Assessment of Safety Measures Provided by Nurses for Mechanically Ventilated Children: Suggested Nursing Guidelines

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Abstract

Background: Children's safety presents a significant challenge, as hospitalized children face a three - times higher likelihood of harm compared to adults. **Aim:** To assess safety measures provided by nurses for mechanically ventilated children. **Design**: A descriptive research design was applied. **Subjects:** All nurses (50) who were working in pediatric intensive care unit. **Setting:** This study was carried out at the pediatric intensive care unit in Assiut University Children's Hospital. **Tools:** Two tools were employed to gather the needed data: interview questionnaire sheet, and observational checklists. **Results**: More than two- fifths (42%) of the studied nurses had fair knowledge about safety measures for mechanically ventilated children, while 30% and 28% of them had poor and good knowledge, with two-thirds (66%) of them showed unsatisfactory practical skills in this area. A significant positive correlation (r = 0.297*) was observed between their overall knowledge and practical performance and a statistically significant difference was detected (Pv =0.036*). **Conclusion:** There was a lack of nurses' knowledge and practices regarding safety measures provided for mechanically ventilated children. So, the researcher **Recommended that** educational programs and advanced training courses should be developed and implemented based on evidence-based guidelines and the specific needs of staff nurses to enhance their knowledge and practices regarding safety measures for mechanically ventilated children.

Keywords: Mechanically ventilated children, Nursing guidelines & Safety measures.

Introduction

Mechanical ventilation is a standard treatment in neonates and pediatric intensive care and is used for several physiological and clinical reasons and is increasingly used as a lifesaving tool in treating acute and chronic respiratory failure, especially in reversible cases (**Sayin & ErdaL., 2018**). It is defined as the use of machine to support a child's breathing by moving air in and out of the lungs, improving oxygen intake, and removing carbon dioxide (**Ebrahim et al., 2023**).

Mechanical ventilation is an essential medical intervention in the context of critical illness; However, the intervention is associated with a risk of significant, potentially preventable complications. Among these are ventilator-associated pneumonia (VAP), sepsis, acute respiratory distress syndrome (ARDS), atelectasis, pulmonary edema and infection, as the artificial airway (breathing tube) may allow germs to enter the lung (**Metwalley et al., 2023**).

In recent years, patient safety has emerged as a critical focus in healthcare, not just due to the acknowledgment of the widespread and serious nature of the issue, but also because effective interventions have shown the ability to minimize, alleviate, or prevent identified risks and harm (**Cai &**

Spreckelmeyer., 2022). Ensuring safety in pediatric intensive care units (PICUs) is crucial due to children's reliance on healthcare providers for their medical needs, given their inability to self-care. Furthermore, children have weaker immune systems than adults, resulting in higher mortality rates and injury rates stemming from medical errors (**Kalroozi et al., 2022**).

Children safety serves as a yardstick for evaluating the quality of medical care provided in hospitals, both excellent and bad. While it is true that children have the right to their personal security and safety while receiving hospital treatment, they also have the right to get high-quality healthcare in compliance with professional standards and standard operating procedures. Medical error instances continue to be quite common in hospitals across the globe (**Safrullah & Bashir., 2022**).

Healthcare professionals employ various strategies to enhance children's safety and improve quality outcomes. Key components of these children's safety measures include accurate identification, effective communication, infection prevention, fall prevention, prevention of bedsores, precautions with high-alert medications, proper administration of medications and blood transfusions, and control of fire and electrical hazards (**Mahmoud et al., 2022**).

Safe practice is a moral and professional duty of the nurse. Therefore, knowledge is an important first attempt in safe children care. Assessing the knowledge and practice of PICU nurses allows for the introduction of suitable education protocols in PICUs. This could raise both children's safety and then individualized care of patients receiving protocol-directed care (**Mahfoz et al., 2022**).

Significance of the study

In critical care units, nearly all pediatric patients are likely to experience at least one potentially life-threatening error during their stay, so it's crucial to implement safety measures in nursing care (**Adly et al., 2020**). High level of knowledge is essential for nurses to provide proper care and reduce the risk of malpractice or negligence. This is because knowledgeable nurses are better equipped with the ethics and children safety principles necessary for effective healthcare delivery. Therefore, it is important to assess the level of nurses' knowledge and practices regarding safety measures provided for mechanically ventilated children (**Rukmini et al., 2024**).

Aim of the Study:

This study aimed to assess safety measures provided by nurses for mechanically ventilated children through assessing nurses' knowledge and practices regarding safety measures provided for mechanically ventilated children.

Research question:

- What is the level of nurses' knowledge and practices about safety measures for children on mechanical ventilation?

Operational definition:

Safety measures

Safety measures are defined as proactive measures taken to prevent adverse events that could negatively affect ill children and potentially lead to complications. These measures involve implementing high-quality practices and delivering optimal healthcare services to ensure the well-being of patients (**Maghfiroh., 2023**).

Theoretical definition:

Guidelines

Guidelines are appropriate methods and options, including pharmaceutical therapy, for managing a specific procedure or treatment for a certain diagnosis or condition, which can be used to enhance clinical decision-making and meet the individual needs of the patient (**Mohamed & Abdalla., 2022**).

Subjects and Method:

Research design:

A descriptive research design was employed in this study.

Setting:

This research was conducted in the pediatric intensive care unit of Assiut University Children's Hospital, which serves the upper Egypt region from El-Fayoum to Aswan. The hospital has six floors, and the pediatric intensive care unit is situated on the second floor, with a bed capacity of 32. However, only 14 beds were in use due to administrative issues. The unit is staffed by 8 medical representatives, 7 head nurses for supervision, 16 highly qualified nurses, and 34 nurses.

Subjects:

A convenience sample of all nurses who were working in the pediatric intensive care unit of Assiut University Children's Hospital were included in this study. Their number was 50 nurses; eight of them completed their secondary education in nursing, 26 of them graduated from the technical institute of nursing, and 16 obtained a bachelor's degree in nursing.

Tools for data collection:

Two tools were used to obtain the data needed for this study:

Tool (1): A structured interview questionnaire sheet for nurses. It consisted of two parts:

Part (1): Personal data of the studied nurses which include age, residence, educational qualifications, marital status, years of experience and previous attendance of training courses. It included 6 questions.

Part (2): Knowledge questionnaire of pediatric nurses about mechanical ventilation as (definition, indications, problems, preparation before connecting the child to MV and nursing role) and nurses' knowledge regarding safety measures as (definition, importance, items of safety measures).

It included 20 "MCQ" questions.

Scoring system for knowledge

Based on the responses provided by study subjects for each question, a correct answer was awarded one mark, while an incorrect or "don't know" answer received no marks. The scores for each item were then tallied and converted into a percentage, which was used to categorize the studied nurses' knowledge into three levels:

- A score of less than 60% indicated poor knowledge.
- A score between 60 and 75% suggested fair knowledge.
- A score of over 75% indicated a good level of knowledge. (**Ahmed et al., 2018**).

Tool (2): Nurses' practice observational checklist sheet:

Indirect observational checklist was used to assess nurses' practice about safety measures provided for mechanically ventilated children which included the following procedures:

Endotracheal tube (ETT) suctioning	(14) items
Mouth care	(9) items
Eye care	(7) items
Administration of high alert medications	(11) items
Alarms and equipment check	(7) items
Infection control measures	(20) items
Prevention of bed sores	(8) items
Prevention of fall	(4) items
Weaning the child from mechanical ventilation	(4) items

Scoring system for practice

The evaluation criteria for the items observed involved assigning a score of "2" for those that were completed done, "1" for those that were incompleted done, and "0" for those that were not done. The practice was considered satisfactory if it achieved a score of 70% or higher, and unsatisfactory if it fell below that threshold **(Mohamed et al., 2019).**

Method of data collection

▪ The researcher obtained official permission from the director of the pediatric intensive care unit (PICU) at Assiut University Children's Hospital to collect the necessary data after explaining the nature of the study.

▪ The researcher introduced herself, explained the nature and purpose of the study, and then obtained the nurses' written consent for voluntary participation.

▪ The researcher developed tools (1) and (2), and five experts in the disciplines of pediatrics and pediatric nursing evaluated it for their content's validity index. The results showed that Tool (1) validity index was 97% and Tool (2) was 96%.

▪ The alpha Cronbach test indicated the tools' reliability to be $\alpha = 0.826$ for tool (1) and $\alpha = 0.834$ for tool (2).

▪ Before the beginning of the study a pilot study was conducted on 10% of nurses (5 nurses) to evaluate the sheet's clarity and application as well as to calculate the time required to complete it, there were no modifications needed and the nurses in the pilot study were included in the total sample.

Field work:

This research was carried out over four months, starting at the beginning of February 2024 and concluding at the end of May 2024. The interviews with the studied nurses were conducted twice a week, considering their available time during the morning and afternoon shifts. To fill out the knowledge questionnaire sheet, two or three nurses were interviewed per day individually after explaining the nature and purpose of the study, and the time required for each interview ranged from 15 to 20 minutes, depending on the response of the participating nurses. For this study, indirect observation of safety measures provided by nurses for mechanically ventilated children was done individually for each nurse. One to two nurses were observed per day during the all-shift. The time required for observation ranged from 5 to 6 hours. After finishing collecting data, a brochure was distributed to all nurses directly involved in the study to help them overcome any identified deficiencies.

Ethical consideration:

1. Research proposal was approved from the Ethical Committee in the Faculty of Nursing (IRB: **1120230691**).
2. There was no risk for nurses during application of research.
3. The study followed common ethical principles in clinical research.
4. Written consent was obtained from nurses that participated in the study, after explaining the nature and purpose of the study.
5. The researcher assured the nurses that their anonymity and confidentiality would be maintained.
6. The pediatric nurses were informed that they had the option to participate in the study or not and that they could withdraw from the study at any point without providing any reasons.
7. The researcher assured the nurses that their data would only be used for research purposes and their privacy would be maintained.

Statistical analysis:

Data entry and data analysis were done using statistical package for the social science (SPSS) version 26. Data were presented as number, percentage means and standard deviation. The Chi-square test was used to compare categorical variables, Pearson correlation coefficients were used to assess the relationship between continuous variables. P-value was considered statistically significant when $p < 0.05$.

Results:

Table (1): Percentage distribution of the studied nurses according to their personal data (n=50)

Personal data		N	%
Age / years:	20 - < 30 years	30	60.0
	30 - < 40 years	17	34.0
	40 years and more	3	6.0
Age (Mean±SD)	30.70±5.257		
Residence	Rural	28	56.0
	Urban	22	44.0
Marital status	Single	15	30.0
	Married	34	68.0
	Divorced / Widow	1	2.0
Educational Qualifications	Secondary school of nursing	8	16.0
	Technical Nursing Institute	26	52.0
	Bachelor's degree in nursing	16	32.0
Years of Experience:	< 5 years	24	48.0
	5 - < 10 years	10	20.0
	10 - < 15 years	7	14.0
	15 years and more	9	18.0
Years of Experience (Mean±SD)	7.26±5.53		
Have you attended a training course on safety measures for mechanically ventilated children?	Yes	17	34.0
	No	33	66.0
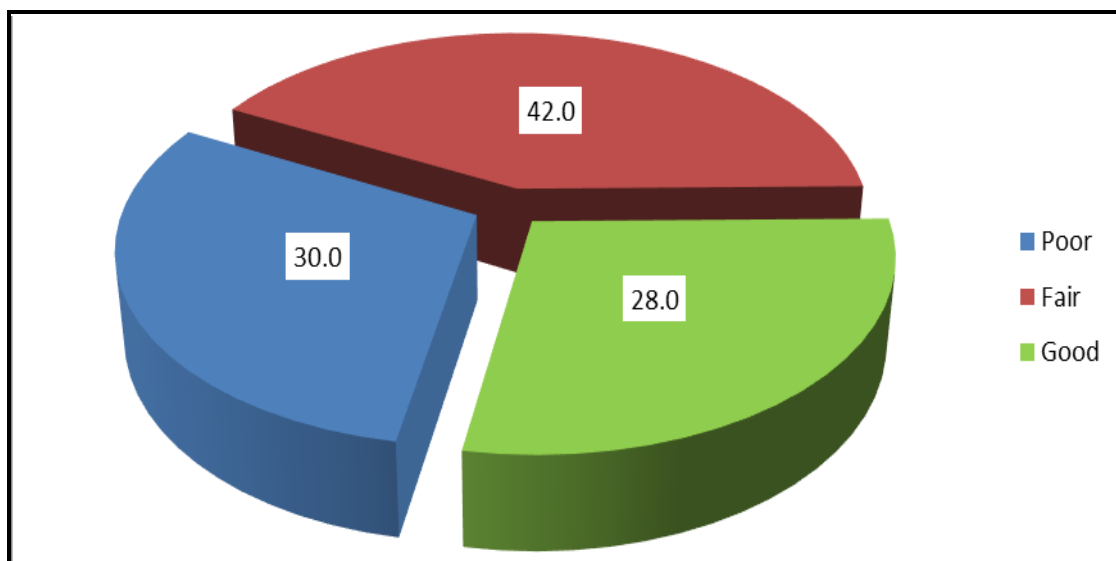
Figure (1): Total knowledge level of the studied nurses according to safety measures for mechanically ventilated children (n=50)

Table (2): Mean ± SD of total practices score of the studied nurses regarding safety measures provided for mechanically ventilated children (n=50)

| Procedures	Max Score	Mean±SD	Mean %
Endotracheal tube (ETT) suctioning	28	17.24±4.5	61.6
Mouth care	18	12.22±2.26	67.9
Eye care	14	9.32±1.49	66.6
Administration of high alert medications	22	15.98±2.61	72.6
Alarms and equipment check	14	5.46±1.94	39.0
Infection control measures	40	30.38±3.91	76.0
Prevention of bed sores for mechanically ventilated children	16	9±2.77	56.3
Prevention of fall for mechanically ventilated children	8	5.12±1.79	64.0
Safety weaning of the child from mechanical ventilation	8	5.72±1.36	71.5
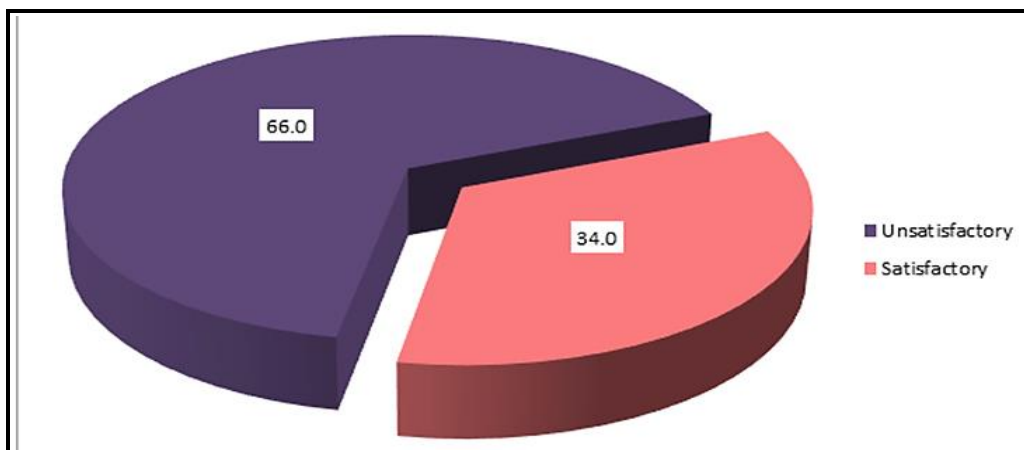
Figure (2): Total practices level of the studied nurses regarding safety measures provided for mechanically ventilated children (n=50)

Table (3): Relation between the personal data of the studied nurses and their total knowledge (n=50)

Personal data	Total knowledge						P. value
	Poor (N=15)		Fair (N=21)		Good (N=14)		
	No	%	No	%	No	%	
Age /years							
20 - < 30 years	9	60.0	12	57.1	9	64.3	
30 - < 40 years	4	26.7	9	42.9	4	28.6	0.470
40 years and more	2	13.3	0	0.0	1	7.1	
Residence							
Rural	9	60.0	12	57.1	7	50.0	0.855
Urban	6	40.0	9	42.9	7	50.0	
Marital status							
Single	4	26.7	5	23.8	6	42.9	0.589
Married	11	73.3	15	71.4	8	57.1	
Widow/Divorced	0	0.0	1	4.8	0	0.0	
Educational Qualifications							
Secondary school of nursing	3	20.0	3	14.3	2	14.3	
Technical Nursing Institute	8	53.3	14	66.7	4	28.6	**0.031***
Bachelor's degree in nursing	4	26.7	4	19.0	8	57.1	
Years of Experience:							
< 5 years	8	53.3	10	47.6	6	42.9	
5 - < 10 years	3	20.0	3	14.3	4	28.6	0.904
10 - < 15 years	2	13.3	4	19.0	1	7.1	
15 years and more	2	13.3	4	19.0	3	21.4	
Have you attended a training course on safety measures for mechanically ventilated children?							
Yes	0	0.0	7	33.3	10	71.4	**<0.001****
No	15	100.0	14	66.7	4	28.6	

Chi-square test   *(**) highly statistically significant difference*

Table (4): Relation between the personal data of the studied nurses and their total practices (n=50)

Personal data	Total Practices				P. value
	Unsatisfactory (N=33)		Satisfactory (N=17)		
	No	%	No	%	
Age /years					
20 - < 30 years	24	72.7	6	35.3	
30 - < 40 years	7	21.2	10	58.8	**0.026***
40 years and more	2	6.1	1	5.9	
Residence					
Rural	20	60.6	8	47.1	0.361
Urban	13	39.4	9	52.9	

Personal data	Total Practices				P. value
	Unsatisfactory (N=33)		Satisfactory (N=17)		
	No	%	No	%	
Marital status					
Single	12	36.4	3	17.6	
Married	20	60.6	14	82.4	0.272
Widow/Divorced	1	3.0	0	0.0	
Educational Qualifications					
Secondary school of nursing	8	24.2	0	0.0	
Technical Nursing Institute	21	63.6	5	29.4	**<0.001****
Bachelor's degree in nursing	4	12.1	12	70.6	
Years of Experience:					
< 5 years	20	60.6	4	23.5	
5 - < 10 years	9	27.3	1	5.9	**<0.001****
10 - < 15 years	2	6.1	5	29.4	
15 years and more	2	6.1	7	41.2	
Have you attended a training course on safety measures for mechanically ventilated children?					
Yes	6	18.2	11	64.7	
No	27	81.8	6	35.3	**0.001****

Chi-square test   *(**) highly statistically significant difference*
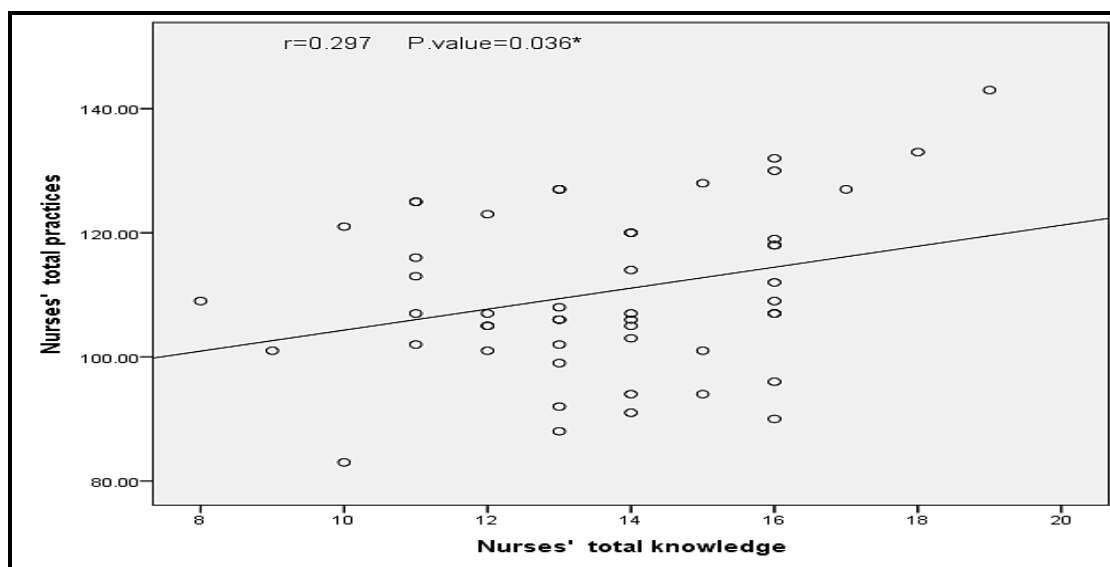

Figure (3): Correlation between total knowledge and total practices levels of the studied nurses regarding safety measures provided for mechanically ventilated children (n=50)

Table (1): Shows the distribution of the studied nurses according to their personal data. The results revealed that 60% of the nurses were in the age group ranged from 20 - < 30 years, with a mean age of 30.70 ± 5.257 years. More than half (56%) of them resided in rural areas, and 68% were married. Concerning their educational qualifications, 52% of them graduated from a Technical Nursing Institute. Furthermore, 48% of the nurses had less than five years of experience in the nursing field, with a mean of 7.26±5.53 years. In addition, 66% of the nurses didn't attend any training courses on safety measures for mechanically ventilated children.

Figure (1): Illustrates the total knowledge level of the studied nurses according to safety measures for mechanically ventilated children. The results showed that 42% of the nurses had fair knowledge about safety measures, while 30% had poor knowledge and 28% had good knowledge.

Table (2): Represents mean ± SD of total practices score of the studied nurses regarding safety measures provided for mechanically ventilated children. It was found that the highest mean score was observed for infection control measures (30.38 ± 3.91), followed by endotracheal tube (ET) suctioning (17.24 ± 4.5). The nurses also scored relatively high on the

administration of high-alert medications (15.98 ± 2.61) and mouth care (12.22 ± 2.26). However, the scores were lower for eye care (9.32 ± 1.49), prevention of bed sores (9.00 ± 2.77), weaning the child from mechanical ventilation (5.72 ± 1.36), alarms, and equipment checks (5.46 ± 1.94). The lowest mean score was observed for the prevention of falls, which was (5.12 ± 1.79).

Figure (2): Shows total practices level of the studied nurses regarding safety measures provided for mechanically ventilated children. Two-thirds (66%) of the nurses had unsatisfactory practices level regarding safety measures provided for mechanically ventilated children, while 34% of them had satisfactory practice.

Table (3): Exhibits relation between the personal data of the studied nurses and their total knowledge. It was observed that a highly statistically significant difference was detected as regards the nurses' educational qualifications and attendance of a training course on safety measures (Pv = 0.031* & < 0.001** respectively). While no statistically significant differences were detected as regards the other personal data of the nurses.

Table (4): Represents relation between the personal data of the studied nurses and their total practices. It was found that the nurses' age, educational qualifications, years of experience, and attendance of a training course on safety measures for mechanically ventilated children had a highly statistically significant association with their total practice (Pv = 0.026* & <0.001** & <0.001** & 0.001** respectively). While personal data, such as residence and marital status, did not show statistically significant associations with the nurses' total practice.

Figure (3): Illustrates correlation between total knowledge and total practices levels of the studied nurses regarding safety measures provided for mechanically ventilated children. It was found that there is a positive correlation between nurses' knowledge about safety measures for mechanically ventilated children and their practice of these measures. The correlation coefficient (r = 0.297*) with a statistically significant difference (P v =0.036*).

Discussion:

The World Health Organization highlights the crucial need to prioritize the safety of hospitalized children, especially those in intensive care units. They emphasize that neglecting patient safety can lead to increased financial burdens, emotional distress for both the children and their families, and extended hospital stays **(Kalroozi et al., 2022)**.

Pediatric nurses play a pivotal role in ensuring children's safety. Their critical perspective on patient safety is essential for providing prolonged and quality care. By adopting and defending this perspective, they can contribute significantly to the overall safety of hospitalized children **(Adly et al., 2020).** So, the current study aimed to assess safety measures provided by nurses for mechanically ventilated children by assessing their knowledge and practice about safety measures for those children and the development of suggested guidelines for nurses based on the needs.

Regarding the age of the studied nurses, the present study reveals that 60% of nurses were between 20 < 30 years old. These findings align with those of **Adly et al. (2020)**, who also reported that approximately two-thirds of the nurses studied were within this age range.

Concerning nurses' qualifications, the findings revealed that over half of the nurses held technical nursing degrees. This finding was consistent with the studies by **Botros et al. (2019) & Ahmed et al. (2022)**, which also reported that more than half of nurses had technical nursing qualifications. While, this result contradicted the findings of **Ahmed et al. (2018)**, who found that most of them had nursing diplomas.

The findings of the current study showed that less than half of the nurses had less than five years of experience in nursing field. This aligns with the findings of **Adly et al. (2020)**, who reported that over a third of their participants had one to five years of experience. However, this finding contradicts the studies by **Fayed et al. (2018)** and **Ali et al. (2019)**, who found that less than half of the staff nurses had 5- < 10 years of experience.

The study found that two-thirds of the nurses didn't attend a training course on safety measures for mechanically ventilated children. This finding is consistent with the studies by **Fayed et al. (2018)** and **Ahmed et al. (2022),** which also reported that the majority of staff nurses didn't participate in training programs related to child safety. This finding is not supported by **Ahmed et al. (2018)**, whose results indicated that the majority had previously participated in training on patient safety, and by **Mamdouh et al. (2020)**, who reported that two-thirds of the study nurses attended training courses on patient safety measures. This finding may be due to inadequate implementation of training programs and a lack of supervisor awareness regarding the importance of safety.

The present study found that more than two-fifths of the nurses had fair knowledge and less than one-third of them had good and poor knowledge. This result aligns with **Adly et al. (2020)** who reported that two-thirds of nurses had unsatisfactory knowledge regarding the application of safety precautions in

pediatric critical care. Similarly, **Ahmed et al. (2022)** found that one-third of nurses had an average level of knowledge, with only a minority showing good level. However, these findings contrast with **Deouky et al. (2024)**, who found that 69.5% of nurses had satisfactory knowledge about children safety during the pre-intervention phase of his study. From the researcher's perspective, the generally low knowledge levels of pediatric critical care nurses about safety measures may be due to a lack of ongoing education programs and continuous quality improvement initiatives.

Regarding overall nurse practices, the current study found that two-thirds of the nurses had unsatisfactory practices concerning safety measures for mechanically ventilated children in the PICU at Assiut University Children Hospital. This is supported by **Fayed et al. (2018)**, who reported that more than two-thirds (68.5%) of nurses had inadequate practices related to child safety, and **Mamdouh et al. (2020)**, who noted that 70% of the nurses had unsatisfactory practices in implementing patient safety measures. Additionally, **Adly et al. (2020)** found that more than half of the nurses had inadequate practices regarding safety standard precautions in pediatric critical care. From the researcher's point of view, these findings may be due to several factors, such as insufficient training, high workloads, inadequate adherence to safety protocols, limited resources, a lack of regular supervision, and gaps in continuous education.

The present study revealed that there was a highly statistically significant relation between nurses who had attended training courses and their knowledge. This finding is consistent with the studies by **Ahmed et al. (2022) & Mamdouh et al. (2020),** which also reported a significant relationship between training and knowledge. The researcher believes that training programs play a vital role in improving child safety by updating nurses' knowledge and practices. Attending training and educational programs, especially in pediatric units, is essential for enhancing children's safety during nursing care.

The study found a positive relation between the total knowledge score of the nurses and their educational qualifications. This finding aligns with the study by **Mamdouh et al. (2020),** which also reported a significant relation between knowledge and qualifications. The researcher suggests that higher educational levels provide specialized knowledge and critical thinking skills, as nurses with a bachelor's degree in nursing demonstrated better knowledge in the study compared to those who graduated from technical nursing institutes or secondary schools of nursing.

In addition, there was a statistically significant

relation between nurses' level of practice and their age. This finding is consistent with the studies by **Adly et al. (2020)** and **Ahmed et al. (2022)**, which also reported a significant relationship between practice and age. The researcher suggests that increased the nurses' clinical experience and skill development with their age may contribute to improving their practice.

Also, there was a highly statistically significant relation between nurses' level of practice and their educational qualifications. This finding is supported by **Mamdouh et al. (2020), Adly et al. (2020) & Ahmed et al. (2022)**, who also reported a significant relation between the nurses' practice and their qualifications. According to the researcher, these results may be attributed to several factors, including advanced education, which provides deeper knowledge and enhanced clinical skills. Additionally, senior staff in the PICU offer comprehensive training, guiding nurses to develop the skills needed to work independently. Frequent doctor rounds also contribute to increasing the nurses' knowledge and skills through continuous learning opportunities.

The results of the current study showed that there was a highly statistically significant relation between nurses' level of practice and their years of experience. This finding aligns with **Adly et al. (2020) & Ahmed et al. (2022)** who found that increased years of experience led to higher total practice scores, suggesting that experience allows nurses to master skills more competently.

The findings of the current study showed a highly statistically significant relation between nurses were attended training courses and their level of practice. This result is supported by **Botros et al. (2019) & Ahmed et al. (2022)**, who reported a significant relation between training courses and improved practice levels. This finding may be due to training courses providing nurses with updated knowledge, practical skills, and a better understanding of protocols, all of which contribute to improved performance in clinical practice.

between the total score of nurses' knowledge and their practices. This finding aligns with **Mamdouh et al. (2020), Ahmed et al. (2022) & Rukmini et al. (2024)**, who also reported a significant positive correlation between total knowledge and practice. This finding reflects that nurses' performance is closely related to their level of knowledge.

Conclusion:

Based on the results of the current study, it can be concluded that there was a lack of nurses' knowledge and practices, and a statistically significant difference was detected between the nurses' overall knowledge and their practices regarding safety measures provided for mechanically ventilated children.

Recommendations:

Based on the findings of the present study, it is recommended that:

1. Integrate child safety concerns into orientation and ongoing educational activities for all pediatric critical care nursing staff is essential to enhance safety performance.
2. The pediatric intensive care unit must have enough highly qualified nurses.
3. Educational programs and advanced training courses should be developed and implemented based on evidence-based guidelines and the specific needs of staff nurses to enhance their knowledge and practices regarding safety measures for mechanically ventilated children.
4. Strict monitoring and ongoing evaluation of nurses' adherence to safety protocols for mechanically ventilated children are needed, with quality teams addressing any deficiencies in practice.
5. Future research is necessary to identify the challenges and barriers to implementing safety measures for mechanically ventilated children.
6. A similar study should be conducted on a larger scale and in different settings to validate and generalize the findings.
7. Provide safety guidelines booklet for nurses regarding the safety of mechanically ventilated children in pediatric intensive care units for all healthcare facilities.

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