Effectiveness of the Educational Program on Nurses 'Performance Regarding Advanced Pediatric Life Support during Cardiopulmonary Resuscitation

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Abstract

Background: Advanced Pediatric Life Support (APLS) is designed from the American Heart Association (AHA) for health care providers who either direct or participate in the management of respiratory and/or cardiovascular emergencies and cardiopulmonary arrest in pediatric patient. **Aims of the study**: The study aimed to evaluate the effectiveness of educational program on nurses' performance regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation in pediatric intensive care unit. **Research design**: A quasi- experimental design was used to conduct the study (one group with pre-test and post-test). **Study setting:** The study was conducted in Pediatric Critical Care Unit (7th floor) at El-Monira hospital Abu El-Rish Pediatric Hospitals affiliated with Cairo University Hospitals. **Subjects:** A purposive sample of 55 nurses regardless of their characteristics (age, gender and educational levels) who were providing care for children during cardiopulmonary resuscitation in the previously mentioned setting over a period of six (6) months respectively. **Tools of data collection: Three tools were used for data collection as Tool I)** Interviewing questionnaire sheet (Pre / Post-test**):** This tool designed by the researcher based on review of relevant national and international literatures. It was used to assess nurses' knowledge during cardiopulmonary resuscitation regarding APLS. **Tool II)** Observational checklists (Pre / Post-test): the checklists developed in the light of related references. **Tool III)** Children outcome' sheet. **The results:** Revealed that the educational program significantly improved nurses' knowledge and practices in Advanced Pediatric Life Support (APLS) during CPR, addressing substantial pre-intervention gaps. There was a statistically significant difference between nurses' knowledge and skills regarding APLS during CPR. **In conclusion:** Sustained education and system-wide enhancements are essential to maintain competencies and improve outcomes. **The study recommended:** Implement periodic refresher courses to ensure sustained knowledge retention and practice proficiency in Advanced Pediatric Life Support (APLS).
Key Words: AHA, APLS, Cardiac arrest, CPR, Pediatric nursing, educational program**.**

I.Introduction

Advanced Pediatric Life Support (APLS) or Advanced Pediatric Life Support (APLS) is designed from the American Heart Association (AHA) for health care providers who either direct or participate in the management of respiratory and/or cardiovascular emergencies and cardiopulmonary arrest in pediatric patient. [1]

There are three emergencies that can occur for an infant or child that need immediate treatment: respiratory problems, circulatory problems, and sudden cardiac problems / sudden cardiac arrest (the last of these is very common in children). Most non-traumatic emergencies in pediatrics involve respiratory problems (respiratory distress or respiratory failure) or circulatory problems (shock). [2]

Successful resuscitation attempts often require healthcare providers simultaneously perform a variety of interventions. Although a Cardio-Pulmonary Resuscitation (CPR) trained by a stander working alone can resuscitate a child within the first moments after collapse, most attempts require the concerted efforts of multiple healthcare providers. Effective teamwork divides the tasks while multiplying the chances of a successful outcome. [3]

Pediatric nurses play a key role in the management of in-hospital cardiac arrest. Often nurses are first on the scene of an arrest-initiating CPR as well as summoning assistance from the advanced life support team. Nursing role is essential in all phases of CPR as team member, successful high-performance teams not only have medical expertise and mastery of resuscitation skills, but pediatric nurses also demonstrate effective communication and team dynamics aiming to save life. [4]

Educational programs for health care providers enhance effective communication and improve team dynamics by providing updating knowledge and skills. Mentally, training of pediatric advanced live support prepares health care providers for treating the child or the infant as systematically approach.[5]

Significance of the Study

High mortality rate of children can be decreased by efficient cardiopulmonary resuscitation which requires standard guidelines and more qualified healthcare providers, especially nurses. High qualified nurses need to be trained on Advanced Pediatric Life Support guidelines in pediatric intensive care units and evaluated from health organizations to improve level of care. [6]

The APLS is a series of protocols to guide responses to life threatening clinical events. These responses are designed to be simple enough to be committed to memory and recalled under moments of stress. The APLS guidelines have been developed from thorough review of available protocols, patient case studies, clinical research; and reflect the consensus opinion of experts in the medical field. The APLS training is to improve the quality of care provided to seriously ill or injured children, resulting in improved outcomes by decreasing mortality rates. [7] So from the researcher's point of view it is important to evaluate nurses' performance regarding Advanced Pediatric Life Support.

Aim of the study

The study aimed to evaluate the effectiveness of educational program on nurses' performance regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation in pediatric intensive care unit through:

- Assessing nurses' performance regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation.
- Developing and implementing educational program for nurses regarding Advanced Pediatric Life Support .
- Evaluating the effectiveness of educational program on nurses' performance regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation.

Research Hypothesis:

The educational program will have a positive effect on nurses' performance during

cardiopulmonary resuscitation regarding Advanced Pediatric Life Support .

II. Subjects and Method

Research design:

A quasi- experimental design was used to conduct the study (one group with pre-test and post-test).

Research setting:

The study was conducted in Abu El-Rish Pediatric Hospitals affiliated to Cairo University Hospitals at Pediatric Critical Care Unit (7th floor) at El-Monira hospital which consists of eleven beds included three isolation beds accepts children from age of two months to eighteen years old. The unit may be extend to include twenty eight bed to serve more critical children and will become the biggest pediatric ICU in Egypt.

Subjects:

A purposive sample of all available nurses (55 nurses) regardless their characteristics (age, gender and educational levels) who were providing care for children during cardiopulmonary resuscitation in the previously mentioned setting over a period of six (6) months respectively under the following inclusion criteria:

Working in the previously mentioned setting at least for one year.

Willing to participate in the study throughout the study period.

In addition, all children subjected to cardiopulmonary resuscitation throughout the study period.

Tools of data collection

Three tools were used for data collection as the following:

Tool I) Interviewing questionnaire sheet (Pre / Post-test):

This tool was designed by the researcher based on review of relevant national and international literatures. It used to assess nurses' knowledge during cardiopulmonary resuscitation regarding to APLS and it included two parts:

The first part: characteristics of nurses as age, gender, years of experience, educational level and training courses regarding cardiopulmonary resuscitation among children with cardiac arrest.

The second part: to assess nurses' knowledge regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation such as definition, indications, techniques, complications and contraindications.

Tool II) Observational checklists (Pre / Post-test): the checklists developed in the light of related references and involve three phases: (preparation, during and post procedure of cardiopulmonary resuscitation) that include 35 steps.

Tool III) Children outcomes' sheet: it involved data of children who are subjected by cardiopulmonary resuscitation (e.g. name, age, diagnosis, gender, date of admission, if children experienced CPR before, number of CPR' cycles, response to CPR and complications of CPR).

Knowledge scoring system:

Nurses' knowledge was checked with a model key answer where correct answer scored (1) and wrong answer scored (0). According to nurse's answers, their knowledge scores were classified into either satisfactory ≥ (85%) or unsatisfactory < (85%).

Tool (II) Children's assessment sheet: to assess children's characteristics (children's age, gender, date of admission, duration of illness and laboratory investigations).

Tool (III) Nurses observational checklist:

Nurses' observational checklist was adapted from **American Heart association, (2020)** and used to assess the nurse`s actual practices related to care before, during and after care of children. This tool included 28 steps about nursing practice (preparation, during and after) cardiac arrest of children undergoing cardiopulmonary resuscitation using the observational checklist which were filled by the researcher.

- **The Scoring system of nursing practice**: Total steps were 28 where score (2) was given for done complete practice, score (1) for practice incomplete done and score (0) for not done or incorrect practice. The scores of all items were summed up and total was (56) divided by number of the items, giving a mean score for the part. These scores were converted into percentage scores.

- The nurse`s practices are considered competent if the percent score was ≥ 85% and incompetent if the percent score was <85%.

Content validity was tested through three panels of experts from pediatric nursing department, Faculty of Nursing, Cairo University to ensure its validity for comprehensiveness, accuracy, clarity and relevance. The necessary modifications were made accordingly.

Content reliability: reliability of the tool using Cronbach Alpha equal (0.7) which means that the tool is reliable.

Pilot study:

A pilot study was carried out involving 5 nurses (10%) from the study subjects (Total is 55 nurses) to test the clarity, applicability, feasibility & relevance of the tools used and to determine the needed time for the application of each one. The nurses who were included in the pilot study were included in the sample because no major modification was done after conducting pilot study.

Fieldwork

The purpose of the study was simply explained to the nurses who agree to participate in the study prior to data collection. The actual work of this study started and completed within six months from the first of **April 2023** to the end of **October 2023.**

1- The researcher was available three days / week in the previously mentioned study setting over a period of six months using the previously mentioned study tools.

2- Nurses were interviewed individually; the purpose of the study was simply explained to the nurses who agreed to participate in the study prior to any data collection.

3- Researcher explained Advanced Pediatric Life Support guidelines (Educational program) to nurses in a group for four days as four sessions (each session took four hours) and illustrate each

role of team member in resuscitation team.

4- Each nurse is observed individually by the researcher during actual cardiopulmonary resuscitation procedure three times for six months. The first time was before the educational program, the second time after educational program and the third time after three months of educational program as follow up.

Ethical considerations:

Approval of the study protocol was obtained from the Scientific Research Ethical Committee in the Faculty of Nursing /Helwan University before starting the study. The researcher clarified the objective of the study to each nurse included in the study. The researcher assured us that maintain anonymity and confidentiality of the subject data. Nurses were informed that their participation is voluntary and that they have the right to withdraw from study at any time without giving any reasons. The nurses assured also that the information collected was treated confidentially and used only for the purpose of the study.

Educational program:

It was designed by the researcher based on actual need assessment of the subjects studied after reviewing the related literature. It is composed of three phases:

1- Assessment phase:

A pre-test was carried out using the previously mentioned tool to assess nurses' knowledge and practice regarding Advanced Pediatric Life Support during cardiopulmonary resuscitation. The purpose of the study and its expectations were explained by the researcher to the studied nurses before starting interviewing and data collection. The time spent filling the questionnaire ranged between 30 minutes and the time needed to fill the checklist depended on nurses' own practices regarding advanced pediatric life support during cardiopulmonary resuscitation.

2- Planning phase:

According to the actual assessment of nurses' knowledge and practices, the content of educational program was designed by the researcher. In addition, the relevant literature regarding Advanced pediatric life supports during cardiopulmonary resuscitation. The content of the educational program included knowledge about cardiac arrest (definition, signs and causes), airway management, shock types and management and team dynamics. As well as the program included practices related to chest compressions, opening airway maneuvers, exercise of range of motion during chest compressions and ratio of compressions with breathing. An illustrated booklet was designed by a researcher in Arabic languages to meet nurses' knowledge. Selecting suitable teaching methods and appropriate media for teaching this content.

3- Implementation phase

The total number of sessions were 4 sessions mixed between theory and practices. Different teaching methods were used such as lectures, group discussion, role play and redemonstration. Suitable media were used as booklets, power point presentations and pictures.

4- Evaluation phase:

Evaluation was carried out immediately after the implementation of the educational program using the same pre-test format as post-test and was repeated after three months for follow up.

Statistical analysis:

The collected data were organized, categorized, tabulated and statistically analyzed using the statistical package for social science (SPSS) version 20. Data was presented in tables and graphs. The statistical analysis included percentage (%), chi-square (X2), and Pearson correlation (r).

The differences observed and associations were considered as follows:

P. > 0.05 insignificance (No difference)

P. ≤ 0.05 significance difference

P. ≤ 0.01 moderate significance difference

P. ≤ 0.001 highly significance difference

- Frequency and percentage for qualitative data: gender, educational level, previous courses, knowledge and practice level.
- Test of association: Chi-square test to compare between two or more groups.

III. Results

Table (1): shows that less than two-thirds of the studied nurses (60%) were males, and more than one-third of them (34.5%) had (1-5) years of experience in the pediatric intensive care unit.

Table (2) shows that more than one third of studied nurses (38.2 %) have satisfactory knowledge level pre-educational program increased to (100%) immediately then slightly decrease to (90.9%) post 3 months of educational program with statistically significant differences which P – Value < 0.0001.

Figure (1) shows that more than one third of studied nurses (38.2 %) have satisfactory knowledge level pre-educational program increased to (100%) immediately then slightly decrease to (90.9%) post 3 months of educational program with statistically significant differences which P – Value < 0.0001.

Table 3 shows that there is statistically significant in Nurses' practices pre-educational program and post educational programs as all Nurses are competent in total practice level after educational program.

Figure (2) shows that Mean and standard deviation of the studied nurse's practices regarding cardiopulmonary resuscitation pre-educational program (22.7), immediate (70), and post-educational program (68.6).

Table 4 shows that Relation between Studied Nurse's Characteristics with their knowledge

Regarding Advanced Pediatric Life Support during Cardiopulmonary Resuscitation in pre- and Post

educational Program as there is statistically significantly (P – Value (0.0001) **) pre-educational program

and (P – Value (0.009) **) Post educational program.

Table 5 shows that there is a positive correlation between total knowledge and total practices pre and post educational program with highly statistically significant (correlation at P value < 0.01**).

Table (1): The Studied Nurses According to Their Characteristics.

Table (1): Percentage distribution of the nurses studied regarding their characteristics (n= 55)

Items	No.	%
Gender		
Female	22	40.0
Male	33	60.0
Age/ year		
18 –< 23	6	10.9
23- <28	22	**40.0**
28 – <33	15	27.3
33- <38	7	12.7
38 _ <43	3	5.5
43 = or more	2	3.6
Mean ± SD		
Marital status		
Single	18	32.7
Married	37	67.3
Educational level		
Diploma school	10	18.2
Technical institute	28	50.9
Specialty	2	3.6
BSc	15	27.3
Years of experience in PICU		
Less than one year	6	10.9
1-5	19	**34.5**
5- 10	13	23.6
10- 15	17	30.9
Mean ± SD		

Table (2): Comparison between pre, immediate, post educational program among the nurses regards their total knowledge level about advanced pediatric life support during cardiopulmonary resuscitation (n= 55).

Items	Pre		Post		Follow up		X^2	*P* - value
	No.	%	No.	%	No.	%		
Total knowledge level								
Satisfactory	21	38.2	55	100.0	50	90.9	120.054	**0.0001****
Unsatisfactory	34	61.8	0	0.0	5	9.1		

Figure (1): Comparison between pre, immediate, post educational program among the nurses regards their total knowledge level about advanced pediatric life support during cardiopulmonary resuscitation (n= 55).

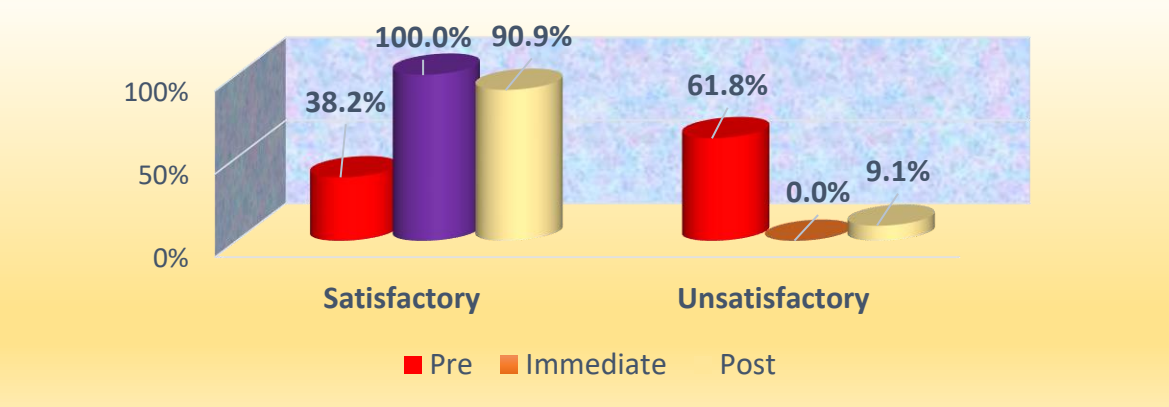

Table (3): Comparison between pre, Post and Follow up educational program among the nurses regards their total practice level about advanced pediatric life support during cardiopulmonary resuscitation (n= 55).

Items	Pre		Post		Follow up		X^2	*P* – value
	No.	%	No.	%	No.	%		
Total practice level								
Competent	0	0.0	55	100.0	55	100.0	……..	0.0001**
Incompetent	55	100.0	0	0.0	0	0.0		

*Significant at p ≤0.05 **Highly significant at p ≤ 0.001 Not significant at p>0.05

Figure (2): Mean and standard deviation of the studied nurse's practices regarding cardiopulmonary resuscitation pre-, immediate, and post-educational program (n= 55).

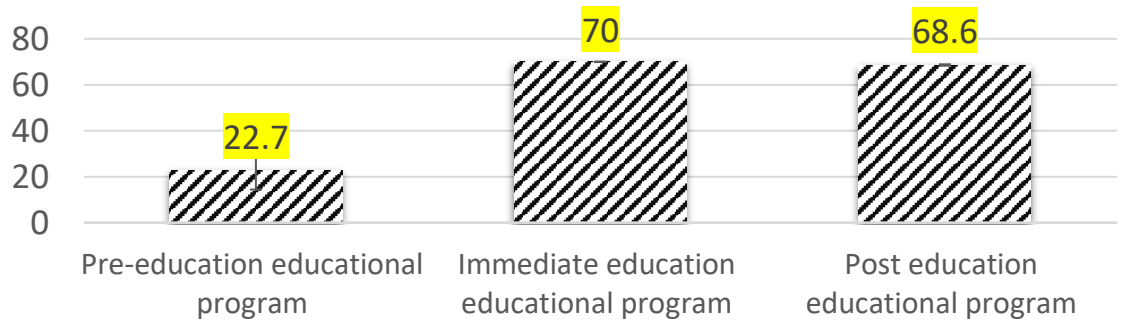

Table (4): Relation between Studied Nurse's Characteristics with their knowledge regarding Advanced Pediatric Life Support during Cardiopulmonary Resuscitation in pre- and Post-educational Program (n= 55).

Items	No.	Pre-educational program				Post educational program			
		Satisfactory (n= 21)		Unsatisfactory (n= 34)		Satisfactory (n= 50)		Unsatisfactory (n= 5)	
		No.	%	No.	%	No.	%	No.	%
Gender									
Female	22	8	36.4	14	63.6	19	86.4	3	13.6
Male	33	13	39.4	20	60.6	31	93.9	2	6.1
X^2 / Fisher (P – Value)		0.051 (0.820)				0.917 (0.338)			
Age/ year									
18 –< 23	6	1	16.7	5	83.3	5	83.3	1	16.7
23- <28	22	8	36.4	14	63.6	21	95.5	1	4.5
28 – <33	15	6	40.0	9	60.0	14	93.3	1	6.7
33- <38	7	3	42.9	4	57.1	6	85.7	1	14.3
38 _ <43	3	2	66.7	1	33.3	3	100.0	0	0.0
43 = or more	2	1	50.0	1	50.0	1	50.0	1	50.0
X^2 / Fisher (P – Value)		2.302 (0.681)				2.022 (0.732)			
Marital status									
Single	18	7	38.9	11	61.1	16	88.9	2	11.1
Married	37	14	37.8	23	62.2	34	91.9	3	8.1
X^2 / Fisher (P – Value)		0006 (0.939)				0.132 (0.716)			
Educational level									
Diploma school	10	2	20.0	8	80.0	9	90.0	1	10.0
Technical institute	28	6	21.4	22	78.6	27	96.4	1	5.6
Specialty	2	2	100.0	0	0.0	1	50.0	1	50.0
BSc	15	11	73.3	4	26.7	13	86.7	2	13.3
X^2 / Fisher (P – Value)		13.198 (0.004)**				5.419 (0.144)			
Years of experience in PICU									
Less than one year	6	2	33.3	4	66.7	5	83.3	1	16.7
1- 5	19	4	21.1	15	78.9	18	94.7	1	5.3
5- 10	13	6	46.2	7	53.8	12	92.3	1	7.7
10- 15	17	9	52.9	8	47.1	15	88.2	2	11.8
X^2 / Fisher (P – Value)		4.341 (0.227)				0.931(0.818)			
Previous training CPR									
Yes	16	14	87.5	2	12.5	12	75.0	4	25.0
No	39	7	17.9	32	82.1	38	97.4	1	2.6
X^2 / Fisher (P – Value)		23.252 (0.0001)**				6.910 (0.009)**			

***Significant at p ≤0.05 **Highly significant at p ≤ 0.001 Not significant at p>0.05**

Table (5): Correlation between Studied Nurse's knowledge and practice regarding Advanced Pediatric Life Support during Cardiopulmonary Resuscitation in pre- and Post-educational Programs

	Post educational program	Pre-educational program

		Total knowledge		Total practices	
		R	P – value	r	P – value
Pre-educational program	**Total knowledge**	0.325	0.0001**	0.417	0.0001**
Post educational program	**Total practices**	0.536	0.0001**	0.562	0.0001**

correlation at P value < 0.01

IV. Discussion

Pediatric cardiac arrest is a critical medical emergency that requires prompt and effective intervention to improve survival and neurological outcomes. Advanced Pediatric Life Support (APLS) guidelines provide a standardized approach to managing such emergencies, emphasizing high-quality cardiopulmonary resuscitation (CPR) and teamwork. Nurses, as integral members of resuscitation teams, play a pivotal role in implementing these guidelines. However, gaps in knowledge and practice can significantly compromise the quality of care delivered during resuscitation efforts **Morgan et al., 2021**[8].

Educational programs have been recognized as essential tools to enhance nurses' competencies in life-saving procedures. These programs provide theoretical knowledge, practical training, and opportunities for hands-on application, ensuring that nurses are prepared to respond effectively in high-stress situations. Despite their importance, many nurses lack formal training in APLS, leading to inconsistent practices and suboptimal outcomes during pediatric resuscitation **Al Balushi, (2021)** [9].

This study evaluates the effectiveness of an educational program designed to improve nurses' knowledge and performance regarding APLS during CPR in a pediatric intensive care unit. By assessing changes in knowledge and practice before, immediately after, and three months post-intervention, the study aims to identify the impact of structured training on nursing performance and its potential to enhance pediatric resuscitation outcomes.

The demographic data reveal a male predominance among nurses (60%) with the largest age group being 23-28 years. Most were married (67.5%) and had a technical institute education (50.9%). This Percentage Percentage distribution suggests a relatively young, moderately experienced nursing workforce, which might influence their adaptability and receptiveness to educational interventions.

One study noted that after participating in an educational program, there were statistically significant improvements in nurses' knowledge regarding CPR definitions, causes, complications, and survival chains, with p-values indicating strong significance ($p<0.001$) **Ibrahim., 2016.** [10]

In another study, the mean pre-test knowledge score for pediatric CPR was 6.5 out of 42, which improved to 38.1 post-training, highlighting the effectiveness of simulation-based training **Dharmarajlu ET AL., 2024.** [11]

Dharmarajlu ET AL., 2024, [11] involving nursing students reported that simulation training significantly increased both knowledge and practical skills scores post-intervention, suggesting that hands-on practice is crucial for effective learning.

Various studies emphasize the need for innovative teaching methodologies to improve CPR training outcomes, recommending active learning strategies that engage participants more effectively **Rojas ET AL., 2023.** [12]

A majority (70.9%) of nurses lacked prior CPR training, although 94.5% had participated in CPR. The significant gap in formal training underlines the importance of educational programs to enhance preparedness. Responsibilities during CPR were varied, with medication administration being the most common (72.7%).

A study indicated that after implementing an educational program, nurses showed statistically significant improvements in both knowledge and performance related to CPR. For instance, pre-training knowledge scores improved from an average of 10.8 to 16 post-training, demonstrating the effectiveness of structured educational interventions **Kuchaki ET AL., 2022.** [13]

Dharmarajlu et al., 2024, [11] has shown that simulation-based training significantly enhances both knowledge and practical skills among nursing professionals. In one study, the mean pre-test knowledge score for pediatric CPR was markedly lower than the post-test score after simulation training, indicating a substantial gain in competence.

The intervention dramatically improved nurses' understanding of cardiac arrest, with accurate definitions rising from 65.5% pre-education to 98.2% immediately after. Slight declines post-intervention (94.5%) highlights the need for sustained reinforcement of knowledge.

Similar findings were reported in studies where educational interventions led to substantial increases in CPR knowledge among nurses. For instance, one study highlighted that the average knowledge score improved significantly from **10.8** pre-training to **16** post-training, showcasing the effectiveness of structured educational programs in enhancing understanding and skills related to CPR **Ibrahim., 2016.** [10]

Another study emphasized that while immediate post-intervention knowledge was high, retention over time posed challenges. It was noted that without regular refreshers or ongoing training, nurses' knowledge could decline, aligning with the observed drop from 98.2% to 94.5% **Kuchaki ET AL., 2022** [13]. This underscores the importance of continuous education and practice drills to maintain high levels of competency.

Despite improvements in theoretical knowledge, some studies indicate that practical application during actual emergencies remains a challenge for many nurses. For example, while knowledge scores increased significantly post-training, adherence to CPR protocols during real-life situations often fell short **Portela et al., 2022** [14]**.** This gap suggests that while educational programs are effective for knowledge acquisition, they may not fully translate into improved performance under pressure.

Pre-intervention, knowledge about heart massage was suboptimal (e.g., 25.5% knew the correct technique). Post-intervention improvements to nearly 100% indicate the effectiveness of the educational program, although small declines in retention after three months suggest ongoing training is crucial.

A study highlighted that simulation-based training significantly enhances knowledge retention and practical skills among healthcare professionals. Participants who underwent simulation training demonstrated greater success in applying CPR skills, indicating that this method effectively reinforces learning and builds confidence in real-life scenarios **Young et al., 2020.** [15]

Laco et al., 2022, [16] has shown that while initial training can lead to substantial knowledge gains, retention declines over time without regular refreshers. A study found that CPR psychomotor skills typically decline three months post-training, reinforcing the need for ongoing education to maintain high competency levels.

Despite high levels of knowledge immediately following training, some studies have indicated that practical application during actual emergencies can be inconsistent. Factors such as stress and environmental conditions may hinder effective performance, suggesting that knowledge alone does not guarantee successful execution during critical situations **Sahu, & Lata., (2010)** [17]**.**

Understanding of CPR concepts such as timing, signs of success, and complications improved significantly post-intervention (100% for many items). Pre-intervention gaps (e.g., 12.7% correct timing) underscore the need for targeted education. Knowledge of ventilation techniques improved remarkably from 30.9% pre-intervention to 100% post-intervention. This underscores the effectiveness of practical training in enhancing procedural knowledge, though some aspects (e.g., ratio comprehension) require periodic review.

A study found that after an educational intervention, nurses exhibited significant improvements in their understanding of CPR concepts, with knowledge scores increasing markedly across various topics. For instance, the study reported that participants' knowledge about CPR timing and techniques rose from low pre-intervention levels to nearly complete understanding post-training, reinforcing the effectiveness of structured educational programs **Ebrahim., 2022**[18]**.**

Ibrahim., 2016[10]**,** has shown that practical training significantly enhances procedural knowledge among healthcare providers. One study indicated that following hands-on training sessions, nurses demonstrated nearly perfect scores in their understanding of ventilation techniques and other critical CPR skills, suggesting that practical experience is crucial for effective learning

The observed decline in retention rates after three months suggests that even well-trained individuals may forget critical information if not regularly practiced or reviewed. Studies have shown that without ongoing reinforcement, healthcare professionals often experience a decrease in both knowledge and practical application skills **Perkins et al., 2015**[19]**.**

The program resulted in a transition from 38.2% satisfactory knowledge pre-education to 100% immediately after. The slight decrease to 90.9% after three months indicates knowledge decay, emphasizing the need for refresher sessions. Pre-intervention practices such as checking equipment were poor (e.g., 89.1% did not check endotracheal tubes). Post-intervention, all nurses performed these tasks competently, demonstrating the program's success in improving preparation.

A study found that after an educational intervention focused on CPR, nurses' knowledge scores significantly increased from pre-test levels to post-test levels, with many achieving nearly perfect scores immediately following training. This aligns with findings that indicate structured educational programs effectively enhance nursing knowledge regarding CPR concepts and practices ($p<0.001$) **Ibrahim., 2016**[10].

Faghihi et al.,2024[20]**,** highlights that while immediate post-training assessments show high competency levels, retention can decline over time without regular reinforcement. A study involving firefighters indicated that although knowledge and skill mean scores remained significantly higher than pre-test levels three months post-intervention, a decline was observed, reinforcing the necessity for ongoing education and refresher courses.

Another study demonstrated that practical training interventions led to marked improvements in nurses' performance regarding CPR tasks, including equipment checks and procedural techniques. This study reported that following the intervention, all participants were able to perform critical tasks competently, indicating the effectiveness of hands-on training in enhancing both knowledge and practical skills **Ebrahim., 2022.** [18]

Despite high levels of theoretical knowledge immediately following training, some studies have pointed out that practical application during actual emergencies can vary significantly. Factors such as stress and environmental conditions may impede effective performance despite high training scores **Rojas et al., 2023.** [12]

Baseline practices, like wearing PPE (1.8%), were severely lacking. The program led to 100% adherence to protocols, highlighting its impact. However, the need for sustained supervision to ensure continued compliance is evident. Tasks such as documentation and cleaning equipment saw marked improvements post-intervention (from <50% to 100%). This suggests that education significantly enhances post-resuscitation practices.

A quality improvement study demonstrated that after targeted training, compliance with CPR documentation improved significantly from less than **30%** to over **90%**. This underscores the effectiveness of structured educational interventions in enhancing adherence to CPR protocols and documentation practices among healthcare providers **Nevrekar et al., 2017**[21]**.**

Another study highlighted that simulation-based training significantly improved CPR skills and teamwork among healthcare staff. Participants showed marked improvements in their performance scores after training sessions, which aligns with the findings that structured educational programs can lead to high levels of compliance and skill retention **Laco., 2022.** [16]

Chamberlain et al., 2022, [22] indicates that focused training on CPR and related procedures can lead to significant enhancements in post-resuscitation practices. For instance, a study found that after implementing a structured training program, healthcare providers demonstrated substantial improvements in critical actions, including documentation and assessment of vital signs during resuscitation events.

All nurses transitioned from being rated incompetent pre-education to competent immediately and post-intervention. This indicates the overall success of the program in addressing practical deficiencies. Despite the training, CPR outcomes remained poor, with an 87.5% mortality rate. This underscores the complexity of pediatric CPR and the potential need for further enhancements in training or equipment.

Dharmarajlu et al., 2024, [11] demonstrated that structured educational interventions significantly improved the competencies of healthcare providers in CPR. Participants transitioned from

low competency levels to nearly complete proficiency after training, reflecting the effectiveness of targeted educational programs in addressing practical deficiencies.

Research has indicated that even with effective training programs, survival rates following cardiac arrest remain low in pediatric populations. A meta-analysis revealed that the average survival to hospital discharge rate for children who received CPR is around **15%**, highlighting that while training can improve immediate skills, it does not necessarily translate into better patient outcomes due to various factors affecting survival rates **Sutton et al., 2022[23].**

The diversity in ages, illnesses, and causes of arrest highlights the varied challenges nurses face in pediatric CPR, necessitating broad and flexible training approaches. Post-education, knowledge improvements were not significantly associated with demographic factors like age or gender, suggesting the program was universally effective. Prior training had a significant positive impact, indicating its critical role.

A study found that CPR training programs significantly improved knowledge and skills across diverse groups of healthcare providers, regardless of demographic factors such as age and gender. This suggests that well-structured training can effectively enhance competencies universally among participants, aligning with the findings that demographic factors did not influence post-education outcomes **Donoghue et al., 2021.** [24]

Akkaya et al., 2023, [25] indicates that previous training plays a crucial role in enhancing CPR knowledge and skills retention. A study highlighted those participants with prior CPR training demonstrated significantly higher scores in knowledge assessments compared to those without prior training. This reinforces the importance of continuous education and the cumulative effect of repeated training on performance.

Studies have emphasized the unique challenges associated with pediatric CPR, including variations in patient age and underlying health conditions. This complexity necessitates flexible and adaptive training approaches to address the specific needs of pediatric patients effectively. A systematic review noted that tailored training programs that consider these variables lead to better preparedness among healthcare providers **Michel et al., 2022.** [26]

However, some research suggests that while prior training is beneficial, the level of experience in pediatric emergency care can also influence outcomes. A study found that healthcare providers with extensive experience in pediatric settings performed better than those with limited exposure, suggesting that practical experience complements formal education **Zenani et al., 2020[27].**

Similar to knowledge, practice improvements were not heavily influenced by demographics. This points to the program's broad applicability across diverse nursing profiles. A significant positive correlation between knowledge and practices (pre- and post-intervention) underscores the interdependence of theoretical understanding and practical application, reinforcing the value of integrated training.

A study on CPR training for healthcare providers found that participants across various demographic backgrounds showed significant improvements in both knowledge and practical skills post-intervention. The results indicated that the training was effective regardless of demographic factors such as age or gender, supporting the notion that well-structured educational programs can enhance competencies universally among participants **Faghihi et al., 2024.** [20]

Tomas, & Kachekele,. (2023). [28] has consistently shown a strong correlation between knowledge and practice in CPR among healthcare professionals. For instance, a study revealed that nurses with better knowledge scores were significantly more likely to demonstrate effective CPR practices, highlighting the importance of integrating theoretical knowledge with practical skills in training programs.

While immediate post-training assessments show significant improvements in knowledge and practice, some studies indicate that retention can decline over time without regular reinforcement. A study found that although participants demonstrated high competency immediately after training, their knowledge and skills diminished significantly three months later, suggesting the need for ongoing education **Rojas et al.,, 2023[12].**

V. Conclusion

The educational program significantly improved nurses' knowledge and practices in Advanced Pediatric Life Support (APLS) during CPR, addressing substantial pre-intervention gaps. Immediate post-education scores were excellent, though slight declines after three months highlight the need for ongoing training. Despite these gains, the high patient mortality rate underscores the complexity of pediatric resuscitation. Sustained education and system-wide enhancements are essential to maintain competencies and improve outcomes.

VI. Recommendations

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

1. **Regular Training Updates:** Implement periodic refresher courses to ensure sustained knowledge retention and practice proficiency in Advanced Pediatric Life Support (APLS).
2. **Simulation-Based Training:** Incorporate high-fidelity simulation to enhance practical skills and decision-making in high-stress CPR scenarios.
3. **Monitoring and Evaluation:** Establish continuous assessment frameworks to identify and address gaps in performance over time.
4. **Policy Support:** Advocate for mandatory CPR training as part of nursing education and routine hospital accreditation requirements.
5. **Interdisciplinary Collaboration:** Promote teamwork through multidisciplinary training to improve communication and coordination during pediatric resuscitation.
6. **Resource Allocation:** Ensure the availability of advanced equipment and adequate staffing in pediatric intensive care units to support effective resuscitation efforts.
7. **Research and Development:** Conduct further studies to explore barriers to effective CPR outcomes and evaluate innovative strategies to improve patient survival rates.

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