with **Abd Elhameed et al. (2024)** who conducted a study about "nurses' knowledge and practice regarding medication administration safety practice" and revealed that most of studied nurses have low level of practices regarding safety medication administration.Similarly, this result is in accordance with **Ahmed et al. (2021)** who conducted a study entitled "Pharmacogenomics Guided Prescription Changes Improved Medication Effectiveness in Patients with Mental Health-Related Disability" and showed that the most of nurses had low performance regarding the medication administration safety.

Regarding Correlation between study variables the present study showed that there was a highly statistically significant **($p<0.01$)** positive correlation between total nurses' knowledge and total practice score. This finding related to nurses with higher levels of knowledge are more likely to demonstrate better clinical practice because adequate theoretical knowledge provides the foundation for safe and effective medication administration. This finding come in accordance with **Bakr Abo El–Ata et al. (2019)** who carried out a study about "Nurses' Performance Regarding Administration of Inotropic Medications for Critically Ill Patients" and revealed that there was statistical significant correlation between knowledge and practices.

Conclusion:

This study concluded that pediatric studied nurses had poor knowledge regarding medication preparation, administration, medication errors and safety measures among children. Moreover, the majority of pediatric studied nurses demonstrated inadequate performance regarding medication errors and safety measures among children.

Recommendations:

1-Conduct continuous in -service educational and training programs for pediatric nurses to improve their knowledge and performance regarding medication errors and medication safety measures.

2- Develop competency -based training programs focusing on safe medication prevention and administration.

3-Implement standardized medication safety protocols checklists to ensure adherence to essential safety measures during medication preparation and administration.

4- Conduct pediatric assessment of pediatric nurse's knowledge and practices regarding medication errors and medication safety measures through observation, competency, checklist and written assessments.

5- Ensure the availability of updated medication guidelines and reference materials in pediatric units to support nurses in safe medication preparation and administration.

6- Strengthen supervision and follow-up by pediatric nursing supervisors to ensure the medication safety slandered are consistently applied in clinical practice.

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Declaration of Conflicting Interests:

The author(s) have disclosed that they have no potential conflicts of interest, financial or personal.

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