Assessment of Nurses' Performance Regarding Care of Mechanically Ventilated Children

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Abstract

Background: Children on mechanical ventilator are totally depended on nurses. So nurses have a major role to play in sustaining the lives of these children by meeting their health requirements. **Aim of the study:** was to assess nurses' performance regarding care of mechanically ventilated children. **A descriptive study design** was conducted in pediatric intensive care units in Suez Canal University Hospitals, Ismailia Medical Complex, Pediatric Hospital at Zagazig University Hospitals and Al Ahrar Hospital in Zagazig city. **Sample:** A purposive sample of 74 nurses. **Tools of data collection: Tool I:** A structured interview questionnaire sheet to assess nurses' knowledge regarding care of mechanically ventilated children. **Tool II:** observational checklist to assess nurses' practice provided to mechanically ventilated children. **Results:** The results of the present study revealed that less than one fourth of studied nurses had good knowledge, less than one third of them had fair knowledge, less than half of them had poor knowledge while more than two third of studied nurses had incompetent total practice level. **Conclusion:** It was concluded that less than half of studied nurses had poor knowledge regarding care of mechanically ventilated children while more than two third of studied nurses practice provided to mechanically ventilated children was incompetent. **Recommendations:** Based on the results of the present study continuous formal training and educational programs about care of mechanically ventilated children will help nurses to update their knowledge and improve their practice.

Keywords: Care, Children Mechanically Ventilated, Nurses, performance

1. Introduction

Mechanical ventilation (MV) refers to the use of life support technology which assists the work of breathing for child who are unable to effectively oxygenate and/or ventilate on their own, in order to maintain adequate oxygenation and ventilation until the underlying pathologic process resolves **(Bolick et al., 2020)**.

Mechanical ventilation is a lifesaving therapy used for children who have an illness or condition that can lead to respiratory failure. It controls or helps a child's respirations when he or she is unable to maintain adequate gas exchange because of
respiratory or ventilatory failure **(Perry et al., 2022).**

Mechanical ventilation is often required to manage emergency conditions or critical illness, whether for airway protection, administration of general anesthesia, or management of acute respiratory failure (ARF).With the goal of improved gas exchange, better child comfort, and rapid liberation from the ventilator **(Shapiro &Barie, 2024).**

Mechanical ventilation is indicated for physiological and clinical reasons. **Physiological objectives** include supporting cardiopulmonary gas exchange, increasing lung volume and reducing the work of breathing. **Clinical objectives** include reversing hypoxemia and acute respiratory acidosis, relieving respiratory distress, preventing or reversing atelectasis and respiratory muscle fatigue, permitting sedation and neuromuscular blockade, decreasing oxygen consumption, reducing intra cranial pressure and stabilizing the chest wall **(Urden et al., 2022)**.

The complications of MV are associated with adverse child outcomes. Therefore, established prophylactic measures should be used to avoid these complications and equally important appropriately timed discontinuation of MV is imperative to minimize these complications **(Kenaan & Hyzy, 2019).**

Children on mechanical ventilator are totally depended on nurses. So the nursing personnel have a major role to play in sustaining the lives of the children by meeting health requirements. Thus for this, a thorough knowledge and skills regarding the nursing care of children on mechanical ventilator is very much essential **(Kakoty & Devi, 2020)** therefore the nursing management of the mechanically ventilated child is challenging on many levels: from the acquisition of highly technical skills; expert knowledge on invasive monitoring; and implementation of interventions to care for these children **(Broden et al., 2022).**

In order to provide the best comprehensive child care while reducing healthcare costs, the nurse must have the knowledge, skills, and abilities to properly

manage a child receiving mechanical ventilation. It is essential that educators, students, and nurse practitioners strive to develop the knowledge necessary to successfully manage children receiving ventilation support and proper mechanical ventilator education strategies at all levels to the healthcare team will have a profound effect on increasing the quality of child care in such field **(Mohamed et al., 2019)**.

Nurses plays an important role in managing child on mechanical ventilation, as they are constantly beside the child, vigilantly looking for any changes in child' condition. Also, optimal child outcome is impacted by effective teamwork among the multidisciplinary team predominantly between the nurses and physicians.So, relational coordination has a strong effect on caregivers' process of preparation to provide and manage care, which promotes better outcomes for children **(Matlhola, 2020)**.

Additionally, with the right knowledge and right skills, nurses can reduce the risk of complications, decrease the length of time in the hospital and improve child outcome, Therefore, it is essential for nurses to have relevant skills and understanding required for their role as they are the key of information to child, relatives and other members of inter disciplinary team **(Kakoty & Devi, 2020).**

Significance of the study:

Mechanical ventilation is a key step in management of critically ill children in pediatric intensive care units accounting for 30% to 64% **(Gowa et al., 2022)**. In Egypt, the incidence of children utilizing mechanical ventilation was 32.8 % **(Bacha et al., 2021).**

Mechanical ventilation is an indispensable form of life support for children undergoing general anesthesia or experiencing respiratory failure in the setting of critical illness. These children are at risk for a number of complications related to both their underlying disease states and complications related to mechanical ventilation itself such as ventilator associated lung injury (VALI), ventilator associated pneumonia (VAP) and pneumothorax **(Rackley, 2020)**. Therefore, this study will be conducted to assess nurse' knowledge and practice as well as determine if they have sufficient knowledge and practice or not about care provided to mechanically ventilated children.

Aim of the Study:

The aim of this study was to assess nurses' performance regarding care of mechanically ventilated children.

Research Questions:

- What is the level of nurses' knowledge regarding care of mechanically ventilated children?
- What is the level of nurses' practice regarding care of mechanically ventilated children?

2. Subjects and Method:

Research design

A descriptive study design was used to conduct this study

Research Settings:

The study was conducted in pediatric intensive care units in Suez Canal University Hospitals, Ismailia Medical Complex, Pediatric Hospital at Zagazig University Hospitals and Al Ahrar Hospital in Zagazig city.

Subjects:

A purposive sample of (74 nurse) who were working in the previous mentioned settings, nurses were included in the study regardless their personal characteristics, willing to participate in the study, have at least one year experience and involved in providing care for children on mechanical ventilator.

Tools of data collection:

Two tools were used to collect the required data.These tools as the following:-

Tool I: A structured interview questionnaire sheet

It was developed by the researcher after reviewing related literatures, designed in Arabic language to collect the required data and it included the following parts:

Part 1: Personal characteristics of the studied nurses such as age, gender, educational level, years of experiences, attendance of any training program regarding care of children on mechanical ventilation.

Part 2: Nurses' knowledge regarding care of mechanically ventilated children

Scoring system for nurses' knowledge was developed by the researcher; each correct answer was scored (1) point and (0) for wrong answer or don't know. The total nurses' knowledge score was ranged from (0 – 67) marks which classified as the following-:

- Good ≥ 80% (53.6 – 67 marks).
- Fair 60-80% (40.2 – < 53.6 marks).
- Poor < 60% (< 40.2 marks).

Tool II: observational checklist for nurses' practice

It was adopted from **(Bowden & Greenberg , 2015) & (Gormley & Martin, 2018)** to evaluate nurses' practice about all aspect of care provided to children on mechanical ventilator.

Scoring system of nurses' practice

It was developed by the researcher, each correct step done adequately will take two points, done in adequately will take one point and zero point for not done. The total level of nurses' practice was ranged from (0-424) marks which classified as the following:

- Competent ≥85% (360.4 – 424 marks)
- Incompetent <85% (< 360.4 marks)

Tools validity and reliability:

For validity assurance purposes, structured interview questionnaire sheet and observational checklist for nurses' practice were reviewed for content validity by three experts in pediatric nursing specialty (one assistant professor from faculty of nursing, Suez Canal University and two assistant professor from faculty of nursing, Benha university) All of their remarks were taken into consideration and the tools were regarded as a valid from the experts' point of view.

Reliability of the tools was examined by using Cronbach's alpha coefficient test in SPSS program, version 26 to measure the internal consistency for all tools. The results were as the following: internal consistency reliability Cronbach's alpha for nurses' knowledge regarding care of mechanically ventilated children is good reliable emerged as (0.781) and nurses' practice (0.796)

Ethical Considerations:

The research approval was obtained from the Scientific Research Ethical Committee of the faculty of nursing Suez Canal University before starting the study. The inclusion of subjects in the study was totally voluntary. A verbal consent was obtained from the nurses to accept to participate in the study and confidentiality of any obtained information was ensured and each nurse has the right to withdraw at any time of the study without incurring any consequences.

Pilot Study:

A pilot study was carried out on 10% of the nurses (7 nurses) to test applicability, feasibility, practicability of the data collection tools and time required to fill in each tool. The result of the obtained data helped in modifications of the study tools by adding arterial blood gases instead of capillary blood gases, and weaning child from mechanical ventilator was added to the observational checklist. Nurses' who participated in the pilot study were excluded from the study sample.

Field Work:

Data were collected within a period of 3 months (from the beginning of July, 2023 to the end of September 2023). After getting the official permission and had their approval to participate in the study. The pilot testing of the study tools was done and analyzed. Nurses were met by the researcher 4 days per week Saturday for nurses in Suez Canal University Hospitals, Monday for nurses in Ismailia Medical Complex, Tuesday for nurses in Pediatric Hospital at Zagazig University Hospitals and Thursday for nurses in Al Ahrar Hospital in Zagazig city. From 9:00 A.M to 2:00 P.M. The researcher interviewed the nurses individually according to their availability (after providing nursing activities of the unit). The purpose of the study was explained briefly to nurses and obtained their verbal consent.

Statistical Design:

The data were collected, coded, tabulated and subjected to statistical analysis. Statistical analysis was performed by Statistical Package for Social Science (SPSS) version 26; also Microsoft Office Excel is used for data handling and graphical presentation. Descriptive statistics were applied in the form of mean and standard deviation for quantitative variables and frequency and percentage for qualitative variables. Qualitative categorical variables were compared using Pearson's correlation coefficient was calculated between variables. Highly statistical significance was considered at P- value $\leq$ 0.001, Statistical significance was considered at P-value $\leq$ 0.05, Non significance P- value > 0.05

3. Results:

Table (1) demonstrates distribution of studied nurses regarding to their personal characteristics. It was found that, less than half of the studied nurses' age 45.9 % ranged between 25 -<30 years old with mean age of 28.33±5.67 years, less than half 47.3 % and more than one third of them 36.5 % were graduated from technical institute and Bachelor degree of nursing respectively. Also, this table reflects that, less than one third of the studied nurses 31.1 % had 1-3 years of experience with mean of 2.74±8.51 years of experience

Figure 1: shows that most of studied nurses 83.8 % were females while only 16.2% were male

Figure 2: It was evident from that, more than half of the studied nurses 58.1 % had attended previous training program compared to 41.9% who never attended any previous training

program about care of mechanically ventilated children.

Figure 3: shows the total nurses' knowledge level. It was revealed that 24.3 %of studied knowledge had good knowledge, 32.4% of them had fair knowledge and 43, 2% had poor knowledge

Table 2: This table clarifies that 68.9 % and 67.6 % of studied nurses had incompetent practice regarding preparation of ventilator and endotracheal tube care while 74.3% of them had incompetent practice regarding chest physiotherapy.

Table 3: Illustrates that 68.9 % of studied nurses' had incompetent practice regarding suctioning of mechanically ventilated children.

Total practice level of studied nurses was illustrated in **figure (4).** It was revealed that 68.9% of studied nurses had incompetent practice.

Table (4): reflects that, there was no statistical significant correlation between total score of nurses' knowledge and their age, educational level and attendance of training courses **(P > 0.05)**.

Table (5): reveals that, there was statistically significant correlation between total nurses' practice level and their educational level, years of experience and attendance of training courses **(P < 0.05).**

4. Discussion:

Mechanical ventilation is a complex intervention that requires a multidisciplinary approach to care, so nurses caring for children on mechanical ventilation require specialist knowledge and skills to monitor, identify and prevent the potential deleterious effect from MV (**Peate & Hill, 2023).**

The finding of the present study revealed that the mean score of studied nurses' age was **28.33±5.67**, while the mean score of nurses' years of experience was **2.74±8.51**.

Concerning total nurses' knowledge level the present study revealed that less than half of the studied nurses had poor total level of knowledge. This might be due to the wide base of nurses' had finished their education in technical institute of nursing, lack of motivation, ICU nurses had not enough time to frequent attend conferences and workshops to enrich and update their knowledge, ICU workload and shortage of the staff number. This finding goes in line with **Ebrahim et al., (2023)** who carried out study about "Nurses' Knowledge Regarding Care Provided to

Children on Mechanical Ventilation" and found that less than two third of studied nurses had poor total knowledge score.

Similarly **Mohamed et al., (2019)** who conducted a study to determine "The effect of Educational Program on Nurses' Knowledge and Practice Caring for Patients on Mechanical Ventilation Working in Assuit University Hospital" agreed with findings of the current study and found that more than half 56% of studied nurses had unsatisfactory knowledge.

On the other hand this result contradicted with **Hassen et al., (2023)** who conducted study about "Knowledge Regarding Mechanical Ventilation and Practice of Ventilatory Care among Nurses Working in Intensive Care Units in Selected Governmental Hospitals in Addis Ababa, Ethiopia" and found that less than half(48.6%) of studied nurses had good knowledge score

Regarding to nurses' practice about preparation of mechanical ventilator, the findings of this study revealed that, more than two third of studied nurses' had incompetent practice. This might be due to more than three quarter of the studied nurses had fair and poor knowledge about mechanical ventilation which adversely affect their practice

This finding was supported by **Mahfoz et al., (2022)** who conducted study about "Effect of Design Nursing Instruction on Mechanically Ventilated Children in Pediatric Intensive Care Units" and found that more than half (56%) of studied nurses in adequately practice preparation of ventilator for mechanically ventilated children and reported that it is important to develop a written protocol for care of mechanically ventilated children in order to support competent practices are actually required in children's Intensive Care Units.

Also, **Akl et al., (2020)** conducted a study to describe "Effectiveness of Ventilator Associated Pneumonia Care Bundle on the Pediatric Critical Care Nurses Knowledge, Practice and Critically ill Neonates Outcome" which supported these results and found that slightly less than two third of them (63.9%) had unsatisfactory practice score regarding ventilator management.

Concerning nurses' total practice about chest physiotherapy, the findings of this study revealed that, slightly more than one fourth of the studied nurses had competent practice while less than three quarter of studied nurses

had incompetent practice. This result attributed to lack of practice training about the importance of chest physiotherapy

This finding in agreement with **Ebrahim et al., (2023)** who carried out study about "The Expected Outcomes of Nursing Care Provided to Children on Mechanical Ventilation" and found that less than three quarter of nurses had insufficient practice regarding chest physiotherapy

Similarly this finding goes in line with **El-Sayed et al., (2023)** who found that less than two third (65%) of nurses had inadequate practice regarding chest physiotherapy.

On the other hand, these findings were disagreed with **Mohamed et al., (2019)** who carried out study to evaluate "Effect of Educational Training Program about Chest Physiotherapy on Nurses' Performance and Clinical Outcomes for infants with Lower Respiratory Problems in Pediatric Intensive Care Unit" and reported that the majority of nurses (84%) had unsatisfactory level of total performance of chest physiotherapy.

The present study revealed that more than two third of studied nurses had incompetent practice regarding suctioning of mechanically ventilated children. This might be due to in the present study observations, nurses did not adhere to best practice suction recommendations including hyper oxygenation before and after suctioning. As well as, limiting period of active suctioning to not exceed ten seconds

This finding goes in line with **Ali et al., (2023)** who conducted a study to evaluate "Effectiveness of Educational Program on Nurses' Knowledge and Practices Regarding Neonatal Endotracheal Tube Suctioning" and reported that most studied nurses (88.3%) had in competent practice regarding neonatal suctioning

Similarly, this finding is agreed with **Sharma & Subin (2023)** who conducted a study about "Effectiveness of video assisted teaching on knowledge and practice regarding suctioning of children on mechanical ventilator among nurses working in pediatric department" and found that more than two third of nurses (68.42%) had average practice regarding suctioning of children on mechanical ventilator.

On the other hand, this finding contradicted with **Ahmed & Hattab (2022)** who carried out study to investigate

"Effectiveness of Intervention Program on Nurses' Practice toward Neonatal Endotracheal Suctioning Procedure" and found that all of neonatal intensive care unit nurses had an inadequate level of practice toward neonatal endotracheal suctioning procedure.

Concerning total practice score of the studied nurses, more than two third of the studied nurses had an incompetent total percentage score of practice. This might be due to the nurses' experience years in PICU only 1-3 years additionally in bachelor degree nurses usually worked as a head nurses not bedside when they worked in governmental hospital, moreover this could be due to shortage of staff nurses which lead to workload in these units and poor management of nurses' time.

This results agreed with **Hegazy& Abusaad (2019)** who conducted a study about "Nurses, Knowledge and Practices about Care of Neonates on Mechanical Ventilators with Respiratory Distress" and found that more than two thirds of the studied nurses (69.2%) had incompetent practical level compared to less than one third of them (30.8%) had competent practical level regarding care for neonates with respiratory distress on mechanical ventilation

In the same line with **El-Garhy et al., (2020)** who carried out a study about "Quality of Nursing Care Provided to Neonates Undergoing Mechanical Ventilation: An Assessment Study" and found that less than one third of studied nurses had (31.7%) competent practice while more than two third (68.3%) had incompetent practice regarding care of neonates on mechanical ventilator.

In the same line with the results, **Sharma et al., (2023)** who conducted a study to develop" nursing care protocol regarding the care of child on mechanical ventilator and assess its effectiveness in terms of knowledge and practice among the staff nurses working in the intensive care unit in selected hospital of New Delhi" found that less than three quarter of studied subjects had incompetent practice regarding care of child on Mechanical ventilator

Concerning correlation between nurses' personal characteristics and their total knowledge score, the current study showed that, there is no statistical significant correlation between total score of nurses' knowledge and their age, educational level and attendance of training courses ($P > 0.05$).

This result agrees with **Mohammed et**

al., (2023) who conducted a study about "Nurses' Knowledge and Practices Regarding Care of High-Risk Neonates Connected with Mechanical Ventilator" and found that there was no statistically significant correlation between nurse's knowledge and their age. Furthermore, this result agrees with **El Shahat & Abd Allah (2019)** who conducted a study about "Effect of Evidence Based Practice Training Program on Professional Nurses' Decision Making Abilities" and displayed that there were statistically significant correlation between nurses` total knowledge score and their years of experience.

On the other hand this finding was contradicted with **Mohammed & Ebrahem (2022)** who carried out study about "Relationship between Critical Care Nurses' Knowledge and Clinical Decision Making Role in Managing Mechanically Ventilated Patients" and reported that there is a statistical significant positive correlation between knowledge and selected characteristics of the studied sample age and education

As regard to correlation between nurses' personal characteristics and their total practice level, the current study revealed that there was statistically significant correlation between total nurses' practice level and their educational level, years of experience and attendance of training courses ($P < 0.05$). This means that, the nurses who spend long experience years in nursing field especially in PICU and attended of training courses had better practice. Indeed, this result goes in the same line with **Abdel Karem et al.,(2022),** entitled " the Effect of Using Mobile Applications on Facilitating Nursing Intervention in Critical Care Units "who concluded that, there was a statistically significant correlation between total practices of the studied nurses of using mobile applications and their qualification at ($P<0.05$).While **Boakye et al.,(2023)** who carried out study about "Socio demographic determinants of knowledge, attitude and practices of Ghanaian nurses towards persons living with HIV and AIDS in Kumasi" was contradicted with these results, as he reported that there was negative correlation with practice and training.

5. Conclusion:

In the light of the present study findings it could be concluded that; less than one fourth of studied nurses had good knowledge regarding care of mechanically ventilated

children while more than two third of studied nurses practice provided to mechanically ventilated children was incompetent

6. Recommendations:

On the light of the current study findings the following recommendations are suggested:

1- Continuous formal education and training programs about care of mechanically ventilated children will help nurses to update their knowledge and improve their practice

2- Designing a brief updated poster and manual Arabic booklets for nurses in pediatric intensive care units regarding care of mechanically ventilated children will improve nurses' knowledge and skill retention.

3- Standardized care of mechanically ventilated children should be available in hospitals for all pediatric intensive care units nurses in order to follow it.

Table (1): Distribution of studied nurses regarding to their personal characteristics (n=74)

Characteristics	No	%
Age/years		
20- 25	25	33.8
25 - <30	34	**45.9**
30-35 +	15	20.3
Mean ±SD 28.33±5.67		
Academic Qualification (Education)		
Diploma	9	12.2
Technical institute of nursing	35	**47.3**
Bachelor degree of nursing	27	**36.5**
Postgraduate	3	4.1
Years of experience		
<1	19	25.7
1-3	23	**31.1**
3-6	19	25.7
6+	13	17.6
Mean ±SD 2.74±8.51		

Figure (1): Studied nurses gender

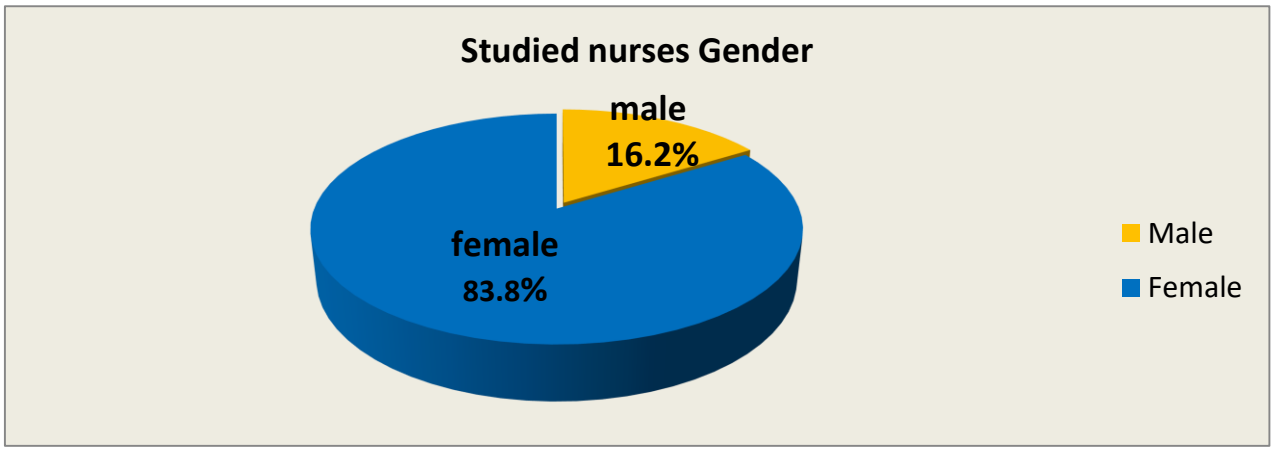

Figure (2): Studied nurses' attendance of training courses

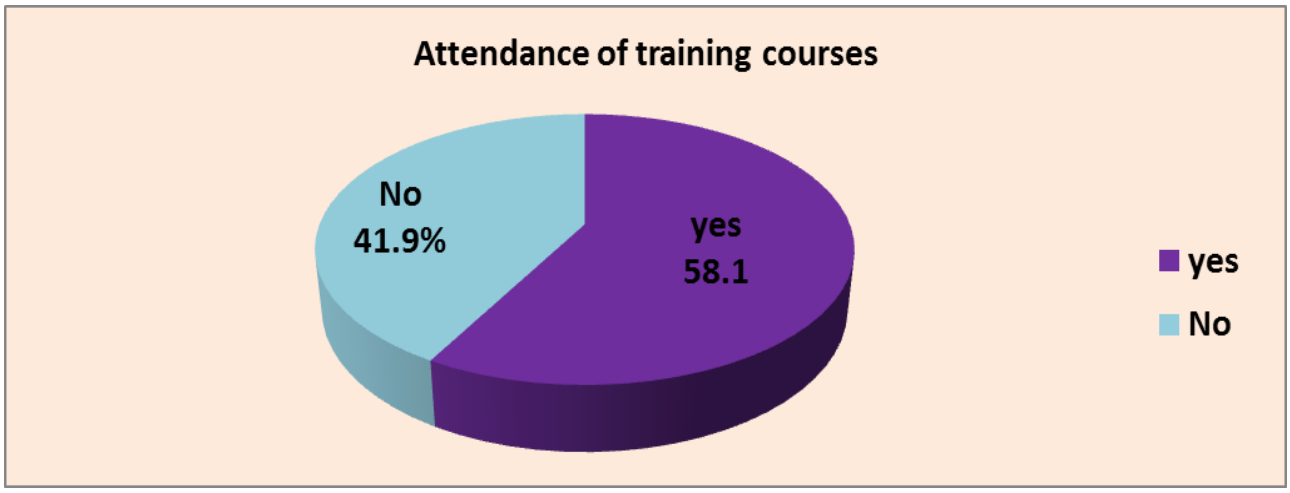

Figure (3): Total nurses knowledge level

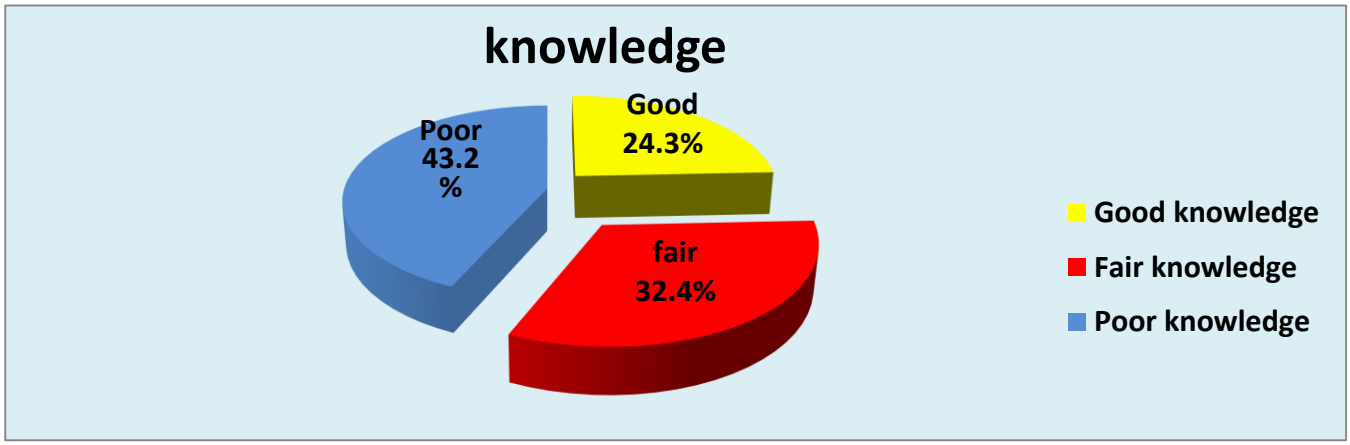

Table (2): Distribution of studied nurses' practice regarding preparation of ventilator, endotracheal tube care and chest physiotherapy (n=74)

Nursing practices	Nurses Practice level			
	Competent		Incompetent	
	No	%	No	%
Total for preparation	25	33.8	49	66.2
Total after initial ventilator setup	18	24.3	56	75.7
Total preparation of ventilator	23	**31.1**	51	**68.9**
Total endotracheal tube care	24	32.4	50	67.6
Total chest physiotherapy	19	25.7	55	**74.3**

Table (3): Distribution of studied nurses' practice regarding suctioning of mechanically ventilated children (n=74)

Nursing practice	Nurses Practice level			
	Competent		Incompetent	
	No	%	No	%
Total oropharyngeal suction	22	29.7	52	70.3
Total nasopharyngeal suction	21	28.4	53	71.6
Total endotracheal suction	26	35.1	48	64.9
Total suctioning	23	31.1	51	**68.9**

Figure (4): Total nurses practice level

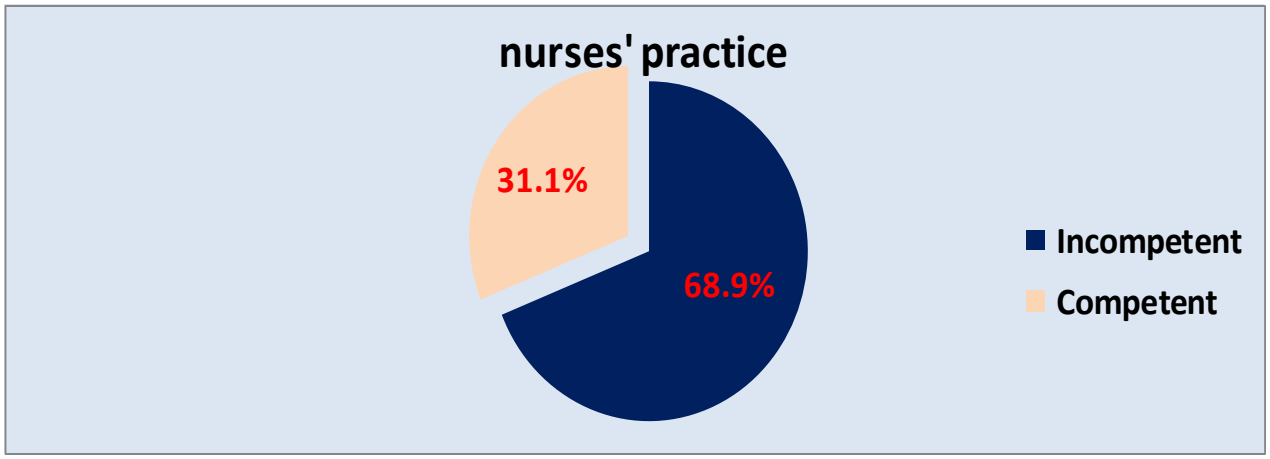

Table (4): Correlation between nurses' personal characteristics and their total knowledge score

Variables	Total knowledge score	
	r	P-value
Age	.160	**.173**
Gender	.822	.027*
Educational level	.098	**.404**
Years of experience	.741	**.039***
Attendance of training courses	.107	**.365**

****highly statistically significance p<.001** ***** statistically significance p<.05**

Table (5): Correlation between nurses' personal characteristics and their total practice level

Variables	Total practice level	
	r	P-value
Age	.100	.396
Gender	.971	.064
Educational level	.605	**.037***
Years of experience	.739	**.039***
Attendance of training courses	.302	**.031***

****highly statistically significance p<.001** ***** statistically significance p<.05**

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