Original Article

The Expected Outcomes of Nursing Care Provided to Children on Mechanical Ventilation

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Abstract

Background: **Background:** Mechanical ventilation is a form of life support technology used to perform the work of breathing for children who are unable to do this on their own .Thus providing adequate nursing care for children on mechanical ventilation is the most contribution to the successful management and outcomes. **Aim :** To evalute the expected outcomes of nursing care provided to children on mechanical ventilation. **A descriptive** study was conducted on 60 nurses and 30 children on mechanical ventilation in paediatric intensive care unit at Al -Ahrar Educational Zagazig Hospital, General Zagazig hospital and Zagazig University Hospital. **Tools:** Structured questionnaire interview , observational checklist and children assessment sheet were used to evaluate nursing care provided to children on mechanical ventilation**. Results :** Revealed that two thirds of studied nurses had poor knowledge and less than two thirds had insufficient practice about nursing care provided for children on mechanical ventilation as well as nurses' qualification and years of experience in a PICU had high positive effect on total practice **Conclusion:** studied nurses had poor knowledge and insufficient practice about nursing care provided for children on mechanical ventilation. Therefore the expected outcomes of nursing care provided to children on mechanical ventilation were unsatisfactory. **Recommendation:** Based on the results of the present study in –service training programs should be developed for nurses directed toward all aspects of care provided for children on mechanical ventilation.

Key words: Expected Outcomes, Nursing Care, Children, Mechanical Ventilation**.**

INTRODUCTION

Mechanical ventilation (MV) refers to the use of life support technology that assist the work of breathing for children who are unable to effectively oxygenate and maintain enough oxygenation and ventilation until the underlying pathologic process resolves**(Bolick et al., 2020).**

Mechanical ventilation (MV) is the skill of using devices to easily transport oxygen and Co2 between the atmosphere and the alveoli with the goal of improving pulmonary gas exchange. MV is pointing to physiological and medical reasons. Physiological objectives include supporting cardiopulmonary gas exchange thereby, increasing lung volume and inhibiting the work of breathing **(Abou Zed and Mohammed,2019).**

The main goals of MV are to prevent hypoxemia and acute respiratory acidosis, cure respiratory distress, prevent atelectasis and respiratory muscle fatigue, allow sedation and neuromuscular blockade, limit oxygen consumption, drop in the intracranial pressure, normal chest wall, and facilitate diagnostic and therapeutic procedures without exhaustion and collapse **(Lucarelli et al., 2020).**

Guilhermino al.,(2018) added that MV is one of the most common care provided in intensive care units (ICUs) in the world. It is indicated for acute respiratory failure, heart failure, sepsis as well as in situations where children are not able to protect their airways, such as drug overdose, slow reversal of anesthetic agents and neuromuscular diseases.

As regards physiological risks associated with MVincluding ventilator-associated lung injury (VALI) and nosocomial infection such as ventilator-associated pneumonia (VAP). Ventilator-associated lung injury occurs through alveolar over distention and cyclic opening and closing of alveoli resulting in diffuse alveolar damage, increased permeability as well as pulmonary edema, cell contraction and cytokine production. Complications can occur due to inappropriate application of mechanical ventilation. This may result in extra alveolar gas causing pneumothorax or subcutaneous emphysema due to high peak inspiratory pressures and alveolar stretch and edema formation as the result of large tidal volume **(Aitken et al., 2019).**

Therefore, many complications can be prevented or treated rapidly through vigilant nursing care. Best practice includes the implementation of a "ventilator bundle" for all mechanically ventilated children to prevent complications and improve

outcomes**(Alsoda et al., 2019).**

Mahfoz et al., (2022) added that care for a child who is receiving MV requires extensive training and supervised practice. The child will require protection from infection, continuous monitoring of vital signs, observation for hypoventilation and hyperventilation, measurement of intake and output, and prevention of disabilities or inactivity. Safe practice is a moral and experienced duty of health professionals. Therefore knowledge is an important part of child security management. Assessing the knowledge and practice of ICU nurses led to the introduction of appropriate education protocols in ICUs. This could raise both child safety and the individualized children caretaking protocol-directed care.

The purpose to give good inclusive care for children, while decreasing health care power the nurse must have the knowledge, practices and abilities to correctly manage children have MV. It is essential that educators, students, and nurse professionals strive to develop the data necessary to successfully manage children receiving ventilation support, proper MV education strategies at all levels to the health care providers will have a large impact on improving the quality of child intervention in such a field**(Reynolds et al., 2018).**

Nurses play an essential role in providing safe and effective nursing care to improve the quality of nursing care provided for children to raise the survival rate for these children , decrease morbidity and mortality rates. They also must provide a safe environment for these children in the unit and follow the infection control policies **(Mustafa et al., 2019).**

Aim of the Study

To evaluate the expected outcomes of nursing care provided to children on mechanical ventilation .

Significance of the study

Children's care on MV cannot be simplified. It needs excellent knowledge and competent practice of a complex and dynamic interaction between several ventilator variables. This knowledge and practice need to be incorporated into accurate and efficient decisions about the best skills while also avoiding ventilator-related risks . So, critical care nurses must have specialized skills and knowledge to practice efficiently in critical situations. Also, they must have a competent level of care for children on the MV. Therefore, this study was conducted to evaluate the expected outcomes of nursing care provided to children on mechanical ventilation.

SUBJECTS AND METHODS

Research design:

A descriptive design was used to carry out the present study .

B-Setting:

This study was conducted at three settings :

Pediatric Intensive Care Unit of Zagazig Children's University Hospital, Zagazig Educational Al-Ahrar Hospital and Zagazig General Hospital.

Subject:-

A convenience sample, 60 nurses and 30 children on mechanical ventilation in Paediatric Intensive Care Unit. The studied children fulfilled the following criteria:-

- Age: 3 -6 years
- Both sexes
- No associated chronic illness or sever fracture

Tools of data collection:

Three tools were utilized for data collection in this study .

Tool (1): Structured Questionnaire Interview

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

Part (I) :Characteristics of Studied Nurses

Characteristics of the studied nurses including(gender, age, marital status, qualification, years of experience and any previous training programs).

.Part (II):

Nurses' knowledge about mechanical ventilation such as (definition, indications, complications, indication of weaning from mechanical ventilation, as well as nurses' knowledge regarding nursing care for children on mechanical ventilation).

Nurses' knowledge	No of points
1-Respiratory system	12 points
2-Mechanical ventilation	22 points
3- Types of mechanical ventilation	20 points
4-Nursing care provided to children mechanical ventilation	49 points
5- Endotracheal tube and its suction	27 points

Scoring system of tool (I):

- Total nurses' knowledge score was developed by the researcher
- Each right answer was given 1 point and zero for wrong one .
- The total scored nurses' knowledge about mechanical ventilation and it's care was (130 points)

The total score of nurses' knowledge about mechanical ventilation and its care was classified as follows:

***Good ≥ 75%**

***Poor <75%**

Tool (2): Observational Checklist.

Observational checklist was designed by the researcher based on related pediatric nursing procedures manual It was used to assess nursing care for the children on mechanical ventilation such as (hand washing, skin assessment ,assessment circulation ,assess respiratory status ,monitoring axillary temperature, endotracheal tube suctioning ,oral/ nasal suction chest physiotherapy (percussion),intravenous infusion ,assisting during endotracheal tube insertion mouth care, eye care, monitoring ABG and positioning of children, nursing care before during after connecting o mechanical ventilation and nursing care before during after weaning from mechanical ventilation).**As guided by** , **Birnback D (2017) , Leifer G and Keenan-Lindsay L (2019)** , **Theresa Kyle D N P (2021) , Hockenberry M J et al., (2021) , London et al.,(2017) , Linnard-Palmer L and Coats G (2016) , Urden, L. D (2017) , Beevi A. (2019) .**

Nurses' Practice	No of points
1-Hand washing	7 points
2-Skin assessment	5 points
3-Assessment circulation	5 points
4-Assess the patient' respiratory status	10 points
5- axillary Temprature	11points
6-Respiratory rate	5 points
7-Endottracheal suction	6 points
8-Arterial blood gases sampling	7 points
9-IVtherapy	12 points
10-Oral care	14 points
11-Eye care	10 points
12-Assesst during endotracheal tube insertion	10 points
13-Nasal /Oral suction	18 points
14-Nursing care before connecting to mechanical ventilation	5 points
15- Nursing care during connecting to mechanical ventilation	2 points
16- Nursing care after connecting to mechanical ventilation	17points
17-Chest physiotherapy (percussion)	9 points
18-Nursing before weaning child from mechanical ventilation	4 points
19- Nursing during weaning child from mechanical ventilation	8 points
20- Nursing after weaning child from mechanical ventilation	4 points

Scoring system of tool II:

Total nurses' practice scores were developed by the researcher .each observed items were checked as done or not done .each correct step was given 1 point and zero was given to not done .

* **The practice score totaled (169 points)**

***The nurse had sufficient level of practice when the total score ≥ 75%**

*** The nurse had insufficient level of practice when the total score <75%**

Tool (III): Children Assessment Sheet.

Children assessment sheet was divided into two main parts as the following:-

Part(I): Characteristics of the studied children on mechanical ventilation such as (gender , diagnosis, modes of mechanical ventilation, what the reason for is connecting child on mechanical ventilation, the period of time for connecting the child on the mechanical ventilation per day, weaning from mechanical ventilation, what is the reason for weaning and Investigation and examinations required for connecting child on mechanical ventilation).

Part(II): -Assessment Sheet of child was designed to assess the outcomes and any complications such as (Pneumothorax, Sinus infection ,Pulmonary edema, VAP ventilation acquired pneumonia, Barotrauma, Oxygen toxicity and Rupture alveoli .

Field work:

Data was collected during six months in the period from beginning November 2021 to the end of April 2022 .The researcher started the data collection three days per week from 9 am to 2 pm at the morning shift.

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 from 15-30 minutes depending on the time of the procedure .The checklist was completed by the researcher during nurses' performance inside PICU .

Also each child was individually assessed to complete **Tool III**.

Pilot study:

A pilot study was carried out on 6 nurses (10% of nurses)to test clarity and applicability of the tools as well as to estimate the time needed for filling the data. According to these pilot study .The required modification were made .Those nurses who were involved in the pilot study were included in the study.

Administrative and Ethical Consideration

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 of Zagazig Children's University Hospital, Zagazig Educational Al-Ahrar Hospital and Zagazig General Hospital .Meeting was conducted first with the director of PICU to obtain permission for conducting the research , explaining the aim and expected outcomes.

4- Statistical Analysis

Data collected from the studied sample was revised, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages and Mean SD.

A correlation coefficient "Pearson correlation" is a numerical measure of some type of correlation, meaning a statistical relationship between two variables. Chi Square test statistic is commonly used for testing relationships between categorical variables. linear regression is a linear approach for modeling the relationship between a scalar response and one or more explanatory variables .Cronbach's Alpha test was used to test reliability of tools.

Significance of the results

- **Highly significant at p-value < 0.01 ** .**
- **Statistically significant was considered at p-value < 0.05 ***
- **Non-significant at p-value > 0.05**

RESULTS

Table (1) Shows characteristics of studied nurses. It was found that 88.3% of studied nurses was females and 50% was in the age group of 20 <30 years old. Moreover 66.7% was married. Concerning years of experience 71.7% of studied nurses had 10years of experience or less. Also the same table shows that 63.3% of studied nurses had attended previous training courses about mechanical ventilations .

Figure (1) Presents qualification of studied nurses. It is revealed that 43.3% of studied nurses was graduated from nursing technical institute while 33.3% was obtained bachelor degree of nursing.

Total knowledge score of studied nurses according to their total domain of knowledge were portrayed in **table (2)** ¸ it was found that 41.7 % of studied nurses had good knowledge about respiratory system. While 66.7%¸ 63.3% of studied nurses had poor knowledge about mechanical ventilation and about types mechanical ventilation respectively. It is revealed from the same table that 40% of studied nurses had good knowledge about the nursing care provided to children on mechanical ventilation while 63.3% had poor knowledge about endotracheal tube and its suction.

table (3) Illustrates that 65% of studied nurses had sufficient level of practice regarding hand washing, while 63.3% had insufficient level of practice about arterial blood gases sampling.. In addition 55% ,51.7 % of studied nurses had insufficient level of practice about in eye care ¸ oral care for ventilated child respectively. It was found that 43.3% of studied nurses had sufficient level of practice about nasal/oral tube suction while 68.3% had insufficient level of practice about endotracheal suction .Regarding chest physiotherapy,71.7% of studied nurses had insufficient level of practice .It is revealed from the table that 68.3% , 65%, 66.7% of studied nurses had insufficient level of practice regarding nursing care before, during and after connecting the child on mechanical ventilation respectively .Also the same table clarified that68.3% , 73.3% ,66.7% of studied nurses had insufficient level of practice regarding nursing care before ,during and after weaning the child from mechanical ventilation respectively .

figure(2) Reveals that, 58.3% of the studied nurses had total insufficient level of practice regarding nursing care for the children on mechanical ventilation ,compared to 41.7% had total sufficient level of practice.

Table (4) Shows characteristics of studied children . It was found that 73.3% of studied children was males. Regarding diagnosis of studied children, it was found that 33.3% of studied children had respiratory failure, while 3.3% had dehydration. Concerning modes of mechanical ventilation, it is revealed from the table that 86.7% of studied children was on SIMV mechanical ventilation while 13.3 % was on CPAP. In addition to what the reason for connecting child on mechanical ventilation¸ it was found that 56.7% of studied children had apnea while 23.3% had hypoxemia.

Figure (3) Presents outcomes of nursing care of children on mechanical ventilation. It was found that 53.3% of the studied children improved while 33.3% was dead.

Table (5) Shows relation between characteristics of studied nurses and their total practice. It was found that there was statistically significant relation between nurses' total practice score and the nurses' age **(P=0.023)**, years of experience **(P=0.038**) and attended training courses **(P= 0.044)**. Also the same table clarified that there was highly statistically significant relation between nurses' total practice score and their qualifications **(P=0.005),** job **(P=0.009**) and years of experience in a PICU **(P=0.004)**.

Multiple Linear regression model for total practice of studied nurses was presented in **Table (6)** it was found that high

significant model detected **(p value. 000)** . Also it is revealed from the table that nurses` qualification, job title and years of experience in a PICU had high frequency positive effect on total practice **(p value <0.01**)** while, age, years of experience and attended training courses had slight frequency positive effect on total practice at **(p value <0.05***).

Table (1): Characteristics of the Studied Nurses (n=60).

Characteristics	N	%
Gender		
Male	7	11.7
Female	53	88.3
Age /years		
20 – 30	30	50.0
30 – 40	27	45.0
≥40	3	5.0
$\bar{x}$S.D 30.25±4.87		
Marital status		
Single	17	28.3
Married	40	66.7
Divorced	2	3.3
Widow	1	1.7
Years of experience		
≤ 10 years	43	71.7
> 10 years	17	28.3
$\bar{x}$S.D 6.93±2.35		
Have you attended training courses for nursing care of cases on the ventilator		
No	38	63.3
Yes	22	36.7

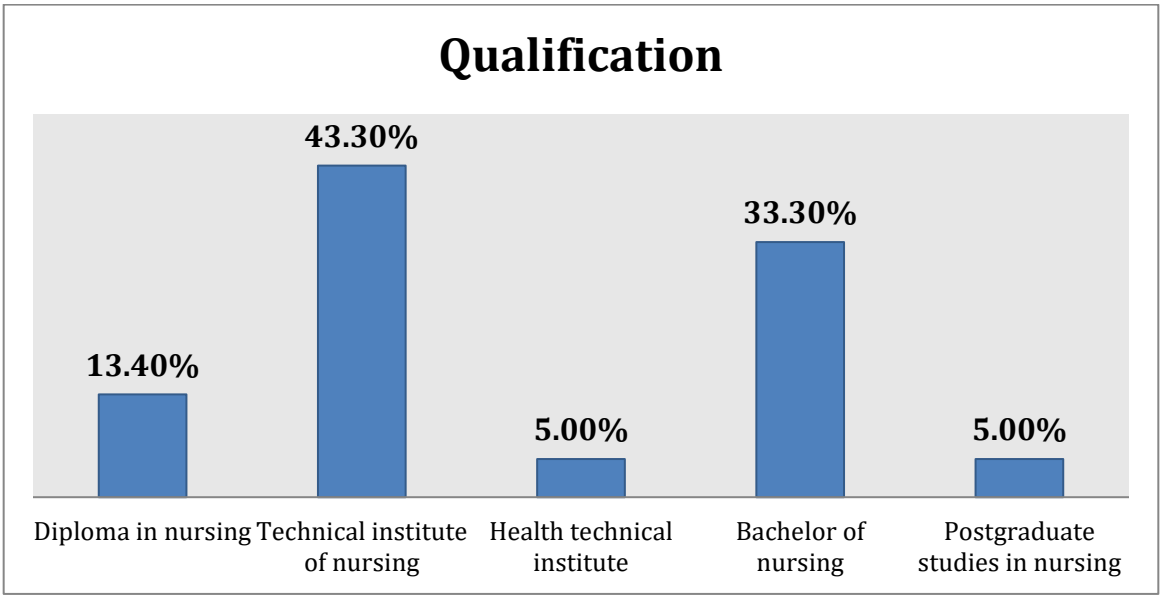

Figure (1): Qualification of Studied nurses.

Table (2): Total Knowledge Score of Studied Nurses according to their Total Domain of Knowledge (n=60).

Total domain	Good		Poor	
	N	%	N	%
Nurses knowledge about respiratory system	25	41.7	35	58.3
Nurses knowledge about mechanical ventilation	20	33.3	40	66.7
Nurses knowledge about types of mechanical ventilation	22	36.7	38	63.3

Nurses knowledge about the nursing care provided to children on of mechanical ventilation	24	40.0	36	60.0
Nurses knowledge about endotracheal tube and its suction	22	36.7	38	63.3
Total	**23**	**38.3**	**37**	**61.7**

Table (3): Nurses' Level of Practice Regarding Nursing Care of Children on Mechanical Ventilation (n=60)

Nurses' practice	Sufficient		Insufficient	
	N	%	N	%
Hand Washing	39	65.0	21	35.0
Arterial blood gases sampling	22	36.7	38	63.3
Eye care	27	45.0	33	55.0
Oral Care	29	48.3	31	51.7
Nasal/Oral tube Suction	26	43.3	34	56.7
Endotracheal suction	19	31.7	41	68.3
Chest physiotherapy(Percussion)	17	28.3	43	71.7
Nursing care before connecting the child on mechanical ventilation	19	31.7	41	68.3
Nursing care during connecting the child on mechanical ventilation	21	35.0	39	65.0
Nursing care after connecting the child on mechanical ventilation	20	33.3	40	66.7
Nursing care before weaning the child from mechanical ventilation	19	31.7	41	68.3
Nursing care during weaning the child from mechanical ventilation	16	26.7	44	73.3
Nursing care after weaning the child from mechanical ventilation	20	33.3	40	66.7

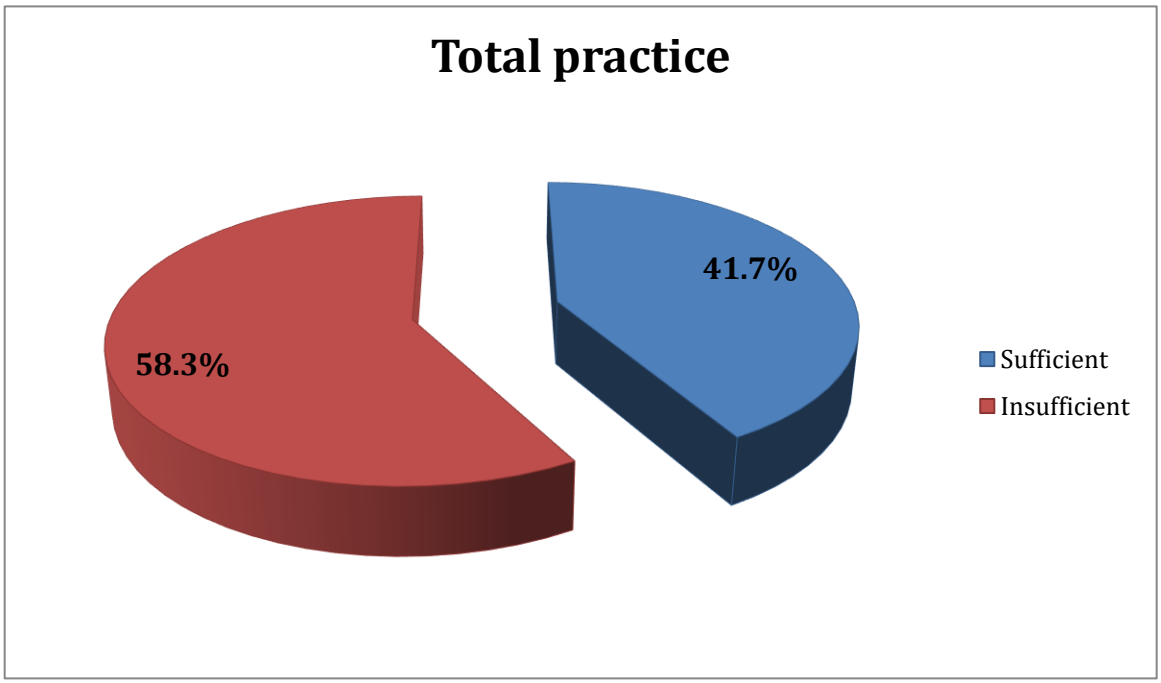

Figure (2): Total Score of Nurses Practice.

Table (4)Characteristics of Studied Children (n=30)

Characteristics	N	%
Gender		
Male	22	73.3
Female	8	26.7
Diagnosis		
Respiratory failure	10	33.3
Pneumonia	7	23.3
Disturbance in conscious	5	16.7
Convulsion	2	6.7
Sudden cardiac arrest	2	6.7
Head trauma	2	6.7
Dehydration	1	3.3
Hypoglycemia	1	3.3
Modes of mechanical ventilation		
CMV	0	0
SIMV	26	86.7
CPAP	4	13.3
IMV	0	0
What the reason for is connecting child on mechanical ventilation		
Apnea	17	56.7
Cyanosis	5	16.7
Hypoxemia	7	23.3
Metabolic acidosis	1	3.3

CMV)Controlled Mandatory Ventilation
(SIMV) Synchronous Intermittent Mandatory ventilation

(CPAP) Continuous Positive Airway Pressure

(IMV)intermittent mandatory ventilation

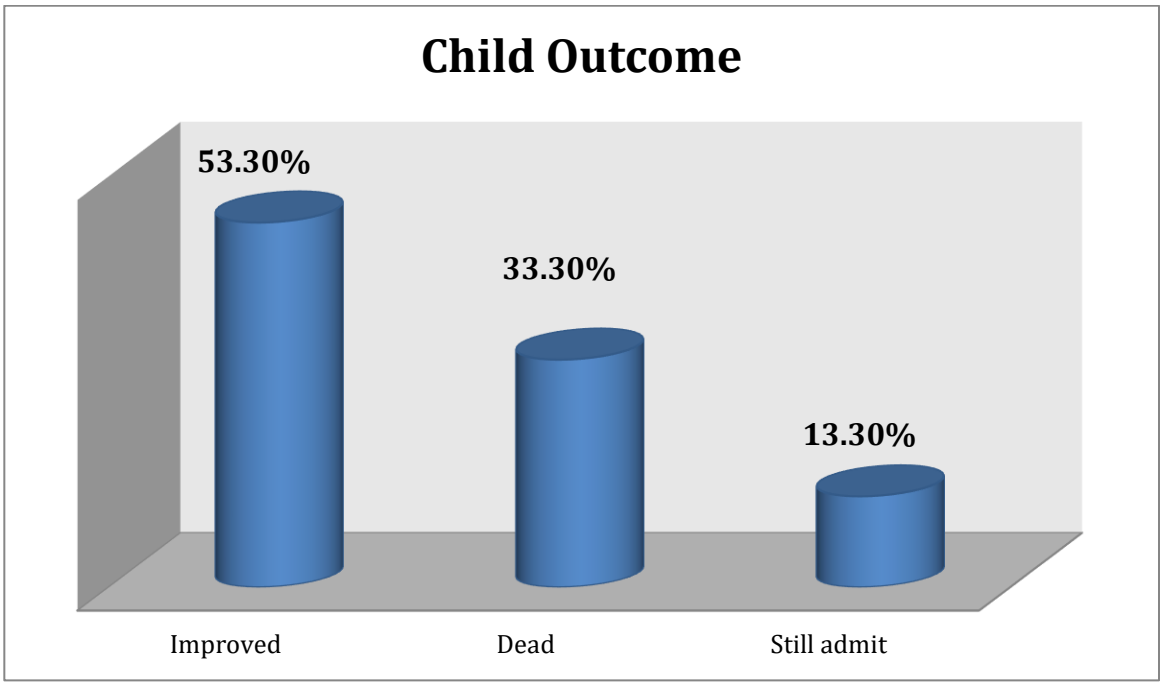

Figure (3): Outcomes of Nursing Care of Children on Mechanical Ventilation

Table (5): Relation between Characteristics of Studied Nurses and their Total Practice (n=60).

Characteristics		Total practice				X^2	P-Value
		Sufficient (n=25)		Insufficient (n=35)			
		N	%	N	%		
Gender	Male	4	16.0	3	8.6	1.006	.061
	Female	21	84.0	32	91.4		
Age	20 – 30	19	76.0	11	31.5	3.064	.023*
	30 – 40	4	16.0	23	65.7		
	≥40	2	8.0	1	2.8		
Marital status	Single	8	32.0	9	22.8	1.124	.067
	Married	16	64.0	24	68.6		
	Divorced	1	4.0	1	2.8		
	Widow	0	0	1	2.8		
Qualification	Diploma in nursing	1	4.0	7	20.0	7.187	.005**
	Nursing technical institute	4	16.0	22	62.9		
	Health technical institute	0	0	3	8.6		
	Bachelor of nursing	18	72.0	2	5.7		
	Postgraduate studies in nursing	2	8.0	1	2.8		
Job	Nurse	20	80.0	25	71.4	6.420	.009**
	Head of Department	2	8.0	0	0		
	Supervisor	3	12.0	10	28.6		
Years of experience	≤ 10 years	11	44.0	32	91.4	7.995	0.038*
	≥ 10 years	14	56.0	3	8.6		
Years of experience in a PICU	<3	0	0	22	62.9	17.19	0.004**
	3-6	1	4.0	13	37.1		
	6-9	12	48.0	0	0		
	≥9	12	48.0	0	0		
Attended training courses	Yes	23	92.0	15	42.9	2.962	.044*
	No	2	8.0	20	57.1		

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

Table (6): Multiple Linear regression Model for Total Practice of Studied Nurses (n=60).

Characteristics	Unstandardized Coefficients		standardized Coefficients	**T**	**P. value**
	B		B		
Age	.152		.098	2.845	.014*
Qualification	.314		.284	6.699	.000**

Job		.384		.272	5.705	.005**
Years of experience		.127		.079	6.987	.029*
Years of experience in a PICU		.378		.260	16.250	.004**
Attended training courses		.194		.099	3.924	.030*
Model	**R^2**	**Df.**		**F**	**P. value**
Regression	**0.049**	5		11.955	.000**

a. Dependent Variable: **Total practice**

b. Predictors: (constant): **Age, Qualification, Job title, Years of experience, Years of experience in a PICU and Attended training courses**

DISCUSSION

Mechanical ventilation (MV) is an automatic device that provides all or part of the work of breathing for children who are unable to breathe sufficiently on their own. The goal of mechanical ventilation is to maintain adequate pulmonary gas exchange, reduce the work of breathing and decrease exhaustion for children. Mechanical ventilation is indicated for numerous clinical and physiological reasons. 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 the children **(Borden et al., 2022).**

The major goals expected outcomes for a child receiving mechanical ventilation include improvement of gas exchange, maintenance of a patent airway, prevention of trauma, promoting optimal communication, minimizing anxiety, and absence of cardiac and pulmonary complications. Each nurse is responsible for her own quality of performance and is accountable for the use of standards to ensure knowledge, safe and comprehensive nursing care providing for children on mechanical ventilation **(Ulisses et al., 2021).**

Regarding age of studied nurses، the result of the present study revealed that half of them were in the age group of 20 <30 years old with mean age 30.25±4.87 years this may be due to that, newly graduated and young age nurses usually assigned to work in ICUs and emergency departments. while higher age category 'senior nurses' perform administrative roles. This result goes in line with **Aziz & Abdul-Hamza (2017)** who conducted a study to assess nurses' knowledge toward the continuous positive airway pressure (CPAP) machine in neonatal intensive care unit in Al- Diwanyia and found that more than half of the studied nurses were in the age group of 20 <30 years old.

On the other hand, this finding contradicts with **Ebrahimi et al. (2020)** who carried out a study to investigate the effect of simulation-based suction education on knowledge and performance of pediatric intensive care unit nurses in Tanzania and reported that, more than half of nurses their age ranged from 40-49years old.

Ibrahim et al., (2019) who conducted study to assess nurses' knowledge and practices related neonatal sepsis in the neonatal intensive care units in **El-Minia** and reported that more than half of studied nurses were graduated from nursing technical institute . This finding was supported with the present study that showed less than half of studied nurses were graduated from nursing technical institute. This finding might be due to in Egypt nursing education showed noticeable growth of academic degrees and replacement of technical secondary school of nursing by technical institute of nursing this make bridging to allow carriers of secondary school diploma degree to increase their qualification and therefore, to be recruited in the critical care units believing that these cadres could have better knowledge and skills of caring for high -risk neonates .

Obaid et al., (2016) who conducted his study in **Baghdad** City to provide information about nurses' knowledge concerning neonatal sepsis in neonatal intensive care units at pediatric teaching hospitals and mentioned that less than three quarters of the studied nurses were females. This result agrees with the current study that showed that most of nurses in the study sample were females from a researcher point of view. This finding may be most of nursing school's graduates were females students because large number of nursing schools were concerned for females.

Concerning Knowledge about respiratory system, the result of current study displayed that less than two thirds of studied nurses had poor knowledge. These results may be due to more than one third of studied nurses not attended training courses and only one third of them had bachelor nursing. This result is consistent with **Alridh et al, (2019**) who studied Knowledge of nurses toward respiratory distress syndrome to have children Maysan Hospital for Child and Childbirth in Misan and mentioned that about half of studied nurses had poor knowledge about respiratory system.

Aziz, & Abdul-Hamza, (2017) who conducted study to assess nurses' knowledge toward the continuous positive airway pressure (CPAP) machine in neonatal intensive care unit at Al-Diwanyia City Hospitals in Baghdad and found that most of the studied nurses had low knowledge about indication of mechanical ventilation . This result is in same line with the current study, that showed that two thirds of studied nurses had poor knowledge about indication of mechanical ventilation due to lack of educational program to refresh nurses's knowledge about mechanical ventilation

Concerning Nurses knowledge about types of mechanical ventilation, the result of present study displayed that less than two thirds of studied nurses had poor knowledge about types of mechanical ventilation. This result may be due to more than one third of studied nurses not attended training courses and only one third of them had bachelor nursing. this result matches with **Ahmed & Abosamra (2015)** who conducted a study to assess knowledge of pediatric critical care nurses regarding evidence based guidelines for prevention of VAP in both pediatric and neonatal intensive care units in Egypt and showed that most of the studied nurses had inadequate knowledge about types of mechanical ventilation.

Mostafa et al., (2016) who performed study to assess nurses' performance regarding care of children undergoing mechanical ventilation in **Egypt** and mentioned that more than half of the studied nurses had satisfactory knowledge about the nursing care provided to children on mechanical ventilation. This finding disagrees with the peresnt study that illustrated that less than two thirds of the studied nurses had poor knowledge nursing care provided to children on of mechanical ventilation. this result might be due to lack of educational program and head nurse's follow up about nursing care provided to children on of mechanical ventilation.

As regards to nurse's knowledge about endotracheal tube and its suction, the result of the present study clarified that the less than two thirds of studied nurses had poor knowledge about endotracheal tube and its suction. This result may be attributed to inadequate training courses provided for nurse to refresh their knowledge. Such result comes according to **Aboalizm & Elhy (2019)** who conducted a study in **Egypt** to determine the effect of education intervention on nurse's knowledge and practices about endotracheal tube suctioning and stated that most of the studied nurses had bad knowledge about endotracheal tube and suction.

On the contrary, this finding disagrees with **Colombage & Goonewardena (2020)** who performed study to assess the intensive care unit (ICU) nurses' knowledge and practice in caring for patients with endotracheal tube and their associated factors in **National Hospital of Sri Lanka (NHSL)** and reported that more than half of the studied nurses had correct knowledge about endotracheal tube and its suction.

Thabet et al., (2021) who carried out his study in **Egypt** to evaluate the influence of training program implementation on nurses' performance regarding neonates invasive mechanical ventilation and found that more than half of the studied nurses had poor knowledge about mechanical ventilation. This finding is in agreement with the present study that revealed less than two thirds of the studied nurses had poor knowledge about mechanical ventilation, this result might be due to lack of nurses' motivation for learning and limited number of nursing staff.

As regards to nurses' practice about oral care, the results of the present study clarified that more than half of studied nurses had insufficient level of practice regarding oral care. this finding could be due to lack of sufficient equipment (toothbrush, chlorhexidine gluconate 0.2%, lip-lubricating ointment) in PICU could improve the provision of oral care by critical care nurses. This finding is consistent with **Behzadi et al., (2019)** who performed study to determine the effectiveness of the nurse education program on the performance of nurses in providing oral care for mechanically ventilated children in **Tehran** and revealed that more than half of studied nurses had insufficient level of practice regarding oral care.

Maraş et al., (2017) who conducted his study to determine intensive care nurses' knowledge and practice levels regarding open system endotracheal suctioning and to investigate if there is a relationship between nurses' demographic characteristics and their knowledge and practice in **Western Turkey** and mentioned that most of studied nurses had fair level of practice regarding endotracheal suction. This finding matches with the present study that clarified more than two thirds of studied nurses had insufficient level of practice regarding endotracheal suction.

This result might be related to nurse can provide more effective care when the number of nurses is adequate during all shifts, proper ratio between number of children and nurses, supplies available and the children's condition .

The present study illustrated that less than three quarters of the studied nurses had Insufficient practice toward chest physiotherapy (Percussion). This result attributed to lack of practice training about the importance of chest physiotherapy. This result agrees with **Abedlatif, (2014)** who provide information about Quality of nursing care provided for preterm infants with respiratory syndrome in **Port Said** and showed that most of nurses had poor level of practice regarding Chest physiotherapy.

Mustafa et al., (2019) who carried out his study in **Assiut University Children Hospital, Egypt** to assess the quality of nursing care provided for neonates on mechanical ventilation and reported that less than two thirds of the studied nurses had total inadequate level of practice regarding nursing care for the studied sample on mechanical ventilation. . This finding is in same line with the result of the current study that displayed less than two thirds of the studied nurses had total insufficient level of practice regarding nursing care for the children on mechanical ventilation. This may be due to insufficient training period and absence of training program to improve the practical nursing skills provided to children undergoing mechanical ventilation .

Concerning modes of mechanical ventilation, the result of present study revealed most of studied children was on SIMV mechanical ventilation while less than one fifth of them was on CPAP. This result matches with **Mukhtar et al., (2014)** who performed study to assess the frequency, indications and immediate-outcomes in mechanically ventilated pediatric patients in tertiary-care center of developing country, **Pakistan** and illustrated that the SIMV most commonly used mode of MV in multiple PICUs, conversely, this finding contradicts with study in **Egypt** by **Meligy et al., (2017)**. Who conducted study to describe the practice of mechanical ventilation (MV) who mentioned pressure support (PS) with CPAP was the preferred method of mechanical ventilation. From researcher point of view, the difference could be due to the preference of the physicians and children capacity of maintaining their saturation on both methods.

Concerning the gender of the studied children**,** finding of the current study proved that, less than three quarters of them were males. This may be related to the fact that respiratory distress is commonly seen in male gender than female associated

with connection to mechanical ventilator. this result parallels with **Kunswa & Mohamed (2021)** who conducted study to evaluate the effect of instructional guidelines on nurses' performance regarding care of high risk neonates undergoing extubation of mechanical ventilator in Ain Shams University Hospitals, **Egypt** and revealed that more than three fifths of them were males connected with mechanical ventilator.

Bacha et al., (2021) who performed study to assess the characteristics and outcomes of mechanically ventilated pediatric patients in Tikur Anbessa Specialized Referral Hospital, **Addis Ababa, Ethiopia** and stated that more than half of the studied children on mechanical ventilation were died . Such results is in disagreement with the current study that presented that more than half of the studied children improved while about one third was dead this difference between studies might be due to Limited knowledge of health providers on the use and management of mechanical ventilator; unavailability of basic tests for mechanical ventilators like blood gases and other necessary drugs all these could have contributed to the poor outcome of ventilated children.

Regarding relationship between characteristics of studied children and their outcome, the result of current study clarified that there was statistically significant relation between outcome of children , modes of MV**,** period connected to MV and weaning **(P<0.05*).** These results may be due to short period of MV and early weaning from mechanical ventilation improving the outcomes of children. This result is in same line with **Meligy et al., (2017)** in Egyptian pediatric intensive care units (PICUs) at Cairo University Pediatric Hospital, and displayed that there was statistically significant relation between outcome of children , modes of MV**,** period connected to MV and weaning **(P<0.05*).**

Concerning relation between characteristics of studied nurses and their total practice, the present study clarified that there was statistically significant relation between nurses` total practice score and the nurses' age**,** qualifications years of experience , attended training courses and years of experience in a PICU. This result may be attributed to increasing years of experience had positive effect on nurses practice level and attended training courses improving their practice level. This finding is supported with **El-Garhy et al., (2020)** who provide information about Quality of Nursing Care Provided to Neonates Undergoing Mechanical Ventilation, and indicated that there were positive relations between the studied nurses' total practice and their qualification, job and their years of experience (P<0.001).

Ayed, (2015) who conducted study to assess the level of knowledge and practice of infection control among nurses in governmental hospitals of **Palestine** and found that there were statistically significant differences between the total practice with their years of experience. This result is in harmony with the current study that revealed nurses` qualification, job title and years of experience in a PICU had high frequency positive effect on total practice **(p value <0.01**)** .These may be related to high education of nurses and head nurse position and long years of experience had positive effect on nurse's performance.

CONCLUSION

studied nurses had poor knowledge and insufficient practice about nursing care provided for children on mechanical ventilation. Therefore the expected outcomes of nursing care provided to children on mechanical ventilation were unsatisfactory.

Recommendation: Based on the results of the present study in –service training programs should be developed for nurses directed toward all aspects of care provided for children on mechanical ventilation

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