Assessment of Nurses' Knowledge and Practices regarding Liberation Bundle in Pediatric Intensive Care Unit

Reem Mohamed Seddik Ali[* 1], Asmaa Nasreldin Mosbeh[* 2], Mona Mohamed Hafez[* 3]Authors
1. Assistant Lecturer at Pediatric Nursing Department, Faculty of Nursing, Damietta University, Dumyat, Egypt
2. Professor at Pediatric Nursing Department, Faculty of Nursing, Ain Shams University, Cairo, Egypt
3. Lecturer at Pediatric Nursing Department, Faculty of Nursing, Ain Shams University, Cairo, Egypt

Abstract

Background: Recent critical care guidelines recommended the evidence-based liberation bundle for patients at pediatric intensive care unit. However, limited information is available on the the bundle in Egyptian hospitals. **Aim:** This study aimed to assess nurses' knowledge and practices regarding liberation bundle in pediatric intensive care unit **Settings:** The study was conducted at pediatric intensive care units in New Damietta Al-Azhar University Hospital and Menoufia University Hospital, Egypt. **Study design:** Descriptive research design was utilized to achieve the aim of this study **Subject:** A convenient sample composed of 52 pediatric nurses from pediatric intensive care units at the previous mentioned settings. **Tools:** Two tools were used: tool one predesigned questionnaire to assess the studied nurses' knowledge regarding liberation bundle. Tool two observational checklists for liberation bundle to assess the studied nurses' actual level of practices regarding liberation bundle. **Results:** Revealed that all of the studied nurses had unsatisfactory level of knowledge and incompetent practices regarding liberation bundle **Conclusion**: All the studied nurses had unsatisfactory level of the total knowledge and incompetent level of the total practices regarding liberation bundle in pediatric intensive care unit. Also, there was a positive correlation between the studied nurses' total level of knowledge and total level of practices regarding liberation bundle. **Recommendations:** Future researches are recommended to replicate the study on large probability samples in order to generalize the results.

Key words: Libeartion Bundle, Nurses' Knowledge and Pracices, Pediatric Intensive Care Unit

Introduction

Pediatric intensive care unit (PICU) is a specialized unit within a hospital that provides the best level of care to critically ill infants, children, teenagers, and young adults aged 0-21. A multidisciplinary team of highly skilled physicians, nurses, respiratory therapists, and other medical professionals who specialize in the treatment of seriously ill children work in the pediatric intensive care unit. The main objective of the PICU is to stabilize, treat, and improve the outcomes of critically ill children ***(Nemani, 2022).***

The mortality rate of severely ill pediatric patients has considerably decreased in recent years due to advances in pediatric medicine and technology, which has resulted in a proportional increase in survival rates. However, after being discharged from the hospital, children who survive the critical diseases often experience chronic physical, psychological, cognitive, and social impairments. These impairments are known as pediatric post-intensive care syndrome (PICS-p) ***(Tang et al., 2024).***

Post-intensive care syndrome is defined as new or worsening health problems arising after PICU discharge. The effects may develop exhaustion, muscle weakness, pain, feeding difficulties, delayed growth; poor sleep hygiene and physical impairment including disabilities that affect their day-to-day functioning ***(Gomez et al., 2023).***

Cognitive effects include altered in cognitive ability, impaired neuro-psychological, and changes in intelligence quotient after discharge. Emotional symptoms in children that last months after PICU discharge are post-traumatic stress disorder (PTSD), anxiety, depression, delusional memories, fear,

aggression, and developmental regression ***(Rahmaty et al., 2023).***

Recently, increasing PICU survival rates and preventing PICS have gained significant attention. The clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in pediatric patients in the PICU were developed through cooperative efforts of the American College of Critical Care Medicine, the Society of Critical Care Medicine (SCCM), and the American Society of Health-System Pharmacists ***(Azamfirei et al., 2023).***

An evidence-based, multicomponent, inter-professional team management strategy, called the liberation bundle is created to facilitate the implementation of SCCM's guidelines. Each element of the liberation bundle is focused on patient-centered outcomes ***(Erbay Dalli et al., 2023).***

The Society of Critical Care Medicine's (SCCM) PICU liberation bundle is also called the ABCDEF bundle. The liberation bundle is a multidisciplinary care approach that includes six connected items, (A) Assess, prevent, and manage pain; (B) Both spontaneous awakening and breathing trials; (C) Choice of analgesia and sedation. (D) Delirium assessment, prevention and management; (E) Early mobility and exercise; (F) Family engagement and empowerment ***(Sosnowski et al., 2023).***

The Bundle creates goals to optimize pain management, lessen excessive sedation, avoid and minimize delirium, facilitate extubating, reduce PICU-acquired weakness and debilitation with early mobility, and integrate patient and family participation into PICU care ***(Lin et al., 2023).***

Additionally, the liberation bundle is an organizational protocol to assess for and treat a series of variables affecting intensive care pediatric patients in an evidence-based manner to decrease iatrogenic harms and enhance the care of the pediatric patients. It is used to prevent PICS especially in pediatric patients receiving mechanical ventilation, reduce mortality, functional and long-term cognitive impairment and PICU readmission in critically ill patients ***(Adriaenssens et al., 2023 & Reznik et al., 2023).***

Pediatric nurses' role is crucial for delivering evidence-based practice in the PICU and for successfully implementing the liberation bundle. The liberation bundle is an evidence implementation strategy for the PICU that often involves a checklist related to pain, agitation, delirium, ventilator care, and family engagement ***(Walz, Canter & Betters, 2020).***

The pediatric nurses must address the liberation bundle checklist during a multidisciplinary rounding discussion that typically include some combination of attending intensivists, fellows, residents, critical care nurse, pharmacists, nutritionists, respiratory therapists and physical therapists ***(King et al., 2023).***

Significance of the study

The prevalence of post intensive care syndrome in pediatric is high, with estimates ranging from 30% to 80% of PICU survivors experiencing at least one symptom of PICS syndrome. PICS creates substantial challenges in returning the child for the previous quality of life before admission to PICU. Critical pediatric patients often experience long-term physical, cognitive, emotional, and social problems post PICU admission ***(van Dijk et al., 2023).***

The liberation bundle is a multidimensional approach to prevent PICS efficiently and effectively. According to the society of critical care medicine in the worldwide, implementing the PICU liberation bundle decreases the probability of hospital death within 7 days by 68%, decreases delirium and coma days by 25% to 50%, minimizes physical restraint use by more than 60% and cut PICU readmissions in half ***(Grieshop, 2023).***

So, nurse's role in implementing the liberation bundle is very important and positive for the critically ill pediatric patients. In Egypt, the researcher observed in the settings of the study that, the studied nurses implement the items of the liberation bundle separately, don't recognize the total items and the importance of the liberation bundle.

Hence, this study was conducted for assessing the studied nurses' knowledge and practices regarding liberation bundle in pediatric intensive care unit.

Aim Of The Study

This study aimed to:

1- Assess nurses' knowledge regarding liberation bundle in pediatric intensive care unit.

2- Assess nurses' practices regarding liberation bundle in pediatric intensive care unit.

Research Questions

1- What is the nurses' knowledge regarding liberation bundle in pediatric intensive care unit?

2- What are the nurses' practices regarding liberation bundle in pediatric intensive care unit?

3- Is there a relation between total nurses' knowledge and their total practices regarding liberation bundle in pediatric intensive care unit?

SUBJECT AND METHODS

Study design:

A descriptive research design was utilized to achieve the aim of this study.

Study settings:

This study was conducted at Pediatric Intensive Care Units (PICUs) in New Damietta Al-Azhar University Hospital and Menoufia University Hospital in Egypt.

Study subjects:

The number of nurses needed for the study was calculated using the G*Power Windows program 3.1.9.7. The criteria utilized for the calculation were as follows: the effect size was set at .25, the error rate alpha probability was .05, the power (1 minus error probability) was .85, and three measurements were taken, based on the research conducted by ***Sim & Lewis, (2012)***. Thus, a convenient sample comprised 52 pediatric nurses (35) from the PICU at Menoufia University Hospital and (17) from the PICU at New Damietta Al-Azhar University Hospital who providing direct care to pediatric patients at least six months at the previously mentioned settings at the time of the study regardless of their age, gender, qualifications, years of experience and attendance of previous training courses related to liberation bundle.

Tools of data collection:

First tool: Predesigned Questionnaire

It was designed by the researcher after reviewing the relevant literatures as ***Khalil et al., (2021) & Marra et al., (2018)*** and it was written in simple Arabic language to suit the level of understanding of the studied nurses. It was used to assess the studied nurses' knowledge regarding liberation bundle and consisted of the following parts:

- **Part (1): It was concerned with the characteristics of the studied nurses** as; age, gender, level of education, years of experience in PICU, and pervious attendance of training courses about liberation bundle.
- **Part (2): It was concerned with assessment of the studied nurses' knowledge regarding liberation bundle.** The total number of questions was 34 in-closed ended questions that were classified as the following:

- The studied nurses' knowledge regarding liberation bundle that included 6 questions.

- The studied nurses' knowledge regarding assessment, prevention and management pain that included 6 questions.

- The studied nurses' knowledge regarding spontaneous awakening trial and spontaneous breathing trial, that included 6 questions.

- The studied nurses' knowledge regarding choice of sedation and analgesia that included one question.

- The studied nurses' knowledge regarding delirium assessment, prevention, and management that included two questions.

- The studied nurses' knowledge regarding early mobility and exercise that included two questions.

- The studied nurses' knowledge regarding family engagement and empowerment that included two questions.

- The studied nurses' knowledge regarding post intensive care syndrome that included 9 questions

Scoring system:

The total score of the studied nurses' knowledge was classified into two categories.

- "Satisfactory": If the studied nurses' total knowledge scores ≥ 85 % which equals ≥ 57.8 marks.

- "Un satisfactory": If the studied nurses' total knowledge scores <85% which equals < 57.8 marks.

Second tool: Observational checklists for Liberation bundle:

It was developed by the ***Society of Critical Care Medicine (SCCM), (2022)*** and was adapted by the researcher to assess the studied nurses' actual level of practices regarding liberation bundle. It consisted of six main items:

- Assessment, prevention and management pain (three scales).

- Breathing trial (spontaneous and awakening protocol) (10 steps).

- Choice of analgesic and sedation (one scale).

- Delirium assessment and management (one scale).

- Early mobility and exercise (4 steps).

- Family engagement and empowerment.

Scoring system:

The total score of the studied nurses' practices was classified into two categories.

- **"Competent":** If the studied nurses' total practices scores ≥ 90 % which equals ≥ 36 marks.

- **"Incompetent":** If the studied nurses' total practices scores < 90% which equals < 36 marks.

Operational Design:

A. Preparatory phase:

The researcher reviewed the past, the current and more recent relevant national and international literature reviews and theoretical knowledge of the various related aspects of the study using available books, articles, periodicals, magazines and internet to be acquainted with the research problem and develop the data collection tools.

B. Content validity and reliability:

Content validity of the developed tools was tested using face and content validity. Validity was tested through a jury of 5 experts (3 professors) and (2 assistant professors) from pediatric nursing department, faculty of nursing, Ain Shams University.

Reliability of the study tools was tested statistically by using Cronbach's Alpha coefficient test which revealed that tools of the study were reliable.

Alpha Cronbach reliability analysis of the used tools:

Items	No of items	Cronbach's Alpha
Knowledge	34	0.727
Practices	20	0.873

C. Pilot study:

The pilot study was carried on a group of 5 pediatric nurses (10%) prior to the official data collection to evaluate applicability and relevance of the study tools and time required to fulfill the study tools. .

D. Field work:

The actual work of this study took about six months, started from beginning of May 2023 to the half of October 2023. The data were collected by the researcher through two days/week (Saturday in New Damietta Al-Azhar University Hospital and Thursday in Menoufia University Hospital) during morning and afternoon shifts from 11 am to 4 pm. The researcher started by introducing herself to the studied nurses, and then gave them a brief individually about the aim of the study prior to data collection. The studied nurses were divided into groups in each shift about 5 to 10 nurses.

The researcher distributed the questionnaire to assess the studied nurses' knowledge regarding liberation bundle using the constructed tool (Pre-designed Questionnaire). The questionnaire was filled by the studied nurses and the time consumed to fill in ranged between 10-15 minutes.

The observational checklists were filled in by the researcher by observing the pediatric nurses' practices and the time consumed to fill in the checklist ranged between 15-20 minutes for each item of the liberation bundle different from nurse to another.

Ethical Considerations

Approval of the study protocol was obtained from the ethical committee in the Faculty of Nursing at Ain Shams University before starting the study Ethical no:24.04.290, Date of approval: November 2020. Written informed consent was obtained from each participated nurse and confidentiality of data and results was considered. Every nurse has the right to withdrawal from the study at any time and without giving any reasons.

Administrative design:

Approval was obtained through an issued letter from the Dean of Faculty of Nursing, Ain Shams University to directors of the previously mentioned settings. The researchers then met the Hospital director and explained the purpose and methods of the data collection.

Statistical design:

The collected data were organized, revised, coded, categorized, tabulated and statistically analyzed using appropriate statistical significance tests. The data were collected and coded using Statistical Package for the Social Sciences (SPSS), version 25(IBM Corp., Armonk, NY, USA) and was also used to do the statistical analysis of data. Data were presented using descriptive statistics in the form of frequencies and percentages. Pearson Correlation Coefficient tests were used to compare frequencies between study variables.

The observed differences and associations were considered as follow:

- p-value > 0.05 Not significant
- p-value ≤ 0.05 Significant

Results

Table (1) clarifies that, 48.1% of the studied nurses aged (20:<25 years old) with mean age (1.73±0.79) years and 84.6% of them were females. Meanwhile, 76.9% of the studied nurses graduated from technical institute of nursing and their mean years of experience was (2.54±1.13).

Figure (1) as regard previous attendance of training courses about liberation bundle, this figure illustrates that 82.7% of the studied nurses didn't attend any training courses related to liberation bundle.

Table (2) clarified that, (98.1%, 98.1% & 100%) of the studied nurses had un satisfactory level of the total knowledge regarding liberation bundle in general, assessment, prevention and management of pain and both spontaneous awakening and breathing trials respectively. Also, this table shows that, (82.7%, 100%, 92.3% & 96.2%) of the studied nurses had un satisfactory level of the total knowledge regarding choice of sedation and analgesia, delirium assessment, prevention, and management, early mobility and exercise and family engagement and empowerment respectively. Morover, this table ilustrates that, 100 % of the studied nurses of the studied nurses had un satisfactory level of total knowledge regarding the liberation bundle.

Figure (2) clarified that; 100% of the studied nurses had incompetent level of the total practices regarding liberation bundle.

Table (3) clarified that, there was a positive correlation between the studied nurses' total level of knowledge and total level of practices regarding liberation bundle with a statistically significant difference (r= 0.609 & p-value = 0.000).

Table (1): Distribution of the studied nurses according to their characteristics (n= 52)

Characteristics of the studied nurses	No.	%
Age / years		
20: < 25	25	**48.1**
25: < 30	16	30.8
≥ 30	11	21.1
$\bar{x}$ ±SD 1.73±0.79		
Gender		
Male	8	15.4
Female	44	**84.6**
Level of education		
Technical institute of nursing	40	**76.9**
Bachelor of nursing science	10	19.2
Post-graduate studies	2	3.9
Years of experience		
< 1	12	23.1
1: < 3	14	26.9
3: < 6	12	23.1
≥ 6	14	26.9
$\bar{x}$ ±SD 2.54±1.13		

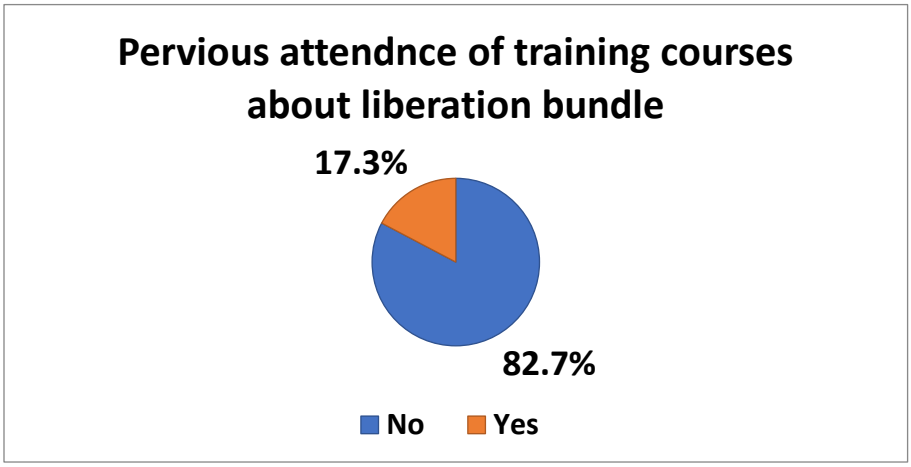

Figure (1): Percentage distribution of the studied nurses according to their pervious attendance of training courses about liberation bundle (n= 52)

Table (2): Distribution of the studied nurses' regarding their total level of knowledge about liberation bundle and it's items (n= 52)

Items	Satisfactory		Un Satisfactory	
	No.	%	No.	%
Total knowledge in general about liberation bundle	1.0	1.9	51	98.1
Total knowledge about items of liberation bundle:				
Assessment, prevention and management of Pain	1.0	1.9	51	98.1
Both spontaneous awakening and breathing trials	0.0	0.0	52	100.0
Choice of Sedation and Analgesia	9.0	17.3	43	82.7
Delirium Assessment, Prevention, and Management	0.0	0.0	52	100.0
Early Mobility and Exercise	4.0	7.7	48	92.3
Family Engagement and Empowerment	2.0	3.8	50	96.2
Total	0.0	0.0	52	**100.0**

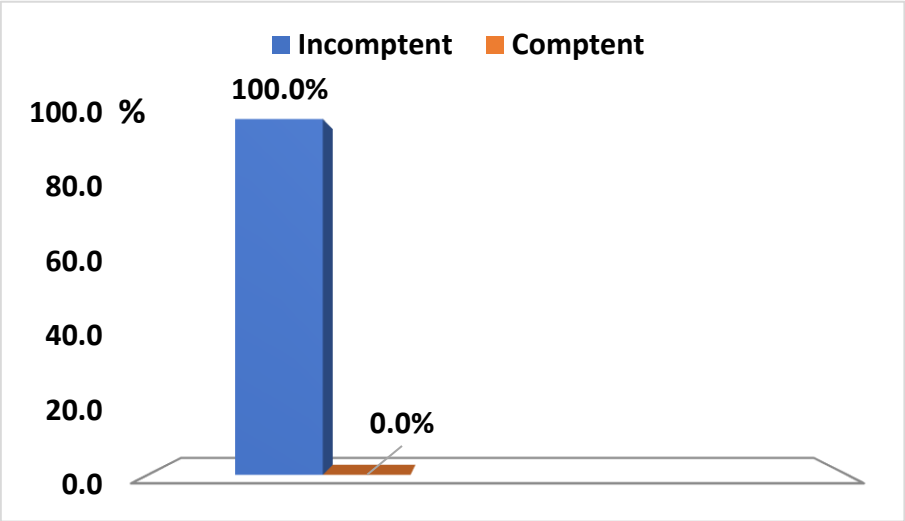

Figure (2): Percentage distribution of the studied nurses regarding their total level of practices about liberation bundle (n= 52)

Table (3): Correlation between the studied nurses' total level of knowledge and total level of practices regarding liberation bundle (n= 52)

Total score level of practices	Total score level of general knowledge	
	r	Sig.
	0.609	0.000*

**** Statistically significant at p≤0.05***

Discussion

The liberation bundle is an inter-professional multicomponent intervention that is appropriate to all pediatric intensive care unit patients. Its implementation is linked to fewer cases of death, delirium, the need for next-day mechanical ventilation and the hospital PICU readmission ***(Erbay Dalli et al., 2023).***

The society for critical care medicine recommended daily implementation of the six items of the liberation bundle that include; Assess, prevent, and manage pain, both spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium assess, prevent, and manage, early mobility and

exercise, and family engagement and empowerment ***(Mion et al., 2023).***

The current results of the study revealed that, less than half of the studied nurses aged (20: < 25 years) with mean age (1.73±0.79) years. From the researcher point of view, this might be due to that, the majority of the studied nurses were newly graduated. This was in disagreement with the study of ***Mohamed, Hassan & El-Sheikh, (2020)***, which was about " Nurses' Knowledge and their Practices regarding Post Intensive Care Syndrome of Critically Ill Pediatric Patients "found that, more than half of the studied nurses were in the age group (30 -<40 years).

Regarding the gender of the studied nurses, the results of the current study showed that, the majority of the studied nurses were females. From the researcher point of view, this might be due to that, the majority of nurses in Egypt are females and their number is still greater than males in the nursing field over the past ten years.

This was supported by ***Mion et al., (2023***), who conducted astudy about "An Exploration of Critical Care Professionals' Strategies to Enhance Daily Implementation of Liberation bundle: A group Concept Mapping Study" found that, more than three quarters of the studied nurses were females.

On the other hand, the results of the current study weren't in accordance with the study of ***Fox & Tung, (2022)***,which was about " Bettering Patient Outcomes in the PICU with the ICU Liberation Bundle (A-F): A Thesis" reported that, most of the studied nurses were males.

The current study revealed that, more than three quarters of the studied nurses graduated from technical institute of nursing. From the researcher point of view, this might be due to that, the fact that Egyptian ministry of health and population hires large numbers of technical nurses in the hospitals every year.

Also, might be due to that, the academic nursing programs at technical institutes typically last on two years, while bachelor's degree programs in nursing take four years to be completed. Given the economic conditions in the region, families often prefer technical institutes as the shortest duration and lowest costs. Moreover, the researcher observed that, the professional nurses with bachelor degree are always preoccupied with administrative tasks at the hospital.

These results were in agreement with the study finding that was carried out by ***Liang et al., (2021)***, who conducted a study about "Implementation of ABCDEF Care Bundle in Pediatric Intensive Care Units: A Cross-Sectional Survey" showed that, more than three quarters of the studied nurses had bachelor of nursing science.

The recent study revealed that, the years of experience of the studied nurses were more than six years with mean years (2.54±1.13). From the researcher point of view, this might be due to that, the hospitals prefer to hire the highly qualified nurses with more experience especially in the critical departments as PICU in which the pediatric nurses can able to endure the critical nursing responsibilities.

This was agreed with the study of ***Erbay Dalli et al., (2023)***, which was about " Practices of The ABCDEF Care Bundle in Pediatric Intensive Care Units as Reported by Nurses: A Cross-Sectional Study from Turkey" reported that, the mean of the professional years of experience for nurses was more than six years.

As regard previous attendance of training courses about liberation bundle, the current study illustrated that, the majority of the studied nurses didn't attend training courses related to liberation bundle. From the researcher's point of view, this might be due to that, shortage of the staff which keeps no time to attend any training courses. Also, there is a lack of in-service education, continuous education and staff development in the study settings.

These findings were in the same line with the result of the study that was done by ***Mohamed, Hassan & El-Sheikh, (2020)*** discovered that, only a small percentage of nurses had previously attended a training program about the liberation bundle.

However, this wasn't approved by ***Bisso et al., (2022)***, who conducted a study about "ABCDEF Bundle Implementation during the

COVID-19 Pandemic in Pediatric Patients" concluded that, nearly two thirds of the participants aware about the items of the liberation bundle.

The current study illustrated that; the vast majority of the studied nurses had unsatsisfactory knowledge about the common scales used for assessment of pain in critically ill children. From the researcher point of view, this result might be due to that, the nurses weren't aware about the importance of appling the pain assessment scales in PICU.

This was in agreement with the study of ***Ismaiel et al., (2022)***, who studied " Assess Nursing Performance during Implementation of PICU Care Bundle for Critically Ill Patients" showed that, half of the studied nurses had unsatisfactory level of knowledge regarding assessment, prevention and management of pain.

The current study showed that, there was unsatisfactory level of the studied nurses' knowledge about both spontaneous awaking and spontaneous breathing trials item. From the researcher point of view, this might be due to that, the concept of the nurses in PICU that, the spontaneous awaking and spontaneous breathing trials for the intubated patients are the physician not the nurses' responsibility.

This result was in accordance with the results of the study, that was done by ***Ahmed et al., (2023)***, which was entitled "Pairing Spontaneous Awakening and Breathing Trials to Improve Weaning of Pediatric Intensive Care Unit Patients: A Systematic Review Protocol" clarified that, the nurses weren't aware about the importance of spontaneous awakening and spontaneous breathing trials in combination for ventilated patients.

The current study showed that, there was unsatisfactory level of the studied nurses' knowledge about choice of sedation and analgesia & delirium assessment, prevention and management items. This might be due to that; the nurses weren't aware with the sedative medications used in PICU and there was no identified delirium assessment and management protocol.

This was supported by ***Zhang, Xie & Tang, (2024)***, whose study was about " Attitudes, knowledge and practices concerning delirium among paediatric intensive care unit nurses: a multisite cross-sectional study in Sichuan, China" mentioned that, only few percentages of nurses had good knowledge regarding delirium assessment, prevention and management and the sedative medications in PICU.

Also, this result was in agreement with the study of ***Lange et al., (2023)*** entitled "Nurses' Knowledge, Barriers and Practice in the Care of Patients with Delirium in the Pediatric Intensive Care Unit in Poland. A Cross-Sectional Study" reported that, the nurses had large knowledge deficit in delirium assessment and the choice the sedation in PICU.

The current study showed that, there was unsatisfactory level of the studied nurses' knowledge regarding early mobility and exercise. This might be due to that, lack of education training programs and resources that provide the nurses about importance of early mobility and exercise for critically ill patients inside PICU.

This was in accordance with the study results of ***Charway, (2020)***, which was about "Improving Nursing Knowledge of Early Mobilization in the Pediatric Intensive Care Unit" concluded that, most nurses' knowledge about early mobilization was unsatisfied and needs to be modified.

As regards to the studied nurses' knowledge about family engagement and empowerment, the finding of this study revealed that, vast majority of the studied nurses had unsatisfactory level of knowledge regarding family engagement and empowerment. From the researcher point of view, this might be due to that, PICU restrictions and decreased numbers of visiting hours.

This wasn't not in agreement with ***Oxenbøll Collet, Albertsen & Egerod, (2023)***, who conducted a study about "Patient and Family Engagement in Danish Pediatric Intensive Care Units: A national Survey" reported that, the critical care nurses were aware

of the role of the family members in caring for their patients.

The current study showed that, the all of the studied nurses had un satisfactory level of total knowledge regarding the liberation bundle. From the researcher point of view, in Egyptian hospitals, the liberation bundle is a relatively new medical concept in the PICU and even the studied nurses have a part of knowledge, each item of the liberation bundle is implemented sperately and without evidence-based practice.

These results were supported by ***Winnie et al., (2022)***, whose study was about "Practice Integration as an Effective Educational Strategy regarding ABCDEF bundle" reported that, nurses' knowledge about the items of the ABCDEF bundle was unsatsifactory.

Additionally, this was in the same context with the study was conducted by ***Liang et al., (2021)***, who studied "Implementation of ABCDEF Care Bundle in Pediatric Intensive Care Units: A Cross-Sectional Survey" stated that, almost half of the involved nurses were unaware of the ABCDEF care bundle.

The current study indicated that more than half of the studied nurses had incompetent level in the practices related to the pain assessment scales. From the researcher point of view, conscious patients cannot describe their pain level correctly for nurses, and comatose patients did not complain. So, the nurses sometimes did not depend on the scales that evaluate pain level.

The current study findings were greed with the Egyptian study of ***Ahmed, EL-Dakhakhny & Mohamed, (2019)***, which was entitled "Effect of an Educational Training Program on Nurses' Pain Assessment at Zagazig University Pediatrics Hospital" found that, the nurses' practices regarding pain assessment were incoptent and need to be modified.

This was in disagreent with the study of ***Limung et al., (2021)***, who conducted a study about "Utilization of Pain Rating Scales in Pediatric Care among Health Professionals in A children's Hospital in Kenya" revealed that, utilization of pain scales by the nurses for patient pain assessment was comptent.

The current study showed that, all of the studied nurses had incompetent level of the total practices about both spontaneous awakening and spontaneous breathing trials. From the researcher point of view, this might be due to that, application of spontaneous awakening and spontaneous breathing protocols not available in PICU.

This was in agreement with ***Liu et al., (2021)***, who studied "Implementation of the ABCDEF bundle for Critically Ill PICU Patients during the Covid-19 Pandemic: A multi-national 1-day Point Prevalence Study" mentioned that, both spontaneous awakening and breathing trials weren't implemented effectively by the nurses in PICU.

The current study revealed that, most of studied nurses had incomptent level of practices concerning choice of sedation and Richmond Agitation-Sedation Scale. From the researcher point of view this might be due to that, the protocol of the sedative mediactions implementation was the physicuain not the nusres' responsibility and Richmond Agitation-Sedation Scale clinical pathway wasn't applied in PICU.

These results were inagreement with the study of ***Amoroso, (2022),*** who studied " PICU Liberation Bundle: A Multidisciplinary Approach" reported that, the protocol of the choice of sedation and Richmond Agitation-Sedation Scale wasn't implemented effectively by the PICU nurses.

Also, this wasn't in accordance with ***Liu et al., (2021)*** reported that, the Richmond Agitation-Sedation Scale was applied effectively by the nurses for sedated patients.

The current study illustrated that, most of studied nurses had incomptent level of practices regarding assessment, prevention and management of delirium in the PICU. This might be due to that; they weren't able to prevent the first stages of delirium and unable to apply the Cornell assessment checklist for pediatric delirium assessment.

This was agreed with the study of ***Huang et al., (2021)***, whose study was about "Implementation of the Liberation Bundle in the Pediatric Intensive Care Unit of Tertiary

Hospitals: Across-Sectional Survey" reported that, majority of the studied nurses didn't perform efficient evaluation of delirium using the Cornell cheklist of pediatric delirium assessment.

These results weren't in accordance with the study of ***Sosnowski et al., (2023)***, whose title was "The Effect of the ABCDE/ ABCDEF Bundle on Delirium, Functional Outcomes, and Quality of Life in A pediatric Ill Patients: A Systematic Review and Meta-Analysis" showed that, delirium assessment nurses' practices was statistically significantly affected.

The current study illustrated that, all of the studied nurses had incompetent level of total practices about performing early mobility and exercise for patients. This defect of practices might be due to that, there was shortage of nursing staff and work overloaded.

This was supported by ***Liu et al., (2021)*** found that, few percentages of the nurses can perform early mobility and exercise for the patients effectively.

This was in disagreement with the results of ***Amin, Ahmed & Said, (2022),*** who conducted a study about "Effectiveness of Early Mobilization Protocol on Critically Ill Children Outcomes and their Activities of Daily Living" found that, there was a positive effect in the nurses' practices regarding the implementing of the early mobilization protocol.

The current study illustrated that there was incompetent level of practices regarding family engagement and empowerment. From the researcher point of view, this might be due to that, infection control measures and policies that prevent entrance of relatives inside PICU.

These findings were in agreement with ***Liu et al., (2021)*** found that, few percentages of nurses allow the family to be engaged in their children care in PICU.

On the contrary, ***Chen et al., (2023),*** whose study was about "Intercostal Nerve Cryoablation is Associated with Reduced Opioid Use in Pediatric Oncology Patients" reported that, family members engage in the health care such as early mobilization for their patients during their visit.

Also, these findings disagreed with ***Lim & Bang, (2023),*** entitled "The Perceptions and Performance of Family-Centered Care among Pediatric Nurses at A Children's Hospital in South Korea: A Descriptive Study " reported that, pediatric hospital nurses had a higher score for applying of family-centered care and engagment.

The current study indicated that the majority of the studied nurses had in competent level of the total practices regarding liberation bundle. From the researcher point of view, this might be due to that, there was staff shortage and workload and they didn't have enough time to complete the all items of the liberation bundle.

Also, lack of decision making in using protocol of care in PICU and nurses only apply doctors' orders and no in-service training courses about liberation bundle for pediatric patients.

These findings were agreed with the study of ***Givens & Bullock, (2022)***, which was entitled "Evaluating the Effectiveness of A multicomponent PICU Care Bundle among Intubated Patients" found that, there was deficiency in the nurses' practices regarding the liberation bundle.

Also, these findings were in agreement with the study of ***Ismaiel et al., (2022)*** revealed that, more than three quarters of the studied nurses had unsatisfactory level of practices regarding care bundle for critically ill patients.

Furthermore, this was in agreement with the study results of ***Engel et al., (2022)***, whose title was "Modified ABCDEF-Bundles for Critically Ill Pediatric Patients - What Could they Look Like?" showed that, there was deficiency in nurses' practices regarding implementation of ABCDEF bundle in PICU.

The current study clarified that, there was a positive correlation between the studied nurses' total level of knowledge and total level of practices regarding liberation bundle with a statistically significant difference (r= 0.609 & p-value = 0.000).

From the researcher point of view, these results might be due to that, there was decrease of opportunity for continuous training and educational programs in the hospital to improve the pediatric nurses' level of practices about the liberation bundle and might be also due to that, there were lack of equipment and shortage of nursing staff.

This was consistent with ***Fox & Tung, (2022)*** found that, there was strong correlation of the baseline nurses' knowledge of the liberation bundle and practices.

Also, this was inagreement with the results of the study done by ***Mohamed, Hassan & El-Sheikh, (2020)*** mentioned that, there was positive correlation between the studied nurses' total knowledge and total practices regarding the liberation bundle.

Conclusion

Based on the findings of the current study, it concluded that, all of the studied nurses had unsatisfactory level of the total knowledge and incompetent level of the total practices regarding liberation bundle in pediatric intensive care unit. Also, there was a positive correlation between the studied nurses' total level of knowledge and total level of practices regarding liberation bundle.

Recommendations

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

- Training courses for nurses are important to improve their knowledge and practices regarding liberation bundle in pediatric intensive care unit.

- Future researches are recommended to replicate the study on large probability samples in order to generalize the results.

References

Adriaenssens, J., Maertens de Noordhout, C., Kohn, L. & Castanares-Zapatero, D. (2023): Prevention of Post-Intensive Care Syndrome. Belgian Health Care Knowledge Centre, 364. https://doi.org/ 10. 57598/R364C.

Ahmed, A., EL-Dakhakhny, A. & Mohamed, S. (2019): Effect of an Educational Training Program on Nurses' Pain Assessment at Zagazig University Pediatrics Hospital. Zagazig Nursing Journal, 15 (1), 19-32.

Ahmed, F., Halimi, A., Nazari, S., Jarrahi, A., Hadavand, F., Al Marzouqi, A., … & Saifan, A. (2023). Pairing Spontaneous Awakening and Breathing Trials to Improve Weaning of Pediatric Intensive Care Unit Patients: A Systematic Review Protocol. Eastern Journal of Healthcare, 3(1):62-67. DOI: 10.31557/ejhc.2023.3.1.62-67

Amin, F., Ahmed, G. & Said, D. (2022): Effectiveness of Early Mobilization Protocol on Critically Ill Children Outcomes and their Activities of Daily Living. Egyptian Journal of Health Care, 13(1), 323-334.

Amoroso, J.A. (2022): PICU Liberation Bundle: A Multidisciplinary Approach. Student Scholarly Projects Collection. https://doi.org/10.46409/sr.XAKX4192

Azamfirei, R., Mennie, C., Dinglas, V.D., Fatima, A., Colantuoni, E., Gurses, A.P., … & on behalf of the PICU Up! Investigators (2023): Impact of A Multifaceted Early Mobility Intervention for Critically Ill Children. Trials, 24(1), 191. https://doi.org/10.1186/s13063-023-07206-2.

Bisso, I., Ávila Poletti, D., Huespe, I., Villalba, D., Olmos, D., Las Heras, M. & Carini, F. (2022): ABCDEF Bundle Implementation during the COVID-19 Pandemic. Acta Colombiana de Cuidado Intensivo, 22, S55–S61. https://doi. org/ 10. 1016/j.acci. 2021.09.002.

Charway, I. A. (2020): Improving Nursing Knowledge of Early Mobilization in the Pediatric Intensive Care Unit. Available from ProQuest Dissertations & Theses Global. (2480333888). Retrieved from https://www.proquest.com/dissertations-theses/improving-nursing-knowledge-early-mobilization/ docview/ 248033 3888/se-2.

Chen, S., Mack, S., Stein, J., Kelley-Quon, L. & Kim, E. (2023): Intercostal Nerve Cryoablation is Associated with Reduced Opioid Use in Pediatric Oncology Patients. Journal of Surgical Research, 377, 384. DOI: 10.1016/j. jss. 2022.11. 004.

Engel, J., Borell, F., Baumgartner, I., Kumpf, M., Hofbeck, M., Michel, J. & Neunhoeffer, F. (2022): Modified ABCDEF-Bundles for Critically Ill Pediatric Patients - What Could they Look Like? Frontiers in Pediatrics

Journal, 10(88),1-11.https://doi.org/10. 3389/ fped.2022. 886334.

Erbay Dalli, Ö., Akça Doğan, D., Bayram, R., Pehlivan, S. & Yildiz, H. (2023): Practices of The ABCDEF Care Bundle in Pediatric Intensive Care Units as Reported by Nurses: A Cross-Sectional Study from Turkey. Nurs Crit Care. doi: 10.1111/nicc.12963. Epub ahead of print. PMID: 37581265.

Fox, E. & Tung, W., (2022): Bettering Patient Outcomes in the PICU with the ICU Liberation Bundle (A-F): A Thesis. Master's Degree. http://hdl.handle.net/ 11714/8307.

Givens, S. & Bullock, L. (2022): Evaluating the effectiveness of A Multicomponent PICU Care Bundle among Intubated Patients. University of Maryland, http://hdl. handle.net/10713/18883.

Gomez, M., la Rosa, E., Faisal, S., Flores, S., Ibrahim, A., Araujo-Contreras, R., … & Manandhar, A. (2023): Insights into Post-Intensive Care Syndrome, A Complex and Multifaceted Condition. Journal of Anesthesia & Intensive Care Medicine, 12(4): 555844. DOI: 10.19080/JAICM.2023.12.555844.

Grieshop, S. (2023): ABCDEF Bundle. American Association of Critical-Care Nurses, 32(2), 100. https://doi. org/ 10.4037/ajcc2023998.

Huang, X., Lei, L., Zhang, S., Yang, J., Yang, L. & Xu, M. (2021): Implementation of the Liberation Bundle in the Pediatric Intensive Care Unit of Tertiary Hospitals in Southwestern China: A Cross-Sectional Survey. The Journal of international medical research, 49(1), 300060520987770. https://doi.org/ 10.1177/ 03000605 20987770

Ismaiel, E., Mohammed, E., Ameen, D. & Abdallah, D. (2022): Assess Nursing Performance during Implementation of PICU Care Bundle for Critically Ill Patients. Egyptian Journal of Health Care, 13(3), 182-193.

Khalil, N., El-Kady, E., Abdel-kader, F. & EL-shafey, M. (2021): Effects of ABCDE Bundle Implementation on Reduction of Delirium among Mechanically Ventilated Patients. Open Journal of Nursing and Medical Care, 2 (2), 1-14. https://doi.org/10.36811/ ojnmc. 2021.110007.

King, A., Potter, K., Seaman, J., Chiyka, E., Hileman, B., Cooper, G., … & Kahn, J. M. (2023): Measuring Performance on the ABCDEF Bundle during Interprofessional Rounds via a Nurse-Based Assessment Tool. American Association of Critical-Care Nurses, 32(2), 92–99. https://doi.org/ 10.4037/ ajcc 2023755.

Lange, S., Mdrzycka-Da Browska, W., Tomaszek, L., Wujtewicz, M., & Krupa, S. (2023). Nurses' Knowledge, Barriers and Practice in the Care of Patients with Delirium in the Intensive Care Unit in Poland-A Cross-Sectional Study. Frontiers in public health, 11, 1119526. https://doi.org/10.3389/fpubh.2023.1119526

Liang, S., Chau, J.P.C., Lo, S.H. S., Li, S. & Gao, M. (2021): Implementation of ABCDEF Care Bundle in Pediatric Intensive Care Units: A Cross-Sectional Survey. Nursing in critical care, 26(5), 386–396. https://doi.org/10. 1111/ nicc.12597.

Lim, S., & Bang, K. (2023): The Perceptions and Performance of Family-Centered Care among Pediatric Nurses at A Children's Hospital in South Korea: a descriptive study. Child health nursing research, 29(3), 207–217. https://doi. org/10.4094/chnr.2023.29.3.207.

Limung, G., Makworo, D., Oluchina, S. & Mburugu, P. (2021): Utilization of Pain Rating Scales in Pediatric Care among Health Professionals in A Children's Hospital in Kenya. International Journal of Africa Nursing Sciences, 14, 100298. https://doi.org/10.1016/ j.ijans.2021.100298.

Lin, J., Srivastava, A., Malone, S., Jennison, S., Simino, M., Traube, I., … & Society of Critical Care Medicine's Pediatric ICU Liberation Campaign Collaborative. (2023): Caring for Critically Ill Children with the PICU Liberation Bundle (ABCDEF): Results of the Pediatric Collaborative. Pediatric critical care medicine, 24(8), 636–651. https://doi.org/10.1097 /PCC. 0000000 000003262.

Liu, K., Nakamura, K., Katsukawa, H., Nydahl, P., Ely, E., Kudchadkar, S., … & Balachandran, J. (2021): Implementation of the ABCDEF Bundle for Critically Ill PICU Patients during the Covid-19 Pandemic: A Multi-National 1-Day Point Prevalence Study. Frontiers in Medicine, 8(28), 860. DOI: 10.3389/fmed.2021.735860.

Marra, A., Ely, E., Pandharipande, P. & Patel, M. (2018): The ABCDEF Bundle in Critical Care. National Library of Medicine, 33(2), 225–243. doi:10.1016/ j. ccc.2016.12.005.

Mion, L., Tan, A., Brockman, A., Tate, J., Vasilevskis, E., Pun, B., … & Balas, M. (2023): An Exploration of Critical Care Professionals' Strategies to Enhance Daily Implementation of Liberation bundle: A group

Concept Mapping Study. Critical care explorations, 5(3), e0872. https://doi.org/10.1097/CCE. 0000000000000872.

Mohamed, A., Hassan, R. & El-Sheikh, O., (2020): Nurses' Knowledge and their Practices regarding Post Intensive Care Syndrome of Critically Ill Pediatric Patients. Mansoura Nursing Journal, 7 (2), 153-161.

Nemani, S. (2022): Pediatric Intensive Care Unit-An Overview. J Intensive Crit Care, 8(2): 67.

Oxenbøll Collet, M., Albertsen, H., & Egerod, I. (2023). Patient and Family Engagement in Danish Intensive Care Units: A National Survey. Nursing in critical care, 10.1111/nicc.12947. Advance online publication. https://doi.org/10.1111/nicc.12947.

Rahmaty, Z., Manning, J., Macdonald, I., Perez, M. & Ramelet, A. (2023): Post-Intensive Care Syndrome in Pediatrics—Enhancing Understanding through A Novel Bioecological Theory of Human Development Lens. Intensive Care Medicine – Paediatric and Neonatal, 1:9. https://doi.org/10.1007/s44253-023-00007-0.

Reznik, M., Steinberg, A., Shutter, L. & Girard, T. (2023): The A2F ICU Liberation Bundle in Neurocritical Care. Current Treatment Options in Neurology, 25: 477–498. DOI:10.1007/s11940-023-00770-7.

Sim J., & Lewis M. (2012). The size of a pilot study for a clinical trial should be calculated concerning considerations of precision and efficiency. Journal of clinical epidemiology. 65(3):301-8.

Society of Critical Care Medicine. (2022): Pediatric ICU Liberation. https://www.sccm.org/Clinical-Resources/ ICULiberation-Home/Pediatric-ICU-Liberation.

Sosnowski, K., Lin, F., Chaboyer, W., Ranse, K., Heffernan, A. & Mitchell, M. (2023): The Effect of the ABCDE/ABCDEF Bundle on Delirium, Functional Outcomes, and Quality of Life in A Pediatric Ill Patient: A Systematic Review and Meta-Analysis. International Journal of Nursing Studies, 138(104), 410. DOI: 10.1016/j.ijnurstu.2022.104410.

Tang, M., Zhang, H., Liu, X., Li, N., Sun, X. & Zhang, X. (2024): Quality of Life among Chinese Child Survivors of Heart Failure after Discharge from Pediatric Intensive Care Unit. Journal of pediatric health care: official publication of National Association of Pediatric Nurse Associates & Practitioners, 38(1), e1–e6. https://doi.org/10.1016/j.pedhc.2023.09.005.

van Dijk, T., van Benthum, M., Maas-van Schaaijk, N. & van Zwol, A. (2023): Health-Related Quality of Life 6 Months after Pediatric Intensive Care Unit Admission for Bronchiolitis: A Prospective Single-Center Cohort Study. European journal of pediatrics, 182(1), 403–409. https://doi.org/10.1007/s00431-022-04700-8.

Walz, A., Canter, M. & Betters, K. (2020): The ICU Liberation Bundle and Strategies for Implementation in Pediatrics. Current Pediatric Rep, 8:69–78. https://doi.org/10.1007/s40124-020-00216-7 Epub 2020 May 16. PMID: 32427162; PMCID: PMC7229434.

Winnie, K., Sanchez, K., Winfrey, E., Furlow, A., Thong, L., Mitchell, C. & Cannon, J. (2022): Practice Integration as An Effective Educational Strategy regarding ABCDEF bundle. AACN advanced critical care, 33(4), 319–328. https://doi .org/ 10. 4037/aacnacc2022171.

Zhang, Y., Xie, J., & Tang, M. (2024). Attitudes, knowledge and practices concerning delirium among paediatric intensive care unit nurses: a multisite cross-sectional study in Sichuan, China. BMC nursing, 23(1), 289. https://doi.org/10.1186/s12912-024-01956-3